



Revolutionizing Nutrition Education: Trends, Innovations, and Prospects in Learning Media

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Abstract: This comprehensive study conducts an in-depth analysis to explore the dynamic landscape of nutrition learning media research, aiming to delineate evolving trends, developmental trajectories, and their consequential implications. Employing bibliometric analysis and content analysis approaches, this research uncovers distinct publication patterns and citation behaviors, spotlighting pronounced trends catalyzed by the COVID-19 pandemic, a testament to the adaptability of educational systems. The study identifies a spectrum of learning media formats, encompassing applications, websites, and game-based platforms, while emphasizing the prevalence of experimental and design methodologies within the research paradigm. Keyword clusters elucidate strategies integrating technology and catering to diverse target audiences. In conclusion, nutrition education media plays a pivotal role in addressing health and sustainability challenges. The study advocates for ensuring equitable access to digital resources and advocates for fostering interdisciplinary collaboration as pivotal facets for future research endeavors. Ultimately, this research significantly contributes to enhancing nutrition literacy and underscores the transformative potential of technology-driven education in empowering informed dietary decisions and augmenting overall health outcomes.

INTRODUCTION

Revolutionary shifts in instructional methodologies and the emergence of cutting-edge strategies such as media-based learning have occurred in the contemporary educational landscape due to technology integration (Groff, 2013). This shift has led to the growing prominence of various media formats in achieving instructional goals, especially in nutrition education (Ciren, 2021; Groff, 2013; Miranti et al., 2021). Against the backdrop of unprecedented global challenges, including the far-reaching impact of the pandemic, there is a growing demand for adaptable and effective learning approaches. Using multiple

platforms and formats in educational media has become crucial for continuous learning in rapid spread and change (Brown, 2021; Chatterjee & Chakraborty, 2021; Rahmatullah & Ghufroon, 2021).

Non-communicable diseases (NCDs) are expanding, global population growth continues, and agriculture's contribution to climate change is undeniable. These interrelated factors pose a complex trilemma involving population dynamics, environmental sustainability, and public health (Willett et al., 2019). Dietary modification often emerges as a significant driver in this complex relationship, underscoring the adoption of healthy eating behaviors as an important

strategy to mitigate these challenges (Willett et al., 2019).

Given the urgency of these interconnected challenges, nutrition education emerges as a critical catalyst in driving the acceptance and adoption of healthier dietary choices. Educational media offers a promising way to disseminate accurate nutrition information and facilitate behavior change. The COVID-19 pandemic has accelerated the shift to distance learning, prompting educators to explore alternative instructional media to meet educational objectives (Bachri et al., 2021; Kusuma et al., 2022; Wijaya & Sugiharto, 2020). This transition significantly underscores the importance of efficiently disseminating appropriate nutrition information in nutrition education. As a result, there has been a noteworthy surge in research efforts focusing on nutrition learning media, including traditional and technology-based approaches (Mohan et al., 2021). Several scientific studies have examined various media platforms, such as those explored by (Winanti et al., 2019), games (Alattabi, 2021), augmented reality (Chanlin & Chan, 2018), and the Internet of Things (IoT) (Alloghani et al., 2016), as means to disseminate nutrition knowledge.

Furthermore, prior scholarly investigations have delved into the realm of nutrition. Zyoud et al. did a bibliometric analysis called "Bibliometric mapping of the landscape and structure of nutrition and depression research: visualization analysis" (Zyoud et al., 2023). They used Scopus data to look at publication patterns and research areas like child nutrition, sports nutrition, nutrition and cancer, and nutrition and COVID-19. Similarly, Silva conducted a bibliometric analysis titled "Food and Nutrition Literacy: Exploring the Divide Between Research and Practice," aimed at assessing the research landscape and bridging the gap between research and practice in food and nutrition literacy (Silva, 2023). Sweileh et al.

examined research on "nutrition and dietetics" in Arab countries through bibliometric analysis, providing valuable insights into this domain (Sweileh et al., 2014).

This study's primary objective is to comprehensively analyze nutrition's dynamic attributes as a learning medium. It aims to give educators, researchers, and policymakers significant and pertinent insights to inform their endeavors and decision-making within this domain. The study's overarching aim is to enhance nutrition education strategies through an exhaustive examination of research patterns, methodologies, and applications. Ultimately, this initiative aspires to constructively impact the advancement of healthier, more informed societies in the face of interconnected challenges encompassing climate change, agricultural consequences, and the escalating prevalence of non-communicable diseases (NCDs).

METHOD

This comprehensive analysis research was conducted with a bibliometric approach using metadata from the Scopus database, which consists of scholarly articles from various academic subjects. The globally recognized Scopus platform is ideal for bibliometric research (Chen et al., 2014). Scopus' broad range of disciplines ensures complete coverage for analyzing the nutrition learning media landscape (Silva, 2023; Sweileh et al., 2014; Zyoud et al., 2023).

Our study focused on Scopus-indexed nutrition education research from 2000 to July 2022. The search criteria used were "nutrition education" and "learning media" (or "educational media" or "learning media" or "educational technology"). We only searched for English-language publications. To obtain an unbiased snapshot and not be affected by database upgrades, the search and data retrieval were conducted on July 7, 2022.

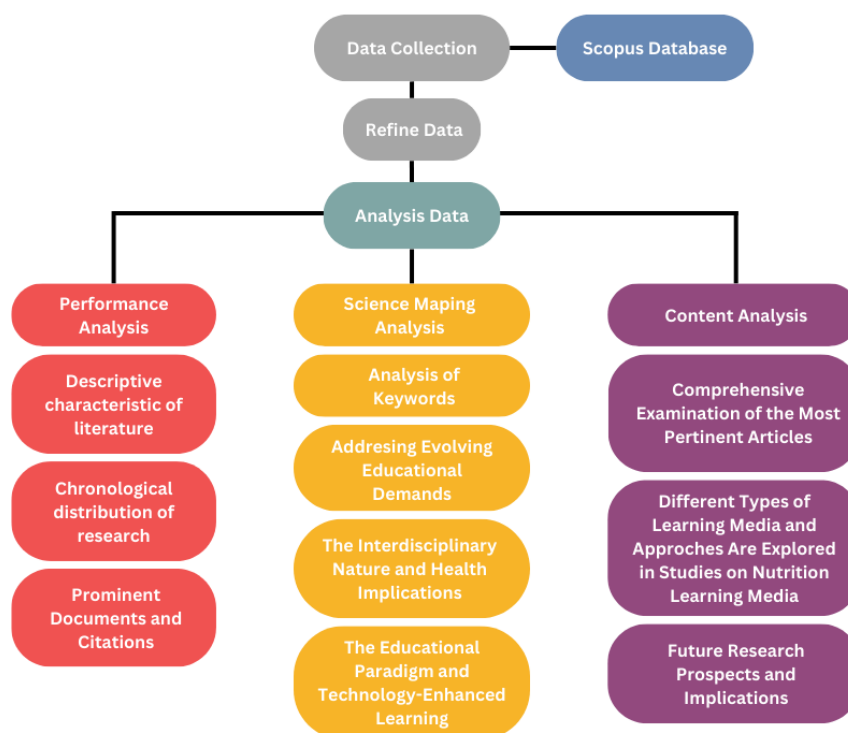


Figure 1. The Research Flow Diagram.

We used VOSviewer 1.6.18, a Java-based analysis tool, to better understand the creation, distribution, partnerships, and research directions of nutrition learning media and future directions. We displayed key research landscape patterns using this method. These patterns include publication volume trends, author-institution collaboration, journal citation patterns, and keyword occurrence networks. VOSviewer helps create network graphs with node labeling and color coding to distinguish things. Node diameters indicate citation or occurrence frequency, while link thickness and length indicate the strength of collaborative interactions (Mubarog et al., 2020; Van Eck & Waltman, 2011, 2014).

The overlay map shows study topics by color-coding the nodes based on the publication year of keywords. The continuum from blue to red shows the progression of study topics from inception to present. Detailed descriptive analysis includes publication year, journal, geographical distribution, institution, author, and references. The above analysis identified prolific authors, productive

teams, active research centers, and prominent publication channels.

A thorough content analysis was conducted on the most relevant nutrition learning media research papers. These papers were selected based on their relevance to the research objectives and themes. The selected publications were systematically evaluated to extract and interpret key findings, methods, and implications. The content analysis aimed to identify patterns, trends, and nutrition learning media research advances. The research covered learning media, research methods, and emerging issues. Using a qualitative approach gained a more in-depth understanding of the research landscape, thus enhancing overall understanding.

RESULT AND DISCUSSION

Global Publishing Volume and Trend

Research articles on nutrition learning instructional mediums from 2000 to July 2022 are shown in Figure 2. Publication growth from 2000 to 2016 fluctuated. An analysis of the chart over time shows a rise and decline. For

example, in 2001, there was a drop. Data rose in 2002 but plummeted in 2003. The lowest number of publications occurred in 2003. It also declined in 2007 and rebounded again in the next two years. Two years later, it fell again. Rocketing increased rapidly in 2014 but was reduced in 2015. Same thing in 2016–2017. Between 2017 and 2021, publication numbers climbed by seven each year.

In 2021, the highest number of publications occurred, notably during the COVID-19 pandemic, highlighting the growing importance of learning media for distance education. However, 2022 saw a drop due to ongoing data collection, yet the trend of rising publications indicates sustained interest and significance in nutrition learning media research.

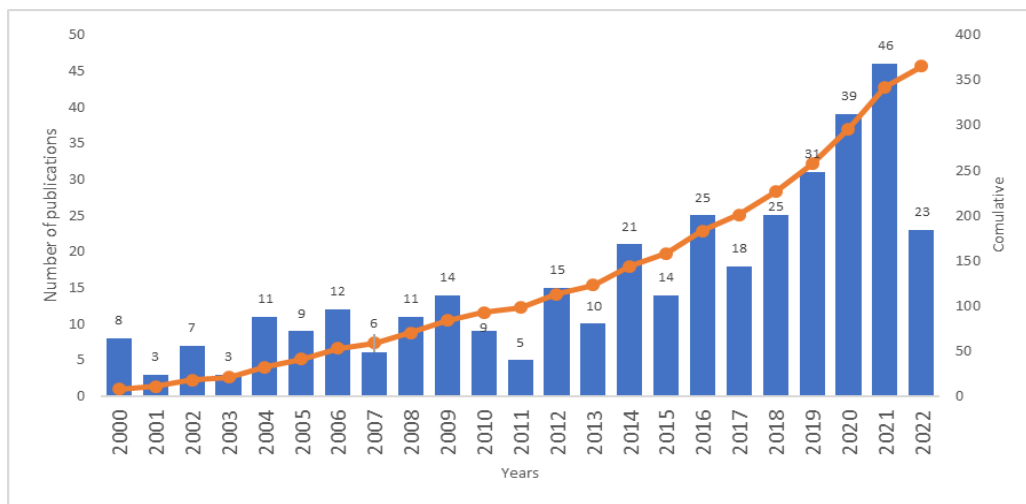


Figure 2. Chronological Distribution of Research Related to Learning Media Articles in Nutrition Learning in Scopus (from 2000 to July 2022).

Prominent Documents and Citations

When examining the second study topic, which explores the advancements in nutrition learning media research by analyzing the citation patterns of pertinent papers, a significant revelation arises. The publications with the highest number of citations reflect influential works that shape the direction of study within the subject. As shown in Table 1, the paper by Reid Chassiakos in 2016 is the most frequently referenced publication in the field (Chassiakos et al., 2016). Furthermore, it effectively corresponds with the current focus on employing digital media to promote health in diverse

environments, such as within families (Hendy et al., 2009). The existence of articles focused on medical aspects, like the research conducted by (Bennie et al., 2016; Frøisland et al., 2012; Jørgensen et al., 2003; Linda et al., 2016), emphasizes the interdisciplinary character of studying nutrition learning media. This research serves as a bridge between health education and medicine; up to 55.4% of citations from this medical field were highly cited. This is consistent with the growing educational approaches and broader health problems, clearly connecting with the study question's investigation of trends and advancements.

Table 1. Top 5 Documents Based on Higher Citation Score.

Rank	Title	Year	Source	Citations	Reference
1	Children and adolescents and digital media	2016	Paediatrics	395	18
2	A randomized non-pharmacological intervention study for prevention of ischaemic heart disease: Baseline results Inter.	2003	European Journal of Preventive Cardiology	377	19

Rank	Title	Year	Source	Citations	Reference
3	The Parent Mealtime Action Scale (PMAS). Development and association with children's diet and weight.	2009	Appetite	125	20
4	Improving diabetes care for young people with type 1 diabetes through visual learning on mobile phones: Mixed-methods study.	2012	Journal of Medical Internet Research	104	20
5	The descriptive epidemiology of total physical activity, muscle-strengthening exercises and sedentary behavior among Australian adults - Results from the National Nutrition and Physical Activity Survey.	2016	BMC Public Health	98	22

Analysis of Keywords

The thorough examination of keywords offers more understanding of the complex field of nutrition education research, in line with the second research question that explores advancements in studies related to nutrition learning materials. The process of identifying and clustering keywords provides insight into the prevailing themes and their interconnectedness within the given domain (Wang et al., 2020). The present study employs topic clusters to reveal multifaceted perspective researchers are now investigating in their scholarly inquiries.

Among the 990 keywords initially found, filters and constraints led to deriving a more focused subset consisting of 44 keywords. Within this set of keywords, a number of terms show notable frequency. Specifically, the terms "nutrition" appeared 32 times, "nutrition education" appeared 24 times, "obesity" appeared 23 times, "diabetes" appeared 18 times, "social media" appeared 12 times, "health education" appeared 11 times, "diet" appeared 11 times, and "digital media" appeared ten times. These terms surpassed the established threshold of 10 occurrences.

Figure 3 provides a graphic representation of the co-occurrence of the mentioned keywords, revealing their interconnections and establishing distinct thematic clusters that shed light on the field of nutrition education research within the initial cluster that has been visually emphasized with the color red, a

group of 12 specific terms amalgamates to create a prominent focal point, denoting a significant accumulation of citations. This cluster mostly focuses on nutrition-related ideas, encompassing keywords such as obesity, diabetes, diet, health inequalities, health promotion, health care, and lifestyle. The interdependence between obesity and diabetes is highlighted by the notable co-occurrence of the phrases "obesity" and "diabetes." This is due to the large contribution of obesity to the risk of developing type 2 diabetes, as demonstrated by (Nguyen et al., 2011).

The second thematic area, the green cluster, highlights the significant importance of nutrition education approaches in research. This cluster consists of ten keywords, with its core concept being "nutrition education." It is supplemented by related concepts like medical education, dietitians, and health literacy. This cluster represents the investigation of innovative pedagogical approaches, encompassing incorporating nutrition instruction via media platforms such as social media and Instagram. Furthermore, including the term "internet" highlights its significance in facilitating digital education and establishing connections with topics such as e-health.

Eight keywords make up cluster three, visually distinguishable by the color blue. This cluster expands the scope of inquiry to include outcomes and support mechanisms within the domain of nutrition education. This cluster shares

similarities with the second cluster but focuses more on engineering-based media. It is characterized by phrases such as serious games, gamification, game-based learning, mobile applications, mobile learning, and augmented reality. These principles provide opportunities to enhance the outcomes of nutrition education by including immersive learning experiences, ultimately resulting in enhanced nutrition knowledge and self-monitoring skills.

Five terms comprise the cluster yellow designates, fourth in the sequence.

This particular cluster exhibits a notable inclination towards health education and sources related to nutrition. This cluster places significant emphasis on health education, health promotion, and nutrition, highlighting the importance of integrating nutrition within the broader framework of health education. Moreover, it is emphasized that the correlation between nutritious sources, particularly vegetables and fruits, is a crucial component of nutrition instruction.

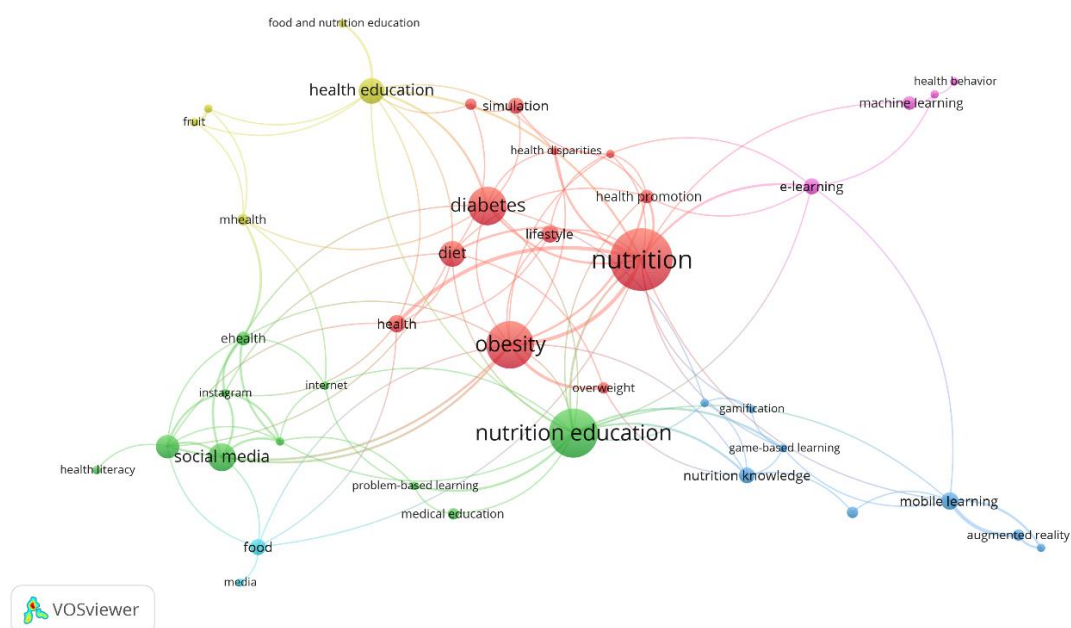


Figure 3. Co-occurrence of Author Keyword.

Cluster five, which has four keywords and is visually distinguishable by purple, relates to a larger healthcare framework. It encompasses cardiovascular illness, e-learning, health behavior, and machine learning. This exemplifies the integration of nutrition education with wider health-related concepts, enhancing the research's multidisciplinary scope. Finally, the sixth cluster, indicated by the color brown and consisting of two keywords, focuses on core elements intrinsically connected to nutrition education research, including food and media.

These clusters provide a comprehensive understanding of the complex and varied aspects of nutrition education research, showcasing the different areas of study that researchers are investigating. The results obtained from this study align closely with the research question's aim of exploring the changing patterns and advancements in nutrition learning media research. The interconnected network of keywords offers a comprehensive perspective on the interplay between different themes and researchers' adoption of an integrated approach to nutrition education. This

approach encompasses technology, health promotion, and pedagogical innovation.

Figure 4 presents a visual representation that illustrates the sequential appearance of author keywords in the domain of learning media in nutrition education. The presented graphic provides a distinct temporal viewpoint, facilitating a more detailed analysis of the development and advancement of particular research topics about learning media within nutrition.

As the chronological progression spans from 2014 to 2020, discernible trends and recurring topics emerge, providing valuable perspectives on the shifting research priorities throughout this period. From 2014 to 2016, the image exhibited a prevalence of deep colors, which signifies a notable intensity of research activities. The study focused on a range of keywords that covered many subjects, such as nutrition, nutrition education, diabetes, health, health education, health promotion, medical education, problem-based learning, the internet, nutrition, and lifestyle knowledge. This particular time frame emphasizes a comprehensive examination of fundamental principles in nutrition education, incorporating both theoretical underpinnings and practical applications. The inclusion of terms such as health promotion and problem-based learning highlights the multifaceted character of research in the field of nutrition education.

The emergence of particular keywords from 2016 to 2018 indicates a noticeable shift in emphasis. The presented visualization demonstrates a notable trend toward using certain terms, including social media, mobile learning, mobile applications, machine learning, e-health, m-health, obesity, and game-based learning. This era represents a notable trend towards using technical breakthroughs and their incorporation

into techniques for nutrition teaching. The use of terms such as social media, mobile learning, and mobile application corresponds to the widespread availability of digital platforms designed for educational use, enabling novel methods for nutrition teaching.

From 2018 to 2020, there was a noticeable change in hue to a vibrant shade of yellow, which indicates a subsequent development in the topic of study. During this phase, researchers exhibited a preference for keywords that emphasize the significance of digital media, gamification, serious games, augmented reality, and platforms such as Instagram. Furthermore, a novel aspect has arisen, centering on important terms associated with fruits and the dietary practice of vegetarianism. This statement proposes a broadening scope in the field of nutrition education research, encompassing current ideas that are in line with societal shifts and improvements in technology.

Figure 4 offers a comprehensive visual depiction that illustrates the chronological development of research topics and significant observations regarding the changing landscape of learning media research in nutrition education. The transitions between color clusters serve as symbolic representations of the dynamic shifts in study focus, encompassing fundamental knowledge, technological integration, and current trends. The comprehensive perspective presented here aligns with the research question's aim to investigate progress and patterns in research on nutrition learning media. It provides a thorough comprehension of the field's development over time.

The findings above offer a comprehensive understanding of nutrition learning media research, aligning with the predetermined research inquiries. Incorporating these findings into a wider theoretical framework

enhances our understanding of this dynamic discipline's consequences, importance, and possible development paths. The findings above fully explain nutrition learning media research by the predetermined research inquiries.

Incorporating these findings into a wider framework provides a more profound understanding of the consequences, importance, and prospective advancements in this developing discipline.

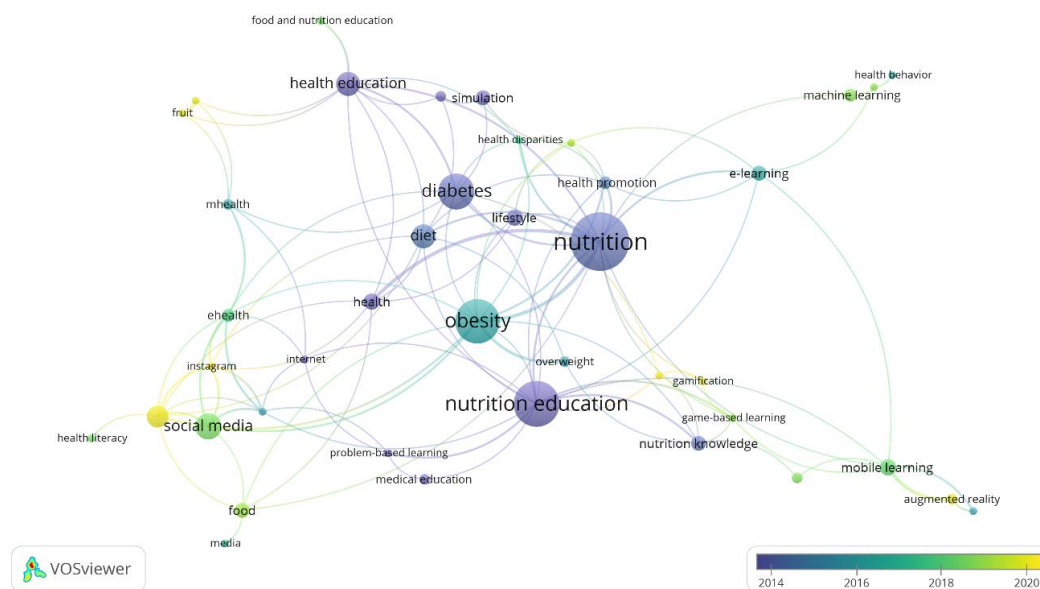


Figure 4. Timeline View of Co-occurrence of Author Keywords in Learning Media in Nutrition.

Addressing Evolving Educational Demands

The fluctuations in publication quantities between 2000 and 2016, followed by a significant increase from 2017 to 2021, can be interpreted as evidence of the adaptable nature of the education sector in efficiently addressing current challenges. The significant increase observed during this period aligns with the worldwide shift towards remote education, which was implemented in reaction to the emergence of the COVID-19 epidemic. The global health crisis has prompted a significant change in educational approaches, leading to the examination and implementation of different learning platforms to ensure the uninterrupted continuation of educational processes (Bachri et al., 2021; Kusuma et al., 2022; Wijaya & Sugiharto, 2020). The increased publication activity can be linked to the growing importance of

learning media in nutrition education. As a result, there has been a significant surge in scholarly attention and investigation on nutrition learning media. The current increase in educational adaptability underscores the potential of educational systems to effectively address disruptions by incorporating technology and developing creative solutions.

The Interdisciplinary Nature and Health Implications

The papers above have garnered substantial citations and encompass many topics. The studies above encompass an analysis of the impact of digital media on the advancement of family health and an investigation centered on medical topics (Halsall et al., 2016; Linda et al., 2016). The publications above underscore the interdisciplinary character inherent in examining nutrition learning media. Adopting an interdisciplinary methodology is congruent with the

research inquiry undertaken in this work, which centered on advancements in scholarly investigation and their impact on citation trends. The statement above emphasizes the significance of collaboration between healthcare, education, and technology experts. It notably underscores the integration of varied viewpoints to enhance the efficacy of nutrition education. Moreover, integrating academic literature on medicine highlights the interconnectedness of health results associated with food decisions, specifically about non-communicable ailments. The statement is consistent with the overarching objective of mitigating the worldwide impact of non-communicable diseases (NCDs) by promoting well-informed dietary choices (Willett et al., 2019).

The Educational Paradigm and Technology-Enhanced Learning

Keyword analysis and clustering techniques reveal nutrition learning media topic trends. The clusters' thematic categorizations correspond with research themes, making research advances and real-world application methods easier to understand. The clusters also suggest that technology-integrated, active-engagement initiatives are replacing classroom-centric methods. The green cluster prioritizes nutrition, social media, digital media instruction, and educational methodology development. Technology-integrated education has led to effective methods for engaging students and teaching nutrition. This includes using

social media, digital platforms, and unique educational resources. The yellow cluster emphasizes nutrition education's need for e-learning, mobile learning, and gamification. Technology-based efforts may boost sector engagement. The clustering of themes shows that nutrition education materials cover health-related behaviors, outcomes, and social settings. Due to the complexity of eating habits, a comprehensive educational plan that considers cultural, social, and environmental factors is needed.

A Comprehensive Examination of the Most Pertinent Articles

The global impact of nutrition learning media research underscores how technology and innovative teaching methods aid informed food choices, benefiting health and the environment. Academic engagement surged during the COVID-19 pandemic, revealing schools' adaptability and resourcefulness for learning continuity. However, digital transformation poses challenges of fairness and inclusivity, particularly for disadvantaged groups lacking access to digital resources. Future research should prioritize inclusive strategies to bridge the digital divide and cater to diverse learners. Collaborative efforts among educators, health professionals, technology experts, and legislators in interdisciplinary nutrition learning media studies facilitate evidence-based nutrition education that supports health promotion. Integration of technology holds the potential to enhance health, education, and societal well-being.

Table 2. The Overview of the Most Pertinent Articles.

No	Author(s)	Method	Learning Media	Finding
1	Natour, N., & Al-Tell, M. (2022) (Al-tell, 2022)	Survey	MyPlate	MyPlate pleases medical, nursing, and pharmacy students. Most participants considered the app easy to use. Some children followed the guidelines, but most ate many fruits and vegetables. Men and women and health-specialized groupings are similar.

No	Author(s)	Method	Learning Media	Finding
2	Dissen, A., & Crowell, T. (2022) (Dissen & Crowell, 2020)	a quasi-experimental control group	Documentary Film (Forks Over Knives)	The treatment group consumed animal food at different rates but not plant food. This study found that presenting the Forks Over Knives DVD influences student animal food consumption but not plant food. Health practitioners should use Forks Over Knives to promote dietary modification as part of a behavior change intervention program.
3	Bawadi, H., et al. (2022, January) (Bawadi et al., 2022)	experimental pre-test/post-test study	Educational tool (A Color-Coded)	Group two had more people who could plan daily meals with the recommended amounts of fruits, protein, dairy, carbohydrates, and calories. Group two's diet plan had a higher healthy eating index than group one's. Due to its visual nature, the redesigned exchange list is accessible to people with limited reading skills.
4	Purwaningsih, S., & Anggraeni, A. A. (2021, November) (Rinawati et al., 2021)	Research and development	whiteboard Animation Video	Dynamic color graphics, captions, dubbers, and background sound make this whiteboard animation film engaging and improve comprehension. Content experts, media experts, and users gave this whiteboard animation video 89.9%, 96.7%, and 89.7%, respectively, indicating its effectiveness as a nutrition science teaching tool in culinary vocational schools.
5	Abdollahi, A. M., et al. (2021) (Abdollahi et al., 2021)	Experiment and questioner	Educational Escape Game	The Games of Food Consortium investigates nutrition knowledge initiatives such as educational escape games and self-study. Teenage Escape Game Instructions Teen self-study nutrition programs are instructional escape games. 46% of respondents said nutrition education escape games are fun and may enhance the intrinsic desire to learn and change behavior. Research is needed.
6	Vedovato, G. M., & Leonardi, F. G. (2021) (Santista et al., 2021)	qualitative outcome evaluation	Online Course Comida de República	Review of the Comida de República Online course on healthy university meals Food interactions improved following the intervention, too. Environmental, interpersonal, and personal barriers to eating healthy included lack of access, time, and family and friend support. Course content, methods, and coaching match students' social circumstances, easing dietary changes.
7	Gosine, L., et al. (2021). (Gosine & Mcsweeney, 2021)	Focus Group	3D Food Printer	The focus group findings suggest that 3D food printers can generate interest in food and nutrition, but they are too new for teaching.
8	Rahmad, S. I. S. S., & Teng, N. I. M. F. (Izzatul et al., 2020)	Website Development and Validity	Website	A premature newborn nutrition page has nine categories. Very good content validation results. Parents need more online explanations. The material, pictures, and readability were clear, but the display validation findings were lacking. Instead, presentation literacy and information quality need little improvement. The site covered preterm babies' diets. It should enhance parental confidence and premature newborn care knowledge.
9	Froome, H. M., et al. (2020)	Experimental study	Foodbot Factory Mobile Serious Game	The serious mobile game program from Foodbot Factory teaches kids the Canadian Food Guide, but its influence on nutrition is uncertain. According to this study, Foodbot Factory motivates kids to learn

No	Author(s)	Method	Learning Media	Finding
10	(Froome et al., 2000) (Jin et al., 2020)	Experimental study	Android-based Educational Application (Mattampu)	about nutrition, improving overall and most sub-scores. Mothers in the first, second, and third trimesters can learn more about nutrition through Android-based instructional programs.
11	(Nasrullah et al., 2020)	Desain and developent	Web-Based Nutrition	Web-based dietary education for hypertension patients will be portable outside of counseling sessions. Healthcare will improve using this website. According to the study, most respondents say the app is straightforward to use across devices. Simple programs are used more. Additionally, the software simplifies data retrieval. A bilingual app (English and Indonesian) is crucial.
12	(Winanti et al., 2019)	Survey a cross-sectional method	Digipedia Edu_Makugiz	The research shows that most respondents agree that the application is easy to use across devices. Easy-to-use programs are more likely to be used. Additionally, the software makes it easy to find certain data. Bilingualism (in English and Indonesian) is vital to app modification.
13	(Alattabi, 2021)	Quasi-experimental approach	Educational Game Tools	Pasting pictures on a slide calendar helps schoolchildren choose nutritious snacks. Children's attitudes toward nutritious snacks don't change, but placing photos on a calendar presentation increases their understanding.
14	(Chanlin et al., 2019)	A mixed-methods	Mobile Augmented Reality	Epistemological analysis showed AR increased learning. Students eventually become more aware of their diet and change their dining habits. According to an epistemological study of students' dietary knowledge and conceptual changes, a mobile nutrition monitoring system increased nutritional concepts and decreased misconceptions. The learning assessment of 65 students who employed this strategy while studying improved significantly from the posttest.
15	(Chlipalski et al., 2019)	Quasi-experimental pre-posttest	Video-based Online Training	Video-based online training is an efficient way to supplement in-person training and get paraprofessionals ready to deliver nutrition topics.
16	(Ashlee et al., 2018)	Quasi-experimental pre-posttest	M Helath	To improve kids' consumption of fruits and vegetables, this pilot study presents a potentially efficient method that consists of a mobile Web site, social media, and text message components.
17	(Azevedo et al., 2018)	Quasi-experimental	Web-based Gamification	The gamified digital interactive platform seems to be a practical and flexible teaching resource for learning about healthy eating. The evaluation of family eating patterns before and after the intervention and a longer intervention period would be beneficial for future program implementations.
18	(Yulia et al., 2019)	Software Development Life Cycle (SDLC)	Digipedia Edu_Makugiz	This database mostly covers West Javan meals and drinks. Nutrition information is available for many foods and drinks. The database was developed using multithreading and multi-user MySQL. Web-based applications are developed using the Waterfall Software Development Life Cycle (SDLC), which involves requirements analysis, design, coding and implementation, testing, and

No	Author(s)	Method	Learning Media	Finding
19	(Tan et al., 2018)	Content analysis	YouTube	<p>maintenance. All have worked flawlessly using the app.</p> <p>The video sample has 187 commercials. Most advertising promotes non-essential goods and drinks. Non-core food advertising uses videos more than overlays. Taste appeal (42.3%), novelty/uniqueness (32.4%), animation (22.5%), fun appeal (22.5%), promotional character use (15.5%), pricing (12.7%), and health and nutritional benefits (8.5%) were the most effective non-core commodity marketing tactics. Like TV, unhealthy food commercials dominate YouTube's kid-targeted content.</p>
20	(Chanlin & Chan, 2018).	Mix Method	Augmented Reality	<p>Students developed and tested an augmented reality nutrition tracker for smartphones. The use of AR enhanced visual appeal, enjoyable learning, and personal relevance, ultimately improving students' knowledge and self-regulation of eating behaviors. To be more effective, ongoing updates to the food information in the AR Food mobile app are necessary. Further research is needed to make it suitable for lifelong self-monitoring by children.</p>
21	(Stotz et al., 2017)	interviews	Online eLearning	<p>Motivation is a major program eligibility barrier. The Internet and literacy were not major hurdles. The use of cooking tutorial videos, recipes, and step-by-step teaching materials is highlighted. Nutrition experts say this show teaches proper nutrition. The findings will inform user-centered programming.</p>
22	(Cruz-maya & Tapus, 2016)	experimental design	Kompai Robot	<p>Robosoft's Kompai robot shows that human speech learning is better. The studies also show that personality strongly impacts learning. People with higher neuroticism scores outperformed those with lower neuroticism throughout multimedia learning. Male participants were more stressed in robot and synthesized sound settings than in other settings. These findings can be used to improve profile-specific instruction.</p>
23	(Alloghani et al., 2016)	design and development	Mobile Health (Internet-of-Things)	<p>This article describes a mobile health app that educates parents and children about obesity to help them eat well. This smartphone software helps evaluate obesity-prevention strategies. The Internet of Things-based app tracks food intake, retrieves distant data, and monitors child data with interactive feedback on the mobile app.</p>
24	(Mohd & Shahbodin, 2016)	design and development of the ADDIE model	PLENut (Personalized Learning Environment for Nutrition)	<p>This study shows that courseware is properly created using personalized learning components and rigorous assessment. PLEnut is anticipated to offer a new approach to nutrition education so that all pupils can better comprehend it. This technique meticulously aligns corporate needs, instructional methods, and learning objectives for an effective program. ADDIE instructional design systematics focus on organizational expectations and what students should know or be able to do following instruction.</p>

No	Author(s)	Method	Learning Media	Finding
25	(Diego et al., 2015)	Design	Computer-Assisted Instruction	This program gives health professionals and students a cutting-edge way to complete nutritional assessments that mix theory and practice and can be integrated into their academic curriculum.
26	(Viggiano et al., 2014)	experiment	Kaledo	Over six months, Kaledo improved BMI scores, nutritional awareness, and diet. It can be effective in initiatives to prevent childhood and teenage obesity.
27	(Tossavainen et al., 2012)	Conceptual design	ICT-based learning	After a three-year education development project, school staff opinions on a nutrition health project implemented through an ICT-based learning environment fell into five categories: multidisciplinary nutrition education, motivation for lifelong nutrition, and school community support for nutrition health activities.
28	(Fančovičová et al., 2010)	Experimental research	Websites	Students' nutritional knowledge scores were not statistically different between the experimental and control groups on the posttest and retention assessments, demonstrating that online and in-person education have equal effects. Compared to ICT, traditional nutrition education is still valuable.
29	(Margolis et al., 2009)	Experiment	Web-based	An acceptable and efficient method for dietitians to educate people about nutritional performance is through the Internet.
30	(Wui & Saat, 2008)	case study	WebQuest	The findings of this investigation suggest three conclusions. WebQuest education is influenced by several factors, including the NutriQuest website's nutrition science content, teachers' and students' positive opinions of WebQuest scientific instruction, and its use.
31	(Nelson, 2006)	Design	WebQuests	Webquests are entertaining and interactive ways to get people interested in nutrition and guide them. WebQuests are a fun and effective way to teach clients, students, and interns about nutrition and technology. Dietitians looking to expand their methods can check out WebQuests.
32	Kreisel, K. (2004) (Kreisel, 2003).	Experiment	Computer-based	This computer application improves nutrition classes. Addressing formative evaluation tool deficiencies can make nutrition learning more engaging, fascinating, and effective. Early and effective nutrition education may have long-term health benefits, although "good" nutrition rarely interests youngsters.
33	(Chanlin & Chan, 2002)	Forum discussion	Online Learning	Images, motion, and dynamic learning approaches help students understand lessons. Task-oriented teaching engages students in learning. Students must study and submit their homework online. Online group discussions are also recommended for study. Students' education opinions were collected.

Different Types of Learning Media and Approaches Are Explored in Studies on Nutrition Learning Media

Nutrition education uses many learning media. Table 2 lists the many

nutrition educational media. The above categories include numerous education issues. Applications (5 articles), website-based platforms (7 articles), game-based learning (3 articles), online learning tools

(4 articles), augmented reality (2 articles), documentary films, color codes, and 3D printers are covered. This study also covers nutrition learning media and research methods. Table 2 shows that 13 papers tested media tactics. Design, research, and software development were also used in nine articles. Three scholarly studies used forum group conversations to examine media viability, while two others used surveys, mixed techniques, and content analysis. In rare cases, conceptual design and case studies were used to analyze the nutrition learning medium.

Prospects for Future Research and Implications

The scholarly literature on nutrition learning media shows its importance in tackling global concerns. Nutrition education may empower people to make educated dietary choices using technology and new pedagogical methods. This can boost their well-being and environmental sustainability.

Academic engagement has increased due to the COVID-19 pandemic, demonstrating educational institutions' ability to use resources and assure uninterrupted learning. However, digital change raises concerns about digital fairness and inclusivity, especially among disadvantaged populations. Future research should focus on inclusive methods that meet diverse learners' requirements and close the digital gap. Nutrition learning media study is interdisciplinary, emphasizing the need for collaboration between educators, health professionals, technology specialists, and legislators. The creation of this connection promotes effective and empirically-based nutrition education initiatives that fit with health promotion goals.

Academic research on nutrition learning media shows its global impact. Technology and creative pedagogy can

help people eat healthy, improving health and the environment. The COVID-19 epidemic has enhanced academic engagement, indicating that educational systems can adapt and utilize resources to ensure learning. Digital transformation raises concerns about digital fairness and inclusivity, especially for excluded communities without digital resources and services. Research should focus on inclusive methods that satisfy diverse learners' requirements and close the digital gap. The interdisciplinary nutrition learning media study emphasizes collaboration between educators, health professionals, technology experts, and legislators. The collaboration is essential to creating effective and empirically validated nutrition education initiatives for health promotion. This partnership could reduce health and educational disparities and advance society by integrating technology.

In conclusion, this study thoroughly examines the dynamic nature of nutrition education about learning media. Current research findings in the field support this analysis. The initial noteworthy contribution arises from the seminal studies conducted by (El-Gayar et al., 2013; LeRouge et al., 2019; Meyer et al., 2019), which provide valuable insights into the rapid uptake of nutrition education applications within our more digitized society. Our research distinguishes itself by extensively investigating many learning media types, including applications, websites, and game-based platforms. This comprehensive approach serves as the fundamental basis of our study. This detailed assessment provides a nuanced comprehension of the dynamic educational environment, contributing a heightened level of complexity to the ongoing discussion. Another significant viewpoint is presented by (Vamos et al., 2021), which underscores the need for

interdisciplinary approaches to improving nutrition literacy. Our research makes a distinctive contribution by emphasizing the adaptation of the school system, with a special focus on the tough circumstances presented by the COVID-19 epidemic. The remarkable adaptability of nutrition education media demonstrated in times of crisis highlights its robustness and responsiveness, a notable strength.

Regarding evaluating the effectiveness of learning media in nutrition education, the (Mythraye & Kanozia, 2021) study provides useful information. Our research supports this viewpoint by adhering to rigorous procedures, primarily via experimental approaches and careful design considerations. The prioritization of methodological depth is a distinctive characteristic of our research, which guarantees a strong basis for comprehending the influence of educational media on nutrition knowledge. Our study distinguishes itself by thoroughly investigating various learning media formats, demonstrating adaptability in the face of difficult conditions, and adhering to rigorous research techniques. By integrating knowledge and ideas derived from contemporary scholarly works, our contribution enriches the existing academic conversation and emphasizes the current and significant nature of our research outcomes. As we progress, our study establishes the foundation for ongoing investigation and advancement in the ever-evolving field of nutrition education via instructional media.

CONCLUSION

This study thoroughly examines the changing patterns in media research concerning nutrition education. This statement highlights the importance of instructional materials in effectively addressing worldwide health and

sustainability issues, specifically focusing on the current COVID-19 pandemic. The analysis of publishing trends demonstrates a fluid pattern, highlighting the flexibility of education during the pandemic while also underscoring the importance of inclusive strategies to address digital disparities. Moreover, the examination of the cited literature highlights the interdisciplinary character of this domain and its significance in the realms of education, healthcare, and policy. The author's keywords that appear together indicate the changing research priorities, with a growing emphasis on methodologies driven by technology, evaluation of effectiveness, and reaching diverse groups of people. The research highlights the efficacy of interactive learning methods, such as applications, websites, and gamified learning, while underscoring the significance of rigorous methodology for evaluating the impact of educational media. To develop evidence-based nutrition education, eliminate health inequities, enhance health literacy, and promote sustainability, it is imperative for future research to prioritize equitable access to educational resources and foster interdisciplinary collaboration.

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