https://doi.org/10.32955/neuje.v8i1.1203

Near East University Journal of Education Faculty (NEUJE)
[volume 8, issue 1]
Received: July 04, 2025 Revised: December 01, 2025 Accepted: December 29, 2025

# THE CONTRIBUTION OF FOOD LITERACY EDUCATION SUPPORTED BY IMMERSIVE TECHNOLOGIES TO SOCIAL SUSTAINABILITY

**Melek Tepe[1,*], Ekrem Bahçekapılı [2]**

[1] Department of Manager Information Systems, Karadeniz Technical University melek.tepe@ktu.edu.tr
[2]Department of Manager Information Systems, Karadeniz Technical University ekrem.bahcekapili@ktu.edu.tr
*Correspondence: melek.tepe@ktu.edu.tr

## Abstract

This paper explores how food literacy education delivered through immersive technologies contributes to social sustainability in education. Food literacy is a critical competency that equips individuals with the knowledge and skills necessary to maintain a healthy lifestyle. It includes the ability to access accurate information, make informed and healthy food choices, and act with environmental and social responsibility. With the integration of digital technologies into educational processes, innovative approaches in food literacy education have gained prominence. Among these, immersive technologies such as augmented reality (AR) and virtual reality (VR) stand out for their ability to promote active engagement, enhance learning motivation, and support long-term knowledge retention.
The use of these technologies in educational settings not only fosters digital literacy but also advances sustainable development goals, including social equity and environmental awareness. This study presents a literature review of academic publications from major databases such as Web of Science, Scopus, and Google Scholar, focusing on the effects of immersive technologies on food literacy education. Although the existing body of research is limited, most studies examine the impact of AR/VR-based applications across diverse educational and literacy levels. Notable implementations include label reading simulations, virtual shopping environments, augmented content interaction, and gamified learning scenarios. Findings suggest that gamified immersive applications, in particular, significantly enhance learner motivation, improve knowledge retention, and effectively increase food literacy levels. However, the limited number of studies and the short-term focus of most current research highlight the need for further investigation. Future studies should evaluate the long-term effects of immersive food literacy education, consider diverse socio-demographic groups, and explore the integration of such technologies into educational policy.

***Keywords:*** food Literacy, social sustainability, augmented reality, virtual reality, educational technologies

## Introduction

Social sustainability refers to the ability of individuals to participate equally and fairly in society, aiming to improve their overall quality of life. In the context of education, social sustainability involves not only access to knowledge but also the ability to apply that knowledge in everyday life. This perspective suggests that education should not only involve instruction but also be structured in a way that enables individuals to make healthy and informed decisions (Sterling, 2001).

One critical life skill evaluated within this framework is food literacy. Food literacy is defined as the ability to access, understand, and apply food- and nutrition-related information

in daily life (Vidgen & Gallegos, 2014). This competency contributes not only to an individual's personal health but also to the well-being of society and environmental protection (Block vd., 2011). However, research indicates that food literacy levels are insufficient both in Turkey and globally (Food and Agriculture Organization of the United Nations, 2023)

Low food literacy impairs individuals' ability to make healthy decisions and is associated with non-communicable health issues such as obesity, diabetes, and cardiovascular diseases. Therefore, enhancing food literacy is essential for public health. This issue is also directly related to several United Nations Sustainable Development Goals, including Goal 3 (Good Health and Well-being), Goal 4 (Quality Education), Goal 10 (Reduced Inequalities), Goal 12 (Responsible Consumption and Production), and Goal 13 (Climate Action) (Presidency of Strategy and Budget of the Republic of Turkey, 2019).

In today's rapidly evolving technological landscape, digital tools are increasingly being used to improve food literacy. In particular, immersive technologies such as virtual reality (VR) and augmented reality (AR) have gained prominence in this area. These technologies foster active participation in the learning process and positively influence users' thoughts and behaviors (Freina, L. & Ott, M., 2015; Vivi Melinda & Andree Emmanuel Widjaja, 2022). By blending real and virtual environments, they make learning more visual, interactive, and memorable (Bosman vd., 2024; Bowman & McMahan, 2007; Chagué & Charbonnier, 2016).

Furthermore, immersive technologies can enhance access to information for disadvantaged groups, thereby promoting equal opportunities in education and reducing social exclusion. Consequently, food literacy education supported by immersive technologies contributes not only to individual well-being but also to the broader social good.

Although there is increasing interest in immersive technologies like augmented reality (AR) and virtual reality (VR) in educational research, studies on their use in food literacy education are still limited and mostly focused on specific contexts. While previous research has shown the teaching benefits of immersive technologies in improving engagement, hands-on learning, and knowledge retention (Makransky & Petersen, 2019; Radianti et al., 2020), there is a lack of comprehensive reviews that systematically examine how these technologies contribute to food literacy education and, more importantly, how they align with broader social sustainability goals. Food literacy is increasingly recognised as a key component of sustainable development because it influences people's food choices, public health, and fair access to food-related knowledge (FAO, 2019; Vidgen & Gallegos, 2014).

Conversely, the lack of a thorough thematic synthesis constrains the field's capacity to discern prevailing research themes, methodological approaches, and sustainability-focused results associated with immersive technologies. Consequently, a literature review employing thematic analysis is essential to uncover conceptual patterns and furnish well-founded recommendations for educators, researchers, and policymakers aiming to utilise immersive technologies to foster socially sustainable.

The purpose of this study is to review existing research on how immersive technologies are applied in food literacy education and to evaluate their contribution to social sustainability, with recommendations provided accordingly.

***Research Question***

What themes emerge from the existing literature regarding the application of immersive technologies in food literacy education and their contributions to social sustainability?

## Methodology

### Research Design

This research is designed as a qualitative literature review study. A qualitative literature review is a research design that aims to synthesize and interpret existing studies through an analytical and interpretive process in order to identify patterns, themes, and conceptual relationships within a body of literature (Snyder, 2019). It aims to synthesize existing research to evaluate the role of immersive technologies—such as virtual reality (VR) and augmented reality (AR)—in food literacy education and their contribution to social sustainability. The model enables a comprehensive understanding by categorizing and interpreting findings from a wide range of academic sources.

### Study Group

The research does not focus on a primary data collection from individuals but rather targets academic publications that address immersive technologies in food literacy education. The sample consists of peer-reviewed articles published in scientific journals indexed in Web of Science, Scopus, and Google Scholar, selected based on their relevance to the topic.

### Data Collection Tools

Relevant studies were identified through a systematic search using the keywords "virtual reality," "augmented reality," "immersive reality," "food literacy," "food," and "education." Articles were first screened by title, abstract, and keywords. Full texts were then examined to determine their inclusion based on relevance to immersive food literacy education and social sustainability.

### Data Analysis Process

The selected studies were analyzed using qualitative content analysis, following established procedures for systematic categorization and interpretation of textual data (Krippendorff, 2018): the objectives of the study, the immersive technology employed, the educational level targeted, the instructional method used (e.g., simulation, gamification, interactive content), the characteristics of the target audience, the reported outcomes, and their contributions to social sustainability. This analysis provided a multi-dimensional understanding of the application and impact of immersive technologies in food literacy education.

## Findings

Based on the studies reviewed in this report, immersive technologies such as virtual reality (VR) and augmented reality (AR) make significant contributions to food literacy education. The findings are categorized into three main themes: The Effects of Augmented Reality (AR) Applications; The Effects of Virtual Reality (VR) Applications; Gamification and General Effects.

### The Effects of Augmented Reality (AR) Applications

Augmented reality (AR) applications have emerged as an effective tool, particularly for the accurate reading and understanding of label information on packaged foods. In some studies conducted on these topics, it has been noted that AR- supported mobile applications

help users read food labels more consciously and that users are satisfied with these applications (Juan et al., 2019a).

In another study, it was observed that these technologies were also effective in learning about nutritional contents such as carbohydrates (Juan et al., 2019b).

Additionally, it has been determined that AR applications provide support to consumers in shopping environments, helping them choose products suitable for their nutritional needs and thereby facilitating the purchasing process. It has been determined that this situation provides significant benefits, especially for consumers who prefer gluten-free or low glycemic index products (Pini et al., 2023).

**The Effects of Virtual Reality (VR) Applications**

Virtual reality (VR) applications have been shown to enhance learning retention by providing interactive, immersive experiences. In one study on food safety education, users learned correct behavioral responses to potential risk situations through simulated virtual scenarios (Lee et al., 2022).

In another study involving children with diabetes, participants who engaged in virtual cooking and healthy eating activities demonstrated improved knowledge and self-confidence (Goldstein et al., 2024). Additional research indicates that VR-based training can be as effective as traditional face-to-face education, thereby enabling broader outreach without compromising educational quality (Baungaard et al., 2023; Daker et al., 2024). Moreover, virtual environments help reduce training costs and eliminate geographical barriers, thereby increasing access to education (Prowse & Carsley, 2021).

**Gamification and General Effects**

Game-based learning environments have been found to be particularly effective in increasing children's food literacy and nutrition knowledge (Yien, et al., 2011). Such applications enhance learning motivation, making the information more permanent.

It has been observed that gamified augmented reality (AR) supported education increases children's desire to learn and makes nutritional information more permanent. Additionally, it has been determined that AR technology reduces cognitive load for students and enhances student success because it caters to different learning styles (Franco-Arellano et al., 2024; Safura Azizoon et al., 2025).

In conclusion, immersive technologies not only provide information but also help transfer this information into daily life. When these technologies are integrated into the education system from an early age, they contribute to users developing healthy lifestyle habits and improving public health. Additionally, these technologies are seen to play an important role in reducing social inequalities and developing environmental awareness (Cassar et al., 2018; Juan et al., 2019b; Sajjadi et al., 2022; Vanderroost et al., 2017).

**Table 1.** *Summary of Immersive Technology Applications in Food Literacy Education*

| Type of Technology | Purpose | Target Group | Reported Effects |
|---|---|---|---|
| Augmented Reality | Label reading, nutrition learning | General population | Improved food label literacy, better dietary decisions |
| Virtual Reality | Food safety, healthy eating behaviors | Children, learners | Increased knowledge, behavior change, cost-effective scalability |

| | | | |
|---|---|---|---|
| Gamification (AR) | Engagement, motivation | School-aged children | Higher motivation, better retention, personalized learning |

## Discussion, Conclusion and Recommendations

This study highlights the transformative potential of immersive technologies—particularly augmented reality (AR) and virtual reality (VR)—in enhancing food literacy education and supporting social sustainability. Previous research indicates that immersive technologies foster deeper cognitive engagement and experiential learning by enabling learners to interact with content in realistic and meaningful contexts, thereby leading to more effective and lasting learning outcomes compared to traditional instructional approaches (Makransky & Petersen, 2019; Radianti et al., 2020).

Specifically, AR applications have been shown to improve food label comprehension and nutritional awareness by providing contextualized and interactive information at the point of decision-making, which in turn promotes healthier food purchasing behaviors (Riar et al., 2022; Sato et al., 2020). VR, on the other hand, supports experiential learning in food safety and nutrition education by simulating real-life scenarios that are otherwise difficult or risky to replicate, making it particularly effective for vulnerable populations such as children with chronic health conditions (Harrington et al., 2018; Makransky et al., 2021).

From a sustainability perspective, enhancing food literacy through immersive technologies supports social sustainability by empowering individuals to make informed food choices, fostering long-term health outcomes, and contributing to more equitable and resilient food systems (FAO, 2019; Tilman & Clark, 2014).

From a sustainability perspective, the promotion of food literacy through immersive technologies supports:

Health and well-being (SDG 3): by preventing diet-related diseases;

Educational equity (SDG 4 & SDG 10): by reaching underserved groups;

Responsible consumption (SDG 12): by fostering environmentally conscious behaviors through virtual simulations.

However, the current body of research is limited, often short-term in nature, and lacking in socio-cultural diversity. To address these gaps:

Future studies should investigate long-term impacts and behavioral change sustainability.

Research must include diverse socio-demographic samples for inclusive generalizability.

Policymakers and educators should prioritize scalable and affordable immersive tools in curriculum planning.

In conclusion, immersive technologies present promising avenues for elevating public food literacy, reducing health disparities, and advancing global sustainability goals. Their thoughtful integration into educational systems—supported by ongoing interdisciplinary research—will be key to building a healthier and more socially equitable future.

## References

Baungaard, C., Lane, K. E., & Richardson, L. (2023). Understanding nutrition students' knowledge, perceived barriers and their views on the future role of nutritionists regarding sustainable diets. Nutrition Bulletin, 48(4), 572-586. https://doi.org/10.1111/nbu.12649

Block, L. G., Grier, S. A., Childers, T. L., Davis, B., Ebert, J. E. J., Kumanyika, S., Laczniak, R. N., Machin, J. E., Motley, C. M., Peracchio, L., Pettigrew, S., Scott, M., & Bieshaar, M. N. G. G. (2011). From Nutrients to Nurturance: A Conceptual Introduction to Food Well-Being. Journal of Public Policy & Marketing, 30(1), 5-13. https://doi.org/10.1509/jppm.30.1.5

Bosman, I. D. V., Smith, A. E., Wong, Y. L., Ka, K. S. D., Alemneh, D., & Chow, A. (2024). Immersive Technology in Education. Proceedings of the Association for Information Science and Technology, 61(1), 721-724. https://doi.org/10.1002/pra2.1086

Bowman, D. A., & McMahan, R. P. (2007). Virtual Reality: How Much Immersion Is Enough? Computer, 40(7), 36-43. https://doi.org/10.1109/MC.2007.257

Cassar, A., Denyer, G., O'Connor, H., & Gifford, J. (2018). A Qualitative Investigation to Underpin the Development of an Electronic Tool to Assess Nutrition Literacy in Australian Adults. Nutrients, 10(2), 251. https://doi.org/10.3390/nu10020251

Chagué, S., & Charbonnier, C. (2016). Real virtuality: A multi-user immersive platform connecting real and virtual worlds. Proceedings of the 2016 Virtual Reality International Conference, 1-3. https://doi.org/10.1145/2927929.2927945

Daker, R., Challamel, G., Hanson, C., & Upritchard, J. (2024). Cultivating Healthier Habits: The Impact of Workplace Teaching Kitchens on Employee Food Literacy. Nutrients, 16(6), 865. https://doi.org/10.3390/nu16060865

FAO. (2019).
Sustainable healthy diets: Guiding principles. Food and Agriculture Organization of the United Nations.

Food and Agriculture Organization of the United Nations. (2023). Türkiye Gıda Okuryazarlığı Stratejisi ve Eylem Planı 2022–2028. https://www.fao.org/publications

Franco-Arellano, B., Brown, J. M., Daggett, Q., Lockhart, C., Kapralos, B., LeSage, A., & Arcand, J. (2024). Updating the Foodbot Factory serious game with new interactive engaging features and enhanced educational content. Applied Physiology, Nutrition, and Metabolism, 49(1), 52-63. https://doi.org/10.1139/apnm-2023-0214

Freina, L. & Ott, M. (2015). A literature review on immersive virtual reality in education: State of the art and perspectives.

Goldstein, S., Chow, O., Schwartz, J., Pais, V., Wright, S., & Gucciardi, E. (2024). Assessing the Feasibility and Acceptability of a Virtual Food Skills and Food Sustainability Program Designed for Children Living With Type 1 Diabetes. Pediatric Diabetes, 2024(1), 3821265. https://doi.org/10.1155/2024/3821265

Harrington, C. M., Kavanagh, D. O., Wright Ballester, G., Wright Ballester, A., Dicker, P., Traynor, O., & Tierney, S. (2018). 360° operative videos: A randomised cross-over study evaluating attentiveness and information retention. Journal of Surgical Education, 75(4), 993–1000. https://doi.org/10.1016/j.jsurg.2017.10.010

Juan, M.-C., Charco, J. L., García-García, I., & Mollá, R. (2019a). An Augmented Reality App to Learn to Interpret the Nutritional Information on Labels of Real Packaged Foods. Frontiers in Computer Science, 1, 1. https://doi.org/10.3389/fcomp.2019.00001

Juan, M.-C., Charco, J. L., García-García, I., & Mollá, R. (2019b). An Augmented Reality App to Learn to Interpret the Nutritional Information on Labels of Real Packaged Foods. Frontiers in Computer Science, 1, 1. https://doi.org/10.3389/fcomp.2019.00001

Krippendorff, K. (2018). Content analysis: An introduction to its methodology (4th ed.). SAGE Publications.

Lee, L., Nisar, H., Roberts, J., Blackford, J., & Kesh Kesavadas, T. (2022). Face and Content Validation of Food Safety Training in Virtual Reality (VR). 2022 IEEE 10th

International Conference on Serious Games and Applications for Health(SeGAH), 1-5. https://doi.org/10.1109/SEGAH54908.2022.9978588

Makransky, G., & Petersen, G. B. (2019). Immersive virtual reality and learning: A meta-analysis. Educational Psychology Review, 31, 1–29. https://doi.org/10.1007/s10648-019-09486-6

Makransky, G., Petersen, G. B., & Immersive Learning Research Group. (2021). Immersive virtual reality and learning: Benefits and challenges. Educational Psychology Review, 33, 151–178.

Pini, V., Orso, V., Pluchino, P., & Gamberini, L. (2023). Augmented grocery shopping: Fostering healthier food purchases through AR. Virtual Reality, 27(3), 2117-2128. https://doi.org/10.1007/s10055-023-00792-1

Presidency of Strategy and Budget of the Republic of Turkey,. (2019).

Prowse, R., & Carsley, S. (2021). Digital Interventions to Promote Healthy Eating in Children: Umbrella Review. JMIR Pediatrics and Parenting, 4(4), e30160. https://doi.org/10.2196/30160

Riar, M., McKenzie, K., & Lyons, A. C. (2022). Augmented reality and consumer decision-making: A systematic review. Journal of Retailing and Consumer Services, 64, 102808. https://doi.org/10.1016/j.jretconser.2021.102808

Safura Azizoon, N. A., Wan Ahmad, W. N., Ahmad Fizal, Q., Jing Rui, T., & Kamaruzaman, M. Y. (2025). iFoodAR: Augmented reality for high school food design technology. International Journal of Evaluation and Research in Education (IJERE), 14(1), 406. https://doi.org/10.11591/ijere.v14i1.29702

Sajjadi, P., Edwards, C. G., Zhao, J., Fatemi, A., Long, J. W., Klippel, A., & Masterson, T. D. (2022). Remote iVR for Nutrition Education: From Design to Evaluation. Frontiers in Computer Science, 4, 927161. https://doi.org/10.3389/fcomp.2022.927161

Sato, K., Matsumura, Y., & Yamaguchi, T. (2020). Using augmented reality to enhance nutrition education: Effects on food label understanding. Computers & Education, 142, 103640. https://doi.org/10.1016/j.compedu.2019.103640

Sterling, S. (with Schumacher Society). (2001). Sustainable education: Re-visioning learning and change (reprint). Green Books for the Schumacher Society.

Tilman, D., & Clark, M. (2014). Global diets link environmental sustainability and human health. Nature, 515(7528), 518–522. https://doi.org/10.1038/nature13959

Vanderroost, M., Ragaert, P., Verwaeren, J., De Meulenaer, B., De Baets, B., & Devlieghere, F. (2017). The digitization of a food package's life cycle: Existing and emerging computer systems in the pre-logistics phase. Computers in Industry, 87, 1-14. https://doi.org/10.1016/j.compind.2017.02.002

Vidgen, H. A., & Gallegos, D. (2014). Defining food literacy and its components. Appetite, 76, 50-59. https://doi.org/10.1016/j.appet.2014.01.010

Vivi Melinda & Andree Emmanuel Widjaja. (2022). Virtual Reality Applications in Education. International Transactions on Education Technology (ITEE), 1(1), 68-72. https://doi.org/10.33050/itee.v1i1.194

Yien, J. M.  Hung, C. M.  Hwang, G. J.  Lin, Y. C. (2011). A game-based learning approach to improving students' learning achievements in a Nutrition course.