SERIOUS GAMES AND INCLUSION IN FOOD EDUCATION: THEORETICAL POTENTIAL AND PEDAGOGICAL CONDITIONS FOR EFFECTIVE USE

Alberto Fornasari
Università degli Studi di Bari Aldo Moro
alberto.fornasari@uniba.it

Michele Martulli
Università degli Studi di Bari Aldo Moro
michele.martulli@lediel.it

Double Blind Peer Review

Citation
Fornasari, A., & Martulli, M. (2026). Serious games and inclusion in food education: Theoretical potential and pedagogical conditions for effective use. *Italian Journal of Health Education, Sport and Inclusive Didactics*, *10*(1). https://doi.org/10.32043/gsd.v1i1.1683

Doi: https://doi.org/10.32043/gsd.v1i1.1683

Copyright notice:
© 2026 The Author(s). This is an open access, peer-reviewed article published by Cares S.r.l. – REN Press and distributed under the terms of the Creative Commons Attribution 4.0 International License (CC BY 4.0), which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

renpress.it/index.php/gsdj
ISSN: 3103-5744

ABSTRACT
Serious games and playful digital technologies offer engagement mechanisms and intrinsic motivation that traditional food education methods struggle to replicate. This theoretical paper analyses the inclusive potential of serious games in food education, examines digital platforms, mobile apps and educational escape rooms, and proposes an original conceptual framework, the GFLI model (Game-based Food Literacy for Inclusion), to guide the design of effective and accessible digital interventions for adolescents' food literacy.

KEYWORDS
Serious games; Food literacy; Game-based learning; Inclusive education; Digital technologies.

Received 2026-04-01
Accepted 2026-07-12
Published 2026-07-15

1. Introduction

Contemporary education faces a challenge of growing scope: how to promote healthy, mindful and sustainable eating behaviours in a generation of adolescents exposed to an uninterrupted flow of digital stimuli, commercial messages and poorly healthy food models (Qutteina et al., 2021). Food literacy (FL) — understood as the set of knowledge, skills and attitudes that enable individuals to plan, choose, prepare and consume food critically and consciously — has established itself as a crucial pedagogical construct for addressing this challenge (Hernandez et al., 2021; Silva et al., 2023). Its development during adolescence is particularly relevant, since it is during this phase that eating habits consolidate and tend to persist over time (Ares et al., 2024). However, traditional school-based food education programmes show clear limitations in terms of student engagement, learning motivation, and the capacity to produce lasting changes in daily practices (Bailey et al., 2019; Medeiros et al., 2022). The transmissive approach, centred on the mere transmission of nutritional notions, proves insufficient to generate the deep transformation that Critical Food Systems Pedagogy sets as its goal (Classens & Sytsma, 2020).

Within this scenario, digital technologies — and in particular serious games, educational escape rooms, mobile applications and MOOC platforms — present themselves as tools capable of reconnecting motivation, learning and behavioural change in food education contexts. This is not simply a matter of "modernising" teaching with technological support, but of rethinking the very architecture of the educational experience, valuing the dimensions of engagement, narrative, immediate feedback and progressive challenge that characterise game-based learning (GBL) (Ke et al., 2016; Breien & Wasson, 2021). This paper pursues a theoretical objective: to analyse the inclusive potential of serious games in food education, to examine the mechanisms through which playful digital technologies can promote food literacy, and to propose an original conceptual framework — the GFLI model (Game-based Food Literacy for Inclusion) — that can guide the design of effective and accessible digital educational interventions. The paper is structured in four main sections: after a review of the theoretical foundations of GBL and of food literacy as a multidimensional competence (Section 2), the main digital applications for food education are examined — serious games, mobile apps and educational escape rooms (Section 3); the GFLI framework is then developed (Section 4), followed by a critical discussion and concluding remarks (Section 5).

2. Theoretical foundations: Game-Based Learning and Food Literacy

Game-based learning (GBL) is an educational approach that draws on the mechanisms intrinsic to games — progressive challenge, immediate feedback, reward, narrative, sense of competence — to promote meaningful learning in formal and non-formal contexts (Ke et al., 2016). Unlike gamification, which consists of applying superficial playful elements to non-playful contexts, GBL implies a complete and structured gaming experience in which educational content is organically interwoven with game mechanics (Zhang et al., 2022). Serious games represent the most articulated form of GBL: they are digital games designed specifically for educational, training or awareness-raising purposes, which preserve the experiential features of gameplay without giving up the cognitive structure of learning (Watsjold et al., 2022). Their effectiveness has been documented across very different disciplinary domains — from medicine (Ang et al., 2018) to corporate training (Patrício et al., 2018), from cybersecurity (Ali Khan et al., 2025) to public health (Farooq et al., 2025) — suggesting that the learning mechanisms they activate are transversal with respect to content. In this sense, Su et al. (2013) propose a quality-evaluation framework for serious game design based on rough set theory and fuzzy TOPSIS logic, offering useful methodological tools to guide playful-educational design.

Engagement in GBL is not a monolithic phenomenon: Ke et al. (2016) distinguish at least three dimensions — cognitive, affective and behavioural — that are activated interdependently during gameplay. Narrative plays a key role: Breien & Wasson (2021), through a systematic review of DGBL (Digital Game-Based Learning), identify a taxonomy of narrative elements — characters, plot, conflict, setting — which, when properly integrated into design, produce positive effects on motivation, engagement and learning. The feedback and reward system constitutes another pillar: Fanfarelli (2020) shows how the combination of narrative elements and badging produces significant effects on both learning and engagement; similarly, Su & Cheng (2015) document how a mobile gamification system produces improvements in motivation and learning outcomes compared with traditional methods. Calvo-Ferrer (2017) confirms these findings in the context of L2 vocabulary acquisition, while Denham (2015) explores the theme of support for conceptual understanding, showing how scaffolding mechanisms embedded in the game can sustain the development of abstract concepts in students with heterogeneous backgrounds. Adaptivity is an increasingly relevant dimension: Vanbecelaere et al. (2021) demonstrate the effectiveness of an adaptive

educational game for early numerical abilities, while Slattery et al. (2025), in a broad systematic review on the use of Minecraft as a DGBL tool, confirm that cognitive, academic and social outcomes depend critically on the quality of the instructional design accompanying the use of the game. Chaves-Yuste & de-la-Peña (2025) confirm the positive impact of digital resources on academic learning also in ESP contexts. The literature documents GBL applications in very different disciplinary contexts — from gamification for relational values (Sarour et al., 2023) to nursing education (Grech & Grech, 2021), from fire safety (Huang et al., 2025) to innovation pedagogy (Patrício et al., 2018) — suggesting that GBL mechanisms are transversal to disciplinary content and potentially applicable to food education with appropriate design adaptations.

Food literacy cannot be reduced to mere nutritional knowledge: it comprises an articulated set of cognitive, practical, critical and relational competences that enable individuals to navigate the complex contemporary food system with awareness (Hernandez et al., 2021). The pedagogical framework proposed by Hernandez et al. (2021) identifies core dimensions of FL: practical competence, critical competence, systemic competence and civic competence. Ares et al. (2024) explore the development of FL in children and adolescents, showing how strategies to promote healthier and more sustainable diets must take into account the specificities of the processes through which this competence is acquired at different developmental stages. Silva et al. (2023) frame this process within the broader context of health communication, showing how the challenges of food literacy are deeply intertwined with those of health literacy. Exposure to social media constitutes a further factor of complexity: Qutteina et al. (2021) document how social media influence adolescents' eating outcomes, creating information environments saturated with commercial messages that require critical competences to be navigated with awareness. School-based food education programmes constitute the main institutional context for the development of FL. Bailey et al. (2019), in a systematic review of secondary school programmes, identify the characteristics of the most effective programmes: multidimensional approaches, active student engagement, and connection with everyday life contexts. Medeiros et al. (2022), in their meta-analysis, document positive effects on adolescents' food consumption, but highlight the high heterogeneity of results. Miller et al. (2023) adopt a systemic perspective on nutrition education, while Miller et al. (2021) highlight significant differences in adolescents' learning interests that call for personalised approaches. Classens & Sytsma (2020) develop the perspective of Critical Food Systems Pedagogy, arguing that educational institutions have the

responsibility to train students able to critically read the food system in its economic, social and environmental dimensions. Equity is a crucial aspect: Wiafe et al. (2023) document how nutrition education produces significant improvements in the eating practices of adolescents in resource-limited settings; Gambescia et al. (2025) highlight the persistent fragmentation of the Italian system of school-based nutrition interventions; Mansfield et al. (2024) show that food communication must be adapted to contexts and age groups in order to be effective and inclusive.

3. Digital tools for food education: serious games, mobile apps and escape rooms

Applications of serious games to food and nutrition education constitute a rapidly developing field, whose evidence base is still consolidating. Abdollahi et al. (2021) document the results of an educational escape game designed to increase nutrition-related knowledge in young adolescents, with positive effects on knowledge acquisition in an engaging and motivating format. Ghadam et al. (2023) examine the effect of a digital game-based nutrition education programme on anaemia indicators in adolescent girls, documenting significant improvements in knowledge and eating practices. Peña et al. (2021) evaluate the effectiveness of a gamification strategy for the prevention of childhood obesity in schools, documenting positive effects on anthropometric indices and eating behaviours. Wiafe et al. (2023) confirm that targeted nutrition education can produce changes in adolescents' eating practices even in resource-limited settings. An established line of research concerns the use of video games — and exergames in particular — to combat obesity: Mack et al. (2017), in a systematic review, show that the evidence on effectiveness is promising but still insufficient to draw definitive conclusions about long-term effects; Guy et al. (2011) argue that digital games can help reduce weight-related social bias through identification mechanisms; Lamboglia et al. (2013) document how exergames can increase energy expenditure and promote a more active lifestyle, while stressing the need to combine them with broader educational interventions; Pakarinen et al. (2017) show that health games can act on psychological variables — self-efficacy, motivation, perceived competence — as well as on observable behaviours. The effectiveness of digital tools is not automatic: Consavage Stanley et al. (2022) develop a digital food and nutrition literacy model that integrates the dimensions of access, critical use and production of food-related digital content; Mansilla et al. (2021) document how a MOOC on food labelling education produces significant increases in consumer awareness, but identify limitations related to accessibility and the persistence of learning; Walker et al. (2018) highlight users' tendency to seek nutritional

information on non-specialised digital platforms, with implications for the design of digital food literacy interventions.

Mobile health applications (mHealth apps) constitute a particularly promising vector for promoting food literacy among adolescents, owing to their ubiquity, accessibility and capacity to integrate into daily life. Turner et al. (2015) examine the potential of mobile technologies for the prevention and treatment of paediatric obesity, showing how apps can support dietary monitoring, goal-setting and real-time behavioural feedback. Quelly et al. (2016), in a systematic review, document promising but heterogeneous evidence, with more consistent results in apps that integrate gamification, social connection and personalisation features. Shin et al. (2019) confirm, through a meta-analysis, the effectiveness of smartphone-based interventions in improving adolescents' physical health. Kim & Xie (2016) analyse the relationship between health literacy and digital health services, showing that users' ability to critically evaluate online health information is itself a competence that requires development and support. Not all mobile applications targeting food-related health produce positive effects: Fairburn & Rothwell (2015) conduct a systematic appraisal of eating disorder apps, showing that most are not based on solid clinical evidence; O'Leary & Torous (2022) update this picture, documenting the proliferation of eating disorder apps and the persistent lack of scientific validation. Regarding personalisation, Hwang & Lee (2016) explore nutrition interventions based on the transtheoretical model through technological convergence; Krishna et al. (2025), in a systematic review of effective digital health interventions for children, identify active engagement, personalisation, social support, progressive feedback and integration with everyday life contexts as key components of success. Claflin et al. (2023) document lasting behavioural changes six months after participation in an online course, while Morze et al. (2023) show how digital technologies can profoundly transform the architecture of learning opportunities within advanced educational ecosystems.

Educational escape rooms represent one of the most innovative and promising GBL applications in recent years. Veldkamp et al. (2022) analyse how students learn during gameplay in an educational escape room, identifying high-level cognitive processes — transfer, metacognition, collaborative problem-solving — that the gaming experience naturally activates. Veldkamp et al. (2020), in a scoping review on escape rooms in education, document the rapid expansion of this approach across very different educational contexts, from primary school to university, from vocational training to healthcare. Chen et al. (2025) document the effects of a civic-

education escape room on learning motivation, critical thinking and flow experience, identifying the combination of narrative immersion and cognitive challenge as a key factor of effectiveness. Applications in health and scientific fields provide a valuable frame of reference: Montel et al. (2025) evaluate the effectiveness of a digital escape room for teaching veterinary anatomy; van Houwelingen et al. (2023) document the development of an escape room based on pharmacokinetics; Sachsenmeier et al. (2025) compare the effects of a digital escape room with traditional review sessions, documenting significant motivational advantages of the playful approach; Bakke & Lewis (2025) describe an escape room for high-yield review in the biomedical sciences; Marcos et al. (2025) present Histopoly, a serious game for teaching histology; Pornsakulpaisal et al. (2023) offer a practical guide to building digital escape rooms, focusing on the conditions that make the gaming experience effective; Caussin et al. (2024) document an educational escape room for pre-clinical training in dentistry; Cotoras et al. (2024) develop and evaluate a virtual escape-room game for teaching industrial bioprocesses; Baranyi & Balducci (2023) present DeapSea, a workflow-supported serious game for stroke rehabilitation. Li et al. (2024) explore the application of scaffolding theory in serious games for cultural heritage learning, and Li et al. (2023) develop the same approach for traditional Chinese murals: the idea that food is a vector of cultural identity aligns with the perspective of food literacy as a systemic and civic competence. Pistono et al. (2024) propose a framework for adaptive serious games that integrates adaptivity, narrative and formative feedback within a flexible game architecture — a model potentially applicable to food education, where the diversity of students' cultural backgrounds and eating habits calls for high degrees of personalisation.

4. The GFLI framework: an integrated theoretical model

The Game-based Food Literacy for Inclusion (GFLI) model proposed here stems from a critical analysis of the literature presented in the previous sections and aims to offer an integrated conceptual framework for the design, implementation and evaluation of playful digital interventions oriented towards food literacy from an inclusive perspective. It is not an operational protocol, but a theoretical frame that identifies the fundamental principles, constitutive dimensions and pedagogical conditions that determine the effectiveness and inclusiveness of GBL tools in food education. The framework is built on the integration of three distinct theoretical traditions: that of game-based learning, which provides the mechanisms of engagement and motivation (Ke et al., 2016; Breien & Wasson, 2021; Zhang et al.,

2022); that of food literacy, which defines the goals and developmental processes of food competence (Hernandez et al., 2021; Ares et al., 2024; Classens & Sytsma, 2020); and that of inclusive pedagogy and technologies for inclusion (Consavage Stanley et al., 2022; Krishna et al., 2025; Morze et al., 2023), which binds educational design to accessibility and attention to diversity.

The GFLI framework articulates four constitutive dimensions. The first is Engagement & Affect: this level concerns the capacity of the digital tool to generate authentic engagement and positive emotional states — curiosity, productive challenge, satisfaction — that make the learning experience intrinsically motivating (Ke et al., 2016; Fanfarelli, 2020; Su & Cheng, 2015). Narrative (Breien & Wasson, 2021), progressive feedback (Vanbecelaere et al., 2021), challenge structure (Denham, 2015) and personalisation elements (Hwang & Lee, 2016) are the main design devices through which this dimension is realised; Calvo-Ferrer (2017) and Zhang et al. (2022) confirm that motivation is the critical mediator between the use of the playful tool and learning outcomes, while Grech & Grech (2021) and Ang et al. (2018) document how engagement can be effectively generated in very different contexts through well-designed game mechanics. The second dimension is Food Literacy Depth: this concerns the tool's capacity to promote all dimensions of food literacy — not only nutritional knowledge, but also practical, critical, systemic and civic competences (Hernandez et al., 2021; Silva et al., 2023). An effective serious game for FL does not merely convey information on calories or nutrients, but creates contexts in which students must reason about production chains, evaluate food information, negotiate choices in social contexts, and reflect on the impact of their own decisions (Classens & Sytsma, 2020; Miller et al., 2023); Medeiros et al. (2022) and Bailey et al. (2019) confirm that multidimensional interventions produce more lasting effects than those that focus on a single dimension.

The third dimension is Inclusive Design: this is what most distinguishes the GFLI model from generic GBL frameworks, placing inclusion as a constitutive principle of design, rather than a subsequent addition. This implies attention to access barriers — technological, linguistic, cognitive, cultural, economic — that can limit the participation of vulnerable students (Bailey et al., 2019; Gambescia et al., 2025; Mansfield et al., 2024). It requires the adoption of Universal Design for Learning principles, the adaptivity of tools (Pistono et al., 2024; Vanbecelaere et al., 2021), availability in different languages and formats, and attention to cultural specificities in food representations (Wiafe et al., 2023); Consavage Stanley et al. (2022) provide the reference conceptual model for operationalising this dimension within the

context of digital food literacy. The fourth dimension is Transfer & Sustainability: this concerns the capacity of the gaming experience to produce lasting changes in food-related knowledge, attitudes and behaviours. Much of the available evidence documents positive effects on short-term learning, but evidence on the persistence of behavioural change is still limited (Mack et al., 2017; Pakarinen et al., 2017). The GFLI framework identifies three conditions for maximising transfer: consistency between in-game challenges and real-life food-choice situations (Bailey et al., 2019); the support of adult educational figures who accompany the gaming experience with moments of metacognitive reflection (Veldkamp et al., 2022); and continuity of the intervention over time, avoiding one-off and decontextualised interventions (Medeiros et al., 2022; Claflin et al., 2023).

Across all four dimensions, the GFLI model identifies three enabling conditions that determine the overall quality of the intervention. The first is design coherence: every element of the game — mechanics, narrative, feedback, content — must be designed in function of the FL objectives. Design must be iterative, grounded in cycles of development and evaluation that incorporate users' perspectives (Pornsakulpaisal et al., 2023; Cotoras et al., 2024); Su et al. (2013) offer methodological tools for evaluating the design quality of serious games, while Ali Khan et al. (2025) and Farooq et al. (2025) confirm that design quality is the main predictor of effectiveness across different training contexts. The second condition is feedback quality: the game's feedback system must be immediate, specific, informative and non-judgemental, so as to support learning without fuelling anxiety or competition — a particularly critical condition in the food domain, where behaviours are emotionally charged and dynamics of shame can hinder openness to change (Guy et al., 2011; Fairburn & Rothwell, 2015; O'Leary & Torous, 2022); Slattery et al. (2025) confirm that the quality of digital feedback significantly mediates learning outcomes in GBL contexts. The third condition is contextual integration: GBL tools must not be used as substitutes for the educational context, but as catalysts for richer learning experiences that integrate the digital experience with moments of reflection, discussion, practice and civic action (Classens & Sytsma, 2020; Sachsenmeier et al., 2025); Morze et al. (2023) suggest that the digital transformation of education requires the construction of coherent digital ecosystems, in which serious games fit as components of a broader educational project, rather than as isolated tools.

5. Discussion and Conclusions

The analysis conducted in the previous sections allows an articulated picture to be drawn of the potential and limitations of serious games and playful digital technologies in food education. On the side of opportunities, it emerges clearly that GBL can offer what traditional transmissive methods struggle to guarantee: authentic engagement, intrinsic motivation, personalisation of the experience, progressive feedback, and the possibility of simulating food-choice situations in safe and controlled contexts (Ke et al., 2016; Abdollahi et al., 2021; Ghadam et al., 2023). The variety of available formats — from narrative serious games to escape rooms (Veldkamp et al., 2022; Chen et al., 2025), from MOOCs to exergames (Lamboglia et al., 2013; Mansilla et al., 2021), from apps to gamification platforms (Turner et al., 2015; Quelly et al., 2016) — makes it possible to respond to very different training needs and to reach heterogeneous student populations. The proposed GFLI framework offers an original theoretical contribution, identifying the constitutive dimensions of an effective and inclusive digital intervention for FL and the pedagogical conditions that determine its success; it distinguishes itself from generic GBL frameworks through its specific attention to inclusion as a founding principle, in line with the vision of the call for papers, which places inclusion at the centre of food education practices and strategies.

A critical examination of the literature, however, also reveals limitations and critical issues that the GFLI framework must necessarily acknowledge. First, most of the available evidence on the effectiveness of GBL in food education comes from small-scale studies, with heterogeneous methodologies, short follow-up periods and non-representative samples (Mack et al., 2017; Pakarinen et al., 2017; Lamboglia et al., 2013): the empirical basis is still insufficient to draw definitive conclusions on long-term effectiveness and on the transferability of results to different contexts. Second, there is a risk of a digital divide: digital technologies can widen educational inequalities if they are not designed with attention to the access barriers that characterise the most vulnerable social groups (Consavage Stanley et al., 2022; Bailey et al., 2019; Gambescia et al., 2025). Third, the design of effective serious games for FL is a complex and costly undertaking, requiring collaboration among educators, nutritionists, designers and technology developers — resources that are often beyond the reach of individual school institutions (Farooq et al., 2025; Huang et al., 2025; Ali Khan et al., 2025), suggesting the need for structured public investment and for collaborative development models at national and international level.

The GFLI framework opens up several lines of future research. The first concerns the empirical validation of the model: longitudinal studies, with mixed methodologies and large, diversified samples, are needed to test the robustness of the identified dimensions and conditions (Medeiros et al., 2022; Sachsenmeier et al., 2025). The second concerns the development of tools for assessing the inclusive quality of GBL interventions for FL. The third concerns the exploration of emerging formats — augmented reality, virtual reality, adaptive artificial intelligence — and their potential for inclusive food literacy (Slattery et al., 2025; Pistono et al., 2024; Chaves-Yuste & de-la-Peña, 2025; Baranyi & Balducci, 2023). The fourth concerns the intercultural and transnational dimensions of GBL interventions for FL: Wiafe et al. (2023), Mansfield et al. (2024) and Li et al. (2023; 2024) indicate that cultural specificities in the representation of food, eating and the body must be systematically integrated into the design of digital tools that aspire to be genuinely inclusive. This paper has proposed a theoretical analysis of the inclusive potential of serious games in food education, developing an original framework — the GFLI model — that integrates the traditions of game-based learning, food literacy and inclusive pedagogy within a coherent and generative conceptual frame. The theoretical results of the work can be summarised in four statements: serious games offer engagement and motivation mechanisms that traditional methods are unable to replicate (Ke et al., 2016; Abdollahi et al., 2021; Breien & Wasson, 2021); their effectiveness depends on the quality of the design and on the capacity to generate experiences that transfer into real behaviours (Bailey et al., 2019; Mack et al., 2017; Pistono et al., 2024); inclusion must be a founding principle of design, not a subsequent addition (Consavage Stanley et al., 2022; Gambescia et al., 2025; Wiafe et al., 2023); empirical research on the effectiveness of GBL in food education is still at an early stage and requires longitudinal, rigorous and culturally sensitive studies (Medeiros et al., 2022; Veldkamp et al., 2022; Krishna et al., 2025). The GFLI framework is not a point of arrival, but a point of departure: a theoretical tool to guide the design and evaluation of digital educational interventions that take seriously both the potential of play, the challenges of inclusion, and the complexity of food competence. In an age in which digital technologies pervade every aspect of young people's experience — including, as Qutteina et al. (2021) document, the dimension of food choices and models — the challenge of food education cannot be addressed while ignoring the potential and the pitfalls of digital environments.

References

Abdollahi, A. M., Masento, N. A., Vepsäläinen, H., Mijal, M., Gromadzka, M., & Fogelholm, M. (2021). Investigating the effectiveness of an educational escape game for increasing nutrition-related knowledge in young adolescents: A pilot study. Frontiers in Nutrition, 8, 674404.

Ali Khan, F., Amjad, K., Ishaq, K., Nawaz, N. A., Rosdi, F., & Dogar, A. B. (2025). Unlocking cybersecurity: A game-changing framework for training and awareness — A systematic review. Human Behavior and Emerging Technologies.

Ang, E. T., Chan, J. M., Gopal, V., & Li Shia, N. (2018). Gamifying anatomy education. Clinical Anatomy, 31(7), 997–1005.

Ares, G., De Rosso, S., Mueller, C., Philippe, K., Pickard, A., Nicklaus, S., van Kleef, E., & Varela, P. (2024). Development of food literacy in children and adolescents: Implications for strategies to promote healthier and more sustainable diets. Nutrition Reviews, 82(4), 536–555.

Bailey, C. J., Drummond, M. J., & Ward, P. R. (2019). Food literacy programmes in secondary schools: A systematic literature review and narrative synthesis of quantitative and qualitative evidence. Public Health Nutrition, 22(16), 2891–2913.

Bakke, J., & Lewis, B. E. (2025). Escaping the ordinary: Mechanics, dynamics, and aesthetic-guided design and evaluation of an escape room for high yield review in basic medical sciences. Anatomical Sciences Education.

Baranyi, R., & Balducci, F. (2023). DeapSea: Workflow-supported serious game design for stroke rehabilitation. International Journal of Computer Games Technology, 2023, 1–14.

Breien, F. S., & Wasson, B. (2021). Narrative categorization in digital game-based learning: Engagement, motivation & learning. British Journal of Educational Technology, 52(1), 91–111.

Calvo-Ferrer, J. R. (2017). Educational games as stand-alone learning tools and their motivational effect on L2 vocabulary acquisition. British Journal of Educational Technology, 48(2), 264–278.

Caussin, É., Qatramiz, A., Guillemot, C., et al. (2024). Creation and evaluation of an educational escape room for preclinical training on 3D printing in dentistry. European Journal of Dental Education.

Chaves-Yuste, B., & de-la-Peña, C. (2025). Impact of digital resources on ESP academic performance. TESOL Journal.

Chen, H., Yohannes, A., & Hung, N. (2025). Effects of escape room game-based civics education on junior high school students' learning motivation, critical thinking and flow experience. British Journal of Educational Technology.

Claflin, S. B., Campbell, J., Mei, I., Mainsbridge, C., & Taylor, B. V. (2023). Self-reported behaviour change 6 months following participation in a free online course about multiple sclerosis. Health Promotion Journal of Australia, 34(2), 345–352.

Classens, M., & Sytsma, E. (2020). Student food literacy, critical food systems pedagogy, and the responsibility of postsecondary institutions. Canadian Food Studies / La Revue Canadienne des Études sur l'Alimentation, 7(1), 8–19.

Consavage Stanley, K., Harrigan, P. B., Serrano, E. L., & Kraak, V. I. (2022). A systematic scoping review to develop a digital food and nutrition literacy model. Obesity Reviews, 23(5), e13423.

Cotoras, D., Valenzuela-Ibaceta, F., Salas, D., & Cárdenas, F. (2024). Development and assessment of a virtual escape-room game for teaching industrial bioprocesses. Biochemistry and Molecular Biology Education, 52(4), 453–461.

Denham, A. (2015). Supporting conceptual understanding through digital gameplay. Journal of Computer Assisted Learning, 31(6), 549–561.

Fairburn, C. G., & Rothwell, E. R. (2015). Apps and eating disorders: A systematic clinical appraisal. International Journal of Eating Disorders, 48(7), 1038–1046.

Fanfarelli, J. R. (2020). Impact of narrative and badging on learning and engagement in a psychology learning game. British Journal of Educational Technology, 51(2), 387–419.

Farooq, F., Ishaq, K., Alvi, A., et al. (2025). Transforming healthcare training: Personalized and gamified first aid education. Human Behavior and Emerging Technologies.

Gambescia, S., Aboul-Enein, B. H., Keller, T., et al. (2025). Effectiveness of school-based nutrition interventions in Italy: A scoping review. Food Science & Nutrition.

Ghadam, O. S., Sohrabi, Z., Mehrabi, M., et al. (2023). Evaluating the effect of digital game-based nutrition education on anemia indicators in adolescent girls. Food Science & Nutrition.

Grech, J., & Grech, J. (2021). Nursing students' evaluation of a gamified public health educational webinar: A comparative pilot study. Nursing Open, 8(5), 2361–2370.

Guy, S., Ratzki-Leewing, A., Gwadry-Sridhar, F., & Masuo, K. (2011). Moving beyond the stigma: Systematic review of video games and their potential to combat obesity. International Journal of Hypertension, 2011, 179124.

Hernandez, K. J., Gillis, D., Kevany, K., & Kirk, S. (2021). Toward a common understanding of food literacy: A pedagogical framework. Canadian Food Studies / La Revue Canadienne des Études sur l'Alimentation, 8(4), 8–25.

van Houwelingen, A., Ter Heegde, F., Boschloo, W., Piek, L., & Wubbels, T. (2023). Development and evaluation of an escape room based on general pharmacokinetics: Students' perceptions of its motivational climate. Pharmacology Research & Perspectives, 11(6), e01155.

Huang, T., Feng, Z., Paes, D., et al. (2025). Gamification for wildfire education and safety training: A systematic literature review and meta-analysis. Journal of Computer Assisted Learning.

Hwang, J., & Lee, J. E. (2016). Tailored nutrition intervention based on the transtheoretical model using technology convergence. FASEB Journal, 30(S1).

Ke, F., Xie, K., & Xie, Y. (2016). Game-based learning engagement: A theory- and data-driven exploration. British Journal of Educational Technology, 47(6), 1183–1201.

Kim, H., & Xie, B. (2016). Health literacy and internet- and mobile app-based health services: A systematic review. Proceedings of the Association for Information Science and Technology, 53(1), 1–6.

Krishna, K., Portsmouth, L., Harris, C., & Ciccarelli, M. (2025). What's the "secret sauce"? A systematic review of effective digital health behaviour change interventions for children. Health Promotion Journal of Australia.

Lamboglia, C. M., Silva, V. T., Vasconcelos Filho, J. E., et al. (2013). Exergaming as a strategic tool in the fight against childhood obesity: A systematic review. Journal of Obesity, 2013, 438364.

Li, Q., Wang, P., Liu, Z., et al. (2023). Using scaffolding theory in serious games to enhance traditional Chinese murals culture learning. Computer Animation and Virtual Worlds, 34(6), e2128.

Li, Q., Wang, P., Liu, Z., et al. (2024). Using scaffolding theory in serious games to enhance cultural heritage learning. Computer Animation and Virtual Worlds, 35(2), e2210.

Mack, I., Bayer, C., Schäffeler, N., et al. (2017). Chances and limitations of video games in the fight against childhood obesity — A systematic review. European Eating Disorders Review, 25(4), 237–267.

Mansfield, D., Sagan, D., O'Donnell, A. J., et al. (2024). High school student and caregiver preferred communication method regarding school meals. Journal of School Health, 94(5), 432–440.

Mansilla, N., Stancu, V., Stickel, L., & Grasso, S. (2021). Increasing food labelling awareness through a massive open online course (MOOC). Nutrition Bulletin, 46(3), 282–291.

Marcos, R., Gomes, A., Santos, M., & Coelho, A. (2025). Histopoly: A serious game for teaching histology to 1st year veterinary students. Anatomical Sciences Education.

Medeiros, G. C. B. S., Azevedo, K. P. M., Garcia, D., Oliveira Segundo, V. H., Mata, Á. N. S., Fernandes, A. K. P., Santos, R. P., Trindade, D. D. B. B., Moreno, I. M., & Guillén Martínez, D. (2022). Effect of school-based food and nutrition education interventions on the food consumption of adolescents: A systematic review and meta-analysis. International Journal of Environmental Research and Public Health, 19(17), 10522.

Miller, M., Barwood, D., Devine, A., Boston, J., Smith, S., & Masek, M. (2023). Rethinking adolescent school nutrition education through a food systems lens. Journal of School Health, 93(3), 218–228.

Miller, M., Barwood, D., Furfaro, M., Boston, J., Smith, S., & Masek, M. (2021). Identifying differences in nutrition-related learning interests of adolescent students. Journal of School Health, 91(8), 641–650.

Montel, C., Cartiaux, B., & Mogicato, G. (2025). Evaluation of the effectiveness of a digital escape room for learning veterinary anatomy. Anatomical Sciences Education.

Morze, N., Smyrnova-Trybulska, E., Drlík, M., & Buinytska, O. (2023). Development of advanced digital ecosystems at universities. European Journal of Education, 58(4), 592–610.

O'Leary, T., & Torous, J. (2022). Smartphone apps for eating disorders: An overview of the marketplace and research trends. International Journal of Eating Disorders, 55(5), 639–648.

Pakarinen, A., Parisod, H., Smed, J., & Salanterä, S. (2017). Health game interventions to enhance physical activity self-efficacy of children: A quantitative systematic review. Journal of Advanced Nursing, 73(4), 794–811.

Patrício, R., Moreira, A. C., & Zurlo, F. (2018). Gamification approaches to the early stage of innovation. Creativity and Innovation Management, 27(4), 499–511.

Peña, S., Carranza, M., Cuadrado, C., et al. (2021). Effectiveness of a gamification strategy to prevent childhood obesity in schools. Obesity, 29(2), 341–349.

Pistono, A. M., Santos, A. M., Baptista, R. J., & Mamede, H. S. (2024). Framework for adaptive serious games. Computer Applications in Engineering Education, 32(1), e22671.

Pornsakulpaisal, R., Ahmed, Z., Bok, H., et al. (2023). Building digital escape rooms for learning: From theory to practice. The Clinical Teacher, 20(4), e13590.

Quelly, S. B., Norris, A. E., & DiPietro, J. L. (2016). Impact of mobile apps to combat obesity in children and adolescents: A systematic literature review. Journal for Specialists in Pediatric Nursing, 21(1), 5–17.

Qutteina, Y., Hallez, L., Raedschelders, M., De Backer, C., & Smits, T. (2021). Food for teens: How social media is associated with adolescent eating outcomes. Public Health Nutrition, 25(2), 290–302.

Sachsenmeier, C., McCarthy, S., Abukabda, A., et al. (2025). Effects of digital escape room versus traditional review sessions on motivation and short-term knowledge. Anatomical Sciences Education.

Sarour, E., Allinjawi, A., Alyahiwi, S., & Albeshri, O. (2023). Can we enhance respectful behaviors toward parents with gamification? An observational study of gamification elements and child attitudes toward parents. International Journal of Computer Games Technology, 2023, 1–14.

Shin, Y., Kim, S. K., & Lee, M. (2019). Mobile phone interventions to improve adolescents' physical health: A systematic review and meta-analysis. Public Health Nursing, 36(4), 524–533.

Silva, P., Araújo, R., Lopes, F., & Ray, S. (2023). Nutrition and food literacy: Framing the challenges to health communication. Nutrients, 15(22), 4708.

Slattery, E. J., Lehane, P., Butler, D., O'Leary, M., & Marshall, K. (2025). Assessing the benefits of digital game-based learning with Minecraft: A broad systematic review. Review of Education, 13(1).

Su, C., & Cheng, C. (2015). A mobile gamification learning system for improving the learning motivation and achievements. Journal of Computer Assisted Learning, 31(3), 268–286.

Su, C., Chen, K. T., Fan, K., & Meen, T. (2013). Rough set theory based fuzzy TOPSIS on serious game design evaluation framework. Mathematical Problems in Engineering, 2013, 1–12.

Turner, T., Spruijt-Metz, D., Wen, C. K., & Hingle, M. D. (2015). Prevention and treatment of pediatric obesity using mobile and wireless technologies. Pediatric Obesity, 10(6), 403–409.

Vanbecelaere, S., Cornillie, F., Sasanguie, D., Reynvoet, B., & Depaepe, F. (2021). The effectiveness of an adaptive digital educational game for early numerical abilities. British Journal of Educational Technology, 52(5), 2048–2062.

Veldkamp, A., Niese, J. R., Heuvelmans, M., Knippels, M. P., & Joolingen, W. R. (2022). You escaped! How did you learn during gameplay? British Journal of Educational Technology, 53(4), 853–868.

Veldkamp, A., van de Grint, L., Knippels, M. P., & van Joolingen, W. R. (2020). Escape rooms in education: A scoping review. British Journal of Educational Technology, 51(4), 1168–1188.

Walker, R., Blumfield, M., & Truby, H. (2018). Beliefs and advice-seeking behaviours for fertility and pregnancy: A cross-sectional study of a global sample. Journal of Human Nutrition and Dietetics, 31(3), 364–372.

Watsjold, B. K., Cosimini, M., Mui, P., & Chan, T. M. (2022). Much ado about gaming: An educator's guide to serious games and gamification in medical education. AEM Education and Training, 6(4), e10777.

Wiafe, M. A., Apprey, C., Annan, R. A., & Owusu-Kwarteng, J. (2023). Nutrition education improves knowledge of iron and iron-rich food intake practices among young adolescents. International Journal of Food Science, 2023, 1–9.

Zhang, Q., Yu, Z., & Bahnasse, A. (2022). Investigating and comparing the effects on learning achievement and motivation for gamification and game-based learning. Education Research International, 2022, 1–12.