Journal of Information Technology Education: Research

An Official Publication of the Informing Science Institute
InformingScience.org

JITEResearch.org

Volume 24, 2025

GAMIFICATION IN ONLINE ADULT LEARNING: A SYSTEMATIC LITERATURE REVIEW

Apostolos Kostas*	University of the Aegean, Rhodes, Greece	apkostas@aegean.gr
George Koutromanos	National and Kapodistrian University of Athens, Athens, Greece	koutro@primedu.uoa.gr
Ioanna Lagopati	National and Kapodistrian University of Athens, Athens, Greece	ioannalagopati@yahoo.gr

* Corresponding author

ABSTRACT

Aim/Purpose	The purpose of this review is to investigate current research on gamification for adult lifelong learning, including tertiary education, work-based learning, and informal learning.
Background	As teaching methods still rely on traditional methods, the necessity of a paradigm shift in teaching methods to foster motivation and leverage better learning outcomes remains a challenge. One of the proposed solutions is to make learning more attractive via contextualized designs that follow the principles of gamification.
Methodology	To address the research questions, a systematic literature review was conducted, based on the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) protocol. As part of the systematic literature review, articles published between 2014 and 2024 were sought. The search query consisted of the various Boolean operators and search terms. The search was conducted in ScienceDirect, SpringerLink, ERIC, and Scopus. Of the 232 articles identified, 141 were selected by applying inclusion and exclusion criteria. After reviewing the abstracts of the selected studies, 36 articles were included in the review.
Contribution	This study contributes by providing a thorough review of the current state of gamified learning in the field of adult education. It synthesizes previous research and offers insights into technologies, theories, elements, and learning outcomes

Accepting Editor Fariza Khalid | Received: January 20, 2025 | Revised: April 18, May 29, 2025 | Accepted: June 1, 2025.
Cite as: Kostas, A., Koutromanos, G., & Lagopati, I. (2025). Gamification in online adult learning: A systematic literature review. *Journal of Information Technology Education: Research, 24,* Article 22.
https://doi.org/10.28945/5549

	of gamified educational interventions. Moreover, this review highlights the potential of gamification to enhance learning experiences through the integration of game elements into educational design, resulting in more efficient and productive training models.
Findings	The study revealed that gamified learning is applicable in a variety of subjects, predominantly in areas related to business administration, economics, and pedagogical studies, as corroborated by prior research. It is diverse and depends on several factors, including the educational purpose, the learning profile, the established learning objectives, and the desired learning outcomes. Gamified learning yields significant learning outcomes for adult learners.
Recommendations for Practitioners	Gamification offers significant potential for enhancing motivation, engagement, and learning in various key areas, including formal education in higher education, corporate training, healthcare, workplace settings, and sustainability. Moreover, when a designer integrates game elements into non-gameful environments, it is crucial to consider specific design parameters. The research indicates that when game elements are thoroughly designed to align with the learning characteristics of adult learners and are based on learning theories related to gamified learning, they enhance the motivation to engage in learning activities. This, in turn, leads to an increase in the learners' self-efficacy.
Recommendations for Researchers	Further investigations into the application of gamified adult education through Learning Management Systems (LMS) are needed. This includes the effectiveness and sustainability of using advanced applications of adaptive and personalized gamification with embedded artificial intelligence in open learning environments, which appears to be a new trend.
Impact on Society	The key outcomes are associated with the enhancement of learning performance and the acquisition of practical knowledge and skills that can be applied in real-world scenarios, such as work environments. In these environments, adults will be able to solve practical problems and enhance their work performance and productivity.
Future Research	As research continues to verify the effectiveness of gamification in terms of learning benefits, further investigation is needed to explore different educational levels and span the continuum of lifelong learning, as well as to examine new emerging technologies, especially generative AI tools.

Keywords	gamification, gamified digital applications, systematic review, online adult learning, lifelong learning

INTRODUCTION

Lifelong learning (LLL) has become increasingly important due to rapid technological advancements, evolving job markets, and the ongoing need for professional and personal skill development (OECD, 2021; UNESCO, 2022). Furthermore, LLL is a key political choice of the European Union (2019) and a national priority because of its connection to employment, economic well-being, and individual participation in society (Gouvias et al., 2019). In this context, aligning learning content with learners' needs and stimulating their interest and participation is essential for the successful implementation of any LLL initiative (Tay et al., 2022). However, since teaching methods still rely on traditional techniques, often characterized by passive knowledge transmission, the need for a paradigm shift in teaching methods to foster motivation and promote better learning outcomes remains a challenge (Hattie, 2009, 2023).

Passive knowledge transmission is an educational approach primarily characterized by the teacher delivering information directly to learners, who receive the content without actively engaging in its construction or practical application. In this traditional model, learners typically adopt a passive role, merely listening, reading, or memorizing, rather than interacting actively with the content or critically applying knowledge to real-world scenarios (Hattie, 2023). For example, in a traditional lecture-based adult education class, learners might sit quietly and take notes while an instructor presents concepts related to management theory. They have limited opportunities to engage actively with the material through interactive discussions, real-life case studies, problem-solving activities, or group collaboration. Instead, their primary task is to absorb the information delivered by the instructor, which results in superficial learning and a limited ability to apply theoretical knowledge in practical contexts. This approach has been criticized for limiting critical thinking, reducing motivation, and hindering learners' capacity to transfer learned knowledge to authentic situations effectively (Knowles et al., 2020).

This traditional approach often fails to engage adult learners effectively, whose learning preferences are shaped by various personal and professional responsibilities, experiences, and motivations (Knowles et al., 2020; Merriam & Baumgartner, 2020). Consequently, these traditional methods can result in reduced motivation, lower engagement, and decreased knowledge retention among adult learners (Hattie, 2023; Merriam & Bierema, 2013).

One proposed solution is to enhance the appeal of learning through contextualized designs that adhere to gamification principles (Hamari et al., 2014). Various studies (Dempsey et al., 2002; Landers, 2014; Salen & Zimmerman, 2003; Werbach & Hunter, 2012) have worked to conceptualize the term "gamification" and concluded that it is a method of learning design that does not involve games but incorporates game elements (points, levels, achievements, prizes, etc.) in non-game contexts (real-life). The experiences created for users (learners) are "gameful" rather than "playful," as the use of game elements and designs is guided by rules that assist users in focusing and orienting themselves toward specific goals. These experiences contribute to users' cognitive and behavioral development (Deterding et al., 2011; Oliveira et al., 2023).

To effectively apply gamification in education, it is essential to carefully consider the characteristics of trainees during the design process, whether for structural gamification (game elements are added only to the activities) or content gamification (game elements are added only to the content) (Somova & Gachkova, 2016). These characteristics also relate to motivation theories as well as constructivist theories, including cooperative and situated learning (Chang et al., 2023; Hu et al., 2023; Mekler et al., 2017; Zhao et al., 2024). Notably, gamification is quite different from "serious games," which aim solely at education without seeking entertainment (Landers, 2014; Sailer et al., 2017).

One of the benefits of gamification is enhancing learners' motivational affordances. These motives are sparked by the satisfaction of learners' needs to feel competent and autonomous when they receive corresponding rewards for achieving goals within the game (Deterding et al., 2011; Prensky, 2003). Gamified applications merge learning with fun and are crafted so that learners can adjust the game's characteristics to fit their learning profiles, leading to increased participation and engagement with the game's goals, which align with learning achievements. Furthermore, game elements create an environment where learners can interact, collaborate, and compete (Prensky, 2003).

According to the literature, various review studies have attempted to contextualize aspects of gamification in different educational settings. For example, Perryer et al. (2016) reviewed gamification as a tool to increase workplace motivation. Subhash and Cudney (2018) examine the application of gamification in higher education but do not provide data on the underlying learning theories. While highlighting how game design elements enhance learner engagement, this study does not investigate their impact on the motivation and self-efficacy of adult learners. Metwally et al. (2021) reviewed gamification in higher education and reported that most studies were implemented in social sciences and engineering/computing courses. They discuss game mechanics and the theoretical framework but do

not detail specific digital tools. Krath et al. (2021) identified several theoretical foundations in gamification research, highlighting motivational, behavioral, and learning effects on adult learners. However, they do not discuss specific fields of implementation, digital gamified tools, or experienced learning outcomes. Tay et al. (2022) emphasized that gamification is not confined to formal education but is also used in informal learning settings and professional upskilling courses. This review highlights that game design elements enhance learners' engagement, but it does not investigate the subject areas, the tools used, or the relationship between the motivation and self-efficacy of adult learners. Finally, in their review, Dahalan et al. (2024) supported the conclusion that gamification and game-based learning can improve academic performance, engagement, and motivation in vocational education learners.

Gamification has emerged as a promising solution since it aligns well with adult learners' expectations for engaging, flexible, and self-directed learning experiences. By integrating motivational and interactive game elements into educational contexts, gamification can enhance learners' intrinsic motivation, engagement, and self-efficacy – critical factors for sustained lifelong learning. Despite this potential, most existing research has primarily explored gamification within higher education settings (Subhash & Cudney, 2018; Vrcelj et al., 2022), overlooking informal and corporate adult learning contexts – areas that are increasingly important due to their direct relevance to workforce development and personal skill enhancement.

This systematic review aims to address this critical gap by thoroughly investigating how gamification has been implemented across the entire spectrum of lifelong learning, including formal, informal, and corporate environments. Understanding these implementations is essential for developing more effective, motivationally rich, and learner-centered educational strategies for adult learners. Clarifying this issue will not only enhance academic understanding but also provide educators and instructional designers with actionable insights to better meet the evolving expectations and needs of adult learners in diverse learning contexts.

This need has prompted the development of the following research questions, which will be explored in detail in our literature review:

RQ1: What tools have been used to implement gamification in adult learning?
RQ2: What learning theories support gamification in adult learning?
RQ3: What are the elements of gamification in adult learning?
RQ4: What are the learning outcomes associated with gamification in adult learning?

In this study, which addresses the aforementioned research questions, we conducted a literature review of 36 empirical research papers in the field of gamified learning, focusing on adult formal and non-formal education. We provide a comprehensive and updated overview of the existing body of literature on this topic. We analyze how gamification has been implemented, specifically examining the types of technologies used, the game elements employed, the learning theories that support instructional designs, and the psychological and behavioral outcomes reported in the studies. The remainder of this paper presents the methodology used for the systematic literature review, the results per research question, a discussion based on the analysis and synthesis of those results, and finally, the limitations of the study along with implications for practice and future research.

METHODOLOGY

A systematic literature review was conducted to address the research questions, following a meticulously defined methodology with distinct implementation phases (Page et al., 2021), which form the basis of its validity criteria (Fink, 2005; Lame, 2019). This approach utilizes the protocol of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA), which includes a checklist of 27 items and a revised flow diagram with three stages, as depicted in Figure 1. Rigorous

inclusion and exclusion criteria were applied (Haddaway et al., 2022; Page et al., 2021) to identify and select relevant articles.

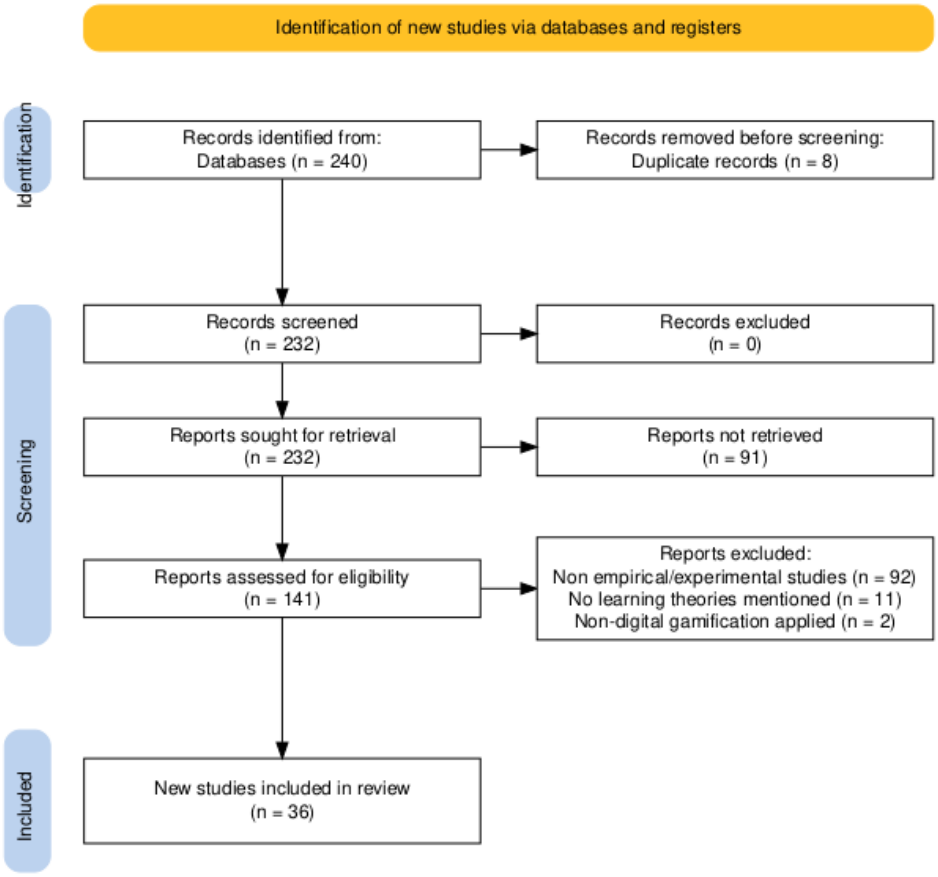

Figure 1. PRISMA flow diagram

The search was conducted exclusively on English articles, and the final search was completed in March 2024, utilizing ScienceDirect, SpringerLink, ERIC, and Scopus. Considering the overall aim and specific research questions of the systematic literature review, the search employed the following Boolean operators and keywords: '[gamification OR "game-based learning"] AND "adult education" AND ["learning theories" OR "game elements" OR "intrinsic motivation"] AND ["formal learning" OR "non-formal learning" OR "informal learning"]', focusing solely on English-language scientific articles published between 2014 and 2024. A total of 232 articles were gathered and screened based on the inclusion/exclusion criteria (see Table 1).

Table 1. Inclusion and exclusion criteria for research articles

Category	Inclusion criteria	Exclusion criteria
Publication type	Research articles in scientific journals or conference proceedings with blind review	Review, position papers, books, and chapters
Publication year	2014-2024	
Research objective	Benefits of gamification in education	Research focusing only on technologies for gamification
Educational content	Formal, non-formal, informal adult education (age 18+)	No specific educational context, K-12 education

Category	Inclusion criteria	Exclusion criteria
Methodological design	Empirical research, mainly interventions involving digital gamification based on specific learning theories	Reports, non-digital game-based learning
Language	English	-
Accessibility	Open/institutional access	-

The management of data for this study was facilitated by using the open-source reference management software Zotero (Trinoskey et al., 2009). To extract, organize, and categorize information, a Google Sheets spreadsheet was created with columns designated for recording data related to the study's identity.

Furthermore, data on the methodological design of the studies were systematically recorded. The spreadsheet also documented the results and conclusions derived from the included studies. After organizing this data, a narrative synthesis was conducted based on the methodology outlined by Petticrew and Roberts (2006). This synthesis was enhanced by creating tables that were designed to highlight the interconnections between the results and the evidence uncovered in the review. Notably, the coding of data within systematic reviews differs from that in primary research, as participant data and author analyses are interpreted to yield third-order constructs, an approach elaborated by Crompton et al. (2021).

In this study, dual coding strategies were employed: a priori coding and grounded coding, aligned with the framework of Crompton et al. (2021). A priori coding was specifically used to extract categories related to articles' Identity, Educational Level, Education Type, and Methodology. Conversely, grounded coding was applied for research extraction categories, initially employing in-vivo coding as discussed by Saldana (2015), without calculating interrater reliability.

Figure 2 presents the frequency of publication per year, with studies conducted in Europe (16, 44.44%), Asia (13, 36.11%), America (5, 13.89%), and Australia/New Zealand (2, 5.56%). Half of the articles were published in two prominent Q1 ranking journals: *Computers & Education* (11, 30.6%) and *Computers in Human Behavior* (10, 27.8%).

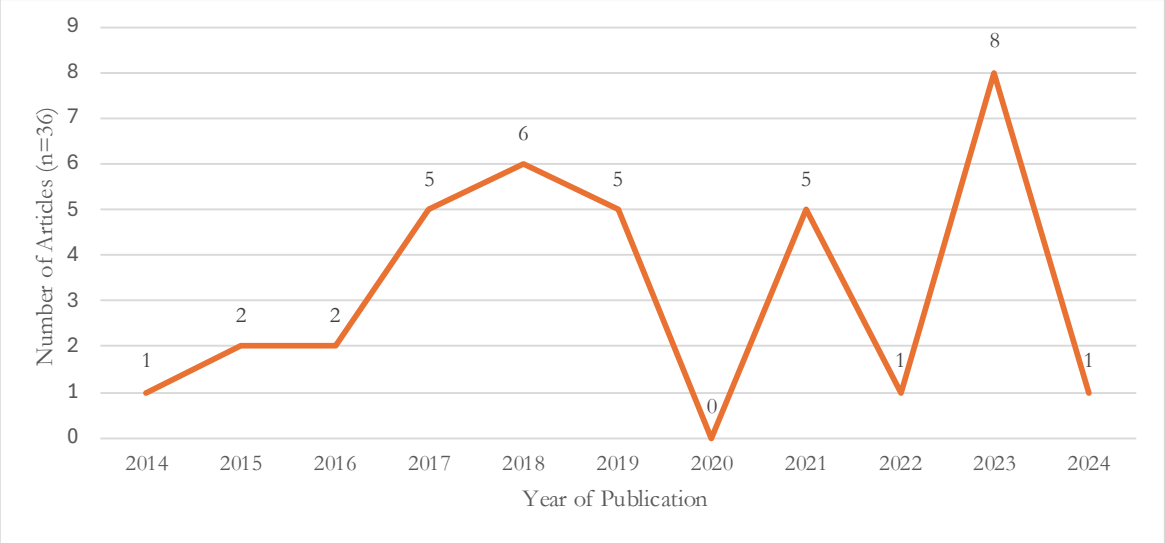

Figure 2. Year of publication

Regarding the preferred research methods, 30 (83%) of the studies used quantitative methods, 5 (14%) used mixed methods, and 1 (3%) used qualitative methods. Specifically, 21 (60%) studies used

questionnaires for data collection, 9 (25%) studies employed pre-post tests, 4 (11%) studies conducted interviews, and 2 (4%) studies utilized observational techniques. Finnaly, an analysis of the subject areas per educational level are presented in Table 2.

Table 2. Subject areas per educational level of the selected articles

Educational level	Subject area	Studies
Informal Learning	Health/physical condition	Cechetti et al. (2019), Hamari and Koivisto (2015), Hassan et al. (2019)
	Crowdsourcing	Feng et al. (2018), Jahn et al. (2021)
	Environment and recycling	Hsu and Chen (2018), Hsu et al. (2017)
	Media and information literacy	Yang et al. (2021)
	Information communication technologies	Xi and Hamari (2019)
	Mathematics	Attali and Arieli-Attali (2015)
	Driving license examinations	Feinauer et al. (2022)
	Not available	Groening and Binnewies (2019), Landers et al. (2017), Mekler et al. (2017), Sailer et al. (2017)
Corporate Training	Automotive	Kim (2021)
	Health	Chang et al. (2023)
	Japanese as a foreign language	Chen et al. (2023)
	Cybersecurity	Zhao et al. (2024)
Post-secondary	Literature reading literacy	Cheng (2023)
Higher Education	Management/economics/ entrepreneurship	Hu et al. (2023), Kauppinen and Choudhary (2021), Murillo-Zamorano et al. (2023), Thomas and Baral (2023)
	Teacher education	De-Marcos et al. (2014), Martí-Parreño et al. (2016), Özdener (2018), Yildiz et al. (2021)
	English	Aldemir et al. (2018), Cao et al. (2023)
	Information communication technologies	De-Marcos et al. (2016)
	Mathematics	Yildirim (2017)
	Psychology	Bernecker and Ninaus (2021)
	Political science	Ding (2019)
	Statistics, library science	Huang and Hew (2018)
	Not available	Van Roy and Zaman (2018)

RESULTS

This section offers a comprehensive review of the data derived from the analysis and synthesis of 36 papers utilizing the PRISMA technique. The four research questions are presented alongside their respective findings.

TOOLS AND TECHNOLOGIES

An analysis of the studies revealed that various tools and platforms have been used to implement gamification in different adult learning settings (Table 3).

Table 3. Tools and platforms per educational level of the selected articles

Educational level	Tool	Description	Studies
Informal learning	Crowdsourcing	www.zbj.com/ www.click-worker.com	Feng et al. (2018), Jahn et al. (2021)
	Trustme!	Online educational game	Yang et al. (2021)
	Online gamified communities	Xiaomi and Huawei	Xi and Hamari (2019)
	TowerStorm	Avatar-based virtual reality for mathematics	Attali and Arieli-Attali (2015)
	e-lifeStyle	m-Health application for hypertension monitoring	Cechetti et al. (2019)
	Driving simulator	Gamified instructions for driver training in semi-autonomous driving and conditional automation	Feinauer et al. (2022)
	Stroop Color and Word Test	Neuro-psychological test measuring the ability to inhibit cognitive interference during the simultaneous processing of two stimuli	Groening and Binnewies (2019)
	Fitocrasy	Online games and social network that aims to use gamification to help users improve their fitness	Hamari and Koivisto (2015)
	HeiaHeia	Practice applications in methods of improving health and physical exercise through points, leaderboard, progress bar	Hassan et al. (2019)
	RecycleBank	Application of learning environmental habits, such as recycling, with reward points	Hsu and Chen (2018)
	Image annotation	Single-player image tagging platform	Mekler et al. (2017)
	Simulation	Web-based environment for the internal handling of materials and supplies at production or delivery sites	Sailer et al. (2017)
	Not available	Not available	Hsu et al. (2017)
	Leaderboard	-	Landers et al. (2017)
Corporate training	MSLP	Mobile Social Learning Platform	Kim (2021)
	D-ST with robot "Kebbi"	Robot-based digital storytelling following the BSFE model in nurse practitioner education	Chang et al. (2023)
	Octalysis	A game-based system for learning Japanese as a second language by employees of an international Japanese company	Chen et al. (2023)

Educational level	Tool	Description	Studies
	Cyber Security Challenges (CSC) + Cloud of Assets & Threats (CATS)	Education and training of professional software engineers on cybersecurity issues in a hybrid work environment	Zhao et al. (2024)
Post-secondary	Virtual reality reading platform	Unity app + Oculus SDK	Cheng (2023)
Higher education	Moodle	Learning Management System with game elements	Aldemir et al. (2018), De-Marcos et al. (2014), Huang and Hew (2018), Thomas and Baral (2023), Van Roy and Zaman (2018), Yildirim (2017)
	Kahoot!	Web 2.0 Quiz	Kauppinen and Choudhary (2021), Yildiz et al. (2021)
	Gather Town	Avatar-based collaboration platform	Hu et al. (2023)
	ECOn+ Star battles	Quiz with game elements in macroeconomics	Murillo-Zamorano et al. (2023)
	Wikispaces	Wiki	Özdener (2018)
	Ribbon Hero	Application for learning MS Office programs (Word, Excel, PPT) through Avatar (Clippy), challenges, and points	De-Marcos et al. (2016)
	English vocabulary learning system	Assist learners with learning a single word, a quiz of one-set words, a leaderboard, and a review of one-set words.	Cao et al. (2023)
	Gamified N-back test	Assessment to measure working memory capacity	Bernecker and Ninaus (2021)
	gEchoLu	Web-based forum with eXperience Points (XP)	Ding (2019)
	Not available	Not available	Martí-Parreño et al. (2016)

Gamification enhances the learning process by aligning with the characteristics of adult learners, thereby increasing their motivation and making learning more enjoyable (De-Marcos et al., 2014). Consequently, learning management systems have incorporated game elements (Özdener, 2018). Specifically, both formal and non-formal education frequently utilize educational digital games and applications to engage learners within and outside the learning context (Kauppinen & Choudhary, 2021).

Furthermore, educational institutions have developed gamified working environments that cater to the learning needs of specific student groups (De-Marcos et al., 2014). Additionally, teachers often use gamification as an assessment tool to identify their students' cognitive and behavioral levels while tracking their progress (Groening & Binnewies, 2019).

In the context of informal learning, a variety of customized applications have been developed and implemented to acquire new knowledge and facilitate personal improvement at all levels. One of the main features of these digital game-based learning applications is their personalization, meaning the game's adaptation to the unique profile and learning needs of the individuals (Hassan et al., 2019).

Some of these applications are designed to help users acquire language or computer skills (Chen et al., 2023; De-Marcos et al., 2016), while others focus on enhancing media and information literacy skills (Yang et al., 2021).

Additionally, some applications focus on promoting health and encouraging the adoption of a healthy lifestyle (Cechetti et al., 2019), as well as those providing physical exercise routines to enhance individuals' physical condition (Hassan et al., 2019). There are also applications designed to familiarize users with environmentally friendly habits, aiming to integrate these habits into everyday life (Hsu & Chen, 2018). Based on Table 3, the various technologies used for gamification can be grouped into thematic categories based on technological type, interaction style, and pedagogical purpose, as follows.

Game-Based Platforms and Quizzes: Platforms are explicitly designed with game mechanics like points, levels, and leaderboards, providing engagement through quizzes and rewards, rapid feedback, and competition.

- Kahoot! – Web 2.0 quiz platform
- Trustme! – Online educational game
- Ribbon Hero – Game-based learning MS Office
- ECOn+ Star battles – Quiz-based macroeconomics learning
- English vocabulary learning system – Word quiz, leaderboard, etc.
- Gamified N-back test – Game-based cognitive task
- Leaderboard – Generic gamification mechanic used in various tools

Simulation and Cognitive Training Tools: Interactive or immersive environments used to simulate scenarios or test cognitive skills, based on skill-building, scenario-based learning, and cognitive enhancement.

- Driving simulator – Semi-autonomous vehicle training
- Stroop Color and Word Test – Cognitive interference test
- Simulation (Sailer et al., 2017) – Logistics and production site training
- Gamified N-back test – Working memory measurement

Virtual/Augmented Reality and Avatar-based Platforms: Use avatars, VR, or immersive environments for collaboration or learning to support immersion, presence, and embodied learning.

- TowerStorm – Avatar-based VR for math
- Virtual reality reading platform – Unity + Oculus SDK
- Gather Town – Avatar-based collaboration space

Health and Lifestyle Apps: Using gamification to encourage healthy behaviors and physical well-being, aiming at behavior change, habit formation, and motivation for health.

- e-lifeStyle – mHealth for hypertension
- Fitocrasy – Fitness-focused social network with game elements
- HeiaHeia – Health tracking with points and leaderboards
- RecycleBank – Environmental learning with reward points

Social Learning and Community Platforms: Foster collaborative, community-based learning with gamified features, fostering peer interaction, social presence, and participatory learning.

- Crowdsourcing sites – Clickworker, ZBJ (informal learning)
- Online gamified communities – Xiaomi, Huawei forums
- gEchoLu – Web forum with XP system
- Wikispaces – Wiki with collaborative aspects

Mobile and Mixed Media Platforms: Applications using mobile, robotics, and storytelling for ubiquitous learning, cross-platform gamification, and storytelling integration.

- MSLP – Mobile Social Learning Platform
- D-ST with robot Kebbi – Robot-based storytelling

- Octalysis system – Language learning via a gamification framework
- CSC + CATS – Cybersecurity hybrid platform

Learning Management Systems (LMS) with Gamification: Traditional LMS platforms enhanced with game elements, for institutional integration, formal assessment, and scalable deployment.

- Moodle (with gamification) – Widely used in higher education
- Not available (Martí-Parreño et al., 2016) – Most likely LMS-based

Learning Theories

An analysis of the studies revealed that various theoretical models have been employed to implement gamification in diverse adult learning settings (Table 4).

Table 4. Learning theories per educational level of the selected articles

Educational level	Theoretical model	Studies
Informal Learning	Self-determination Theory	Feinauer et al. (2022), Groening and Binnewies (2019), Hamari and Koivisto (2015), Hassan et al. (2019), Jahn et al. (2021), Kim (2021), Mekler et al. (2017), Sailer et al. (2017), Xi and Hamari (2019)
	Goal-Setting Theory	Groening and Binnewies (2019), Landers et al. (2017)
	Cognitive Theory of Multimedia Learning	Yang et al. (2021)
	Motivational Affordance Theory	Feng et al. (2018)
	Prospect Theory	Groening and Binnewies (2019)
	DGBL Theories	Groening and Binnewies (2019)
	Utilitarian and Hedonic User Experience	Hsu and Chen (2018)
	Psychological Satisfaction Need Theory	Sailer et al. (2017)
	User Experience	Hsu et al. (2017)
	Feedback Intervention Theory	Hassan et al. (2019)
	Technology Acceptance Theory	Hassan et al. (2019)
	Emotional Attachment Theory	Hassan et al. (2019)
	Habituation Theory	Hassan et al. (2019)
	Cognitive Evaluation Theory	Mekler et al. (2017)
	Causality Orientation Theory	Mekler et al. (2017)
	Achievement Goal Theory	Mekler et al. (2017)
	No specific theories, only game mechanics	Attali and Arieli-Attali (2015), Cechetti et al. (2019)
Corporate Training	Flow Theory	Chen et al. (2023), Kim (2021)
	Causality Orientation Theory	Chang et al. (2023), Kim (2021)
	Self-determination Theory	Chen et al. (2023)
	Cognitive Evaluation Theory	Kim (2021)
	Intrinsic and Extrinsic Motivation Theory	Kim (2021)
	Organismic Integration Theory	Kim (2021)
	Goal-Setting Theory, Sociocultural Theory	Chen et al. (2023)

Educational level	Theoretical model	Studies
	No specific theories, only game mechanics	Zhao et al. (2024)
Post-secondary	Transportation-imagery Theory	Cheng (2023)
Higher Education	Self-determination Theory	Aldemir et al. (2018), Cao et al. (2023), De-Marcos et al. (2014), Huang and Hew (2018), Van Roy and Zaman (2018), Yildiz et al. (2021)
	Goal-setting Theory	Cao et al. (2023), Huang and Hew (2018), Thomas and Baral (2023)
	Collaborative Learning Theories	Hu et al. (2023), Özdener (2018)
	Flow Theory	Huang and Hew (2018), Thomas and Baral (2023)
	Social Comparison Theory	Cao et al. (2023), Huang and Hew (2018)
	Sociocultural Theory	Özdener (2018)
	Stimulus Organism Response Theory	Thomas and Baral (2023)
	Behavior Reinforcement Theory	Thomas and Baral (2023)
	Creative Self-Efficacy Theory	Yildiz et al. (2021)
	Embedded Learning Theory	Yildiz et al. (2021)
	Situational Theory	Yildiz et al. (2021)
	Self-control	Bernecker and Ninaus (2021)
	No specific theories, only game mechanics	De-Marcos et al. (2016), Kauppinen and Choudhary (2021), Martí-Parreño et al. (2016), Murillo-Zamorano et al. (2023), Yildirim (2017)

The primary theories that support the design of game elements and the use of gamification, as identified in the current literature review, are motivational theories (Table 4) that underpin gamification (Groening & Binnewies, 2019). This includes Self-Determination Theory and Goal-Setting Theory (Cao et al., 2023; Chen et al., 2023; Groening & Binnewies, 2019; Huang & Hew, 2018).

The Self-Determination Theory suggests that mechanisms of internal motivational development are activated to fulfill individuals' psychological needs for autonomy, competence, and social connection (Aldemir et al., 2018; De-Marcos et al., 2014; Feinauer et al., 2022; Hamari & Koivisto, 2015; Hassan et al., 2019; Jahn et al., 2021; Mekler et al., 2017; Sailer et al., 2017; Van Roy & Zaman, 2018; Xi & Hamari, 2019; Yildiz et al., 2021). This theory encompasses sub-theories such as the Cognitive Evaluation Theory, the Organismic Integration Theory, and the Causality Orientation Theory (Kim, 2021). The Goal-Setting Theory can act as a catalyst to enhance user engagement by effectively achieving game goals (Landers et al., 2017). This theory aligns with the Stimulus-Organism-Response Theory, which posits that the game's goals function as external stimuli that shape the user's emotional, behavioral, and cognitive abilities to complete a task (Thomas & Baral, 2023).

Some researchers suggest using constructivist theories to motivate adult learners through gamification. These theories assert that learning involves constructing new knowledge through the user's interaction with new data and experiences. Situated Learning Theory, which falls under this category, indicates that knowledge acquisition occurs within a community of practice, promoting interaction and cooperation among participants (Mekler et al., 2017). Self-Directed Theory, which provides learners with a sense of autonomy and control over the pace and duration of learning, aligns well with this educational framework. Similarly, Self-Regulation Theory enables learners to monitor their progress through the game's reward features, such as their position on leaderboards and the badges

they earn by fulfilling objectives (Aldemir et al., 2018). Constructivist Theories also include Sociocultural Theories, which emphasize building knowledge through learners' interactions, thus encouraging cooperation and constructive competition (Chen et al., 2023). These theories are often referred to as Collaborative Learning Theories, as they rely on communication among learners to organize, coordinate, and develop a unified strategy to achieve their assigned goals (Hu et al., 2023).

Additionally, theories related to the design of game elements are often utilized in educational gamification. The most prominent of these is Flow Theory, which seeks to align users' skills with the game's level of difficulty to sustain their interest and prevent them from abandoning the game's objectives, as well as the learning goals (Chen et al., 2023; Huang & Hew, 2018; Kim, 2021; Thomas & Baral, 2023). Special attention should be paid to users' self-evaluation at this juncture. As elaborated in Social Comparison Theory and Control-Value Theory of Achievement Emotions, when players in a game compare themselves to those at a significantly higher level, their motivation to improve their performance decreases. Conversely, as their level nears that of other players, their intent to enhance their ranking increases (Cao et al., 2023; Huang & Hew, 2018; Thomas & Baral, 2023).

Another learning theory used in gamification to design reward elements like badges is Prospect Theory. This theory suggests that users' engagement with the game increases when they perceive personal benefits. These benefits may include acquiring new knowledge, ideas, and experiences; making new acquaintances; improving their social status; or even gaining material privileges (Groening & Binnewies, 2019). A comparable theory applied in gamification to create game elements that fulfill users' needs for rewards is Feedback Intervention Theory (Hassan et al., 2019). Furthermore, Behavior Reinforcement Theory asserts that reward elements should be designed to be delivered to the user gradually, from the beginning to the final goal, through the achievement of intermediate goals. This method helps sustain interest and enhance performance (Huang & Hew, 2018; Thomas & Baral, 2023).

Finally, several theories significantly influence learners' acceptance of gamification as a tool for the learning process. These include the Theory of Reasoned Action, the Emotional Attachment Theory, and the Habituation Theory, which pertain to psychological mechanisms of attachment to technology (Hassan et al., 2019; Kim, 2021).

According to Table 4, the various learning models used for gamification can be categorized into four main groups based on underlying psychological, pedagogical, and motivational themes, as follows:

Motivation and Engagement Theories: These models emphasize the significance of both internal and external motivation, pursuing goals, and actively engaging in behaviors to sustain motivation, promote personalized goals, and foster autonomy in learning tasks.

- Self-Determination Theory (widely used): Focuses on autonomy, competence, and relatedness.
- Intrinsic and Extrinsic Motivation Theory
- Goal-Setting Theory
- Achievement Goal Theory
- Organismic Integration Theory
- Flow Theory: Deep immersion and enjoyment during tasks
- Feedback Intervention Theory
- Behavior Reinforcement Theory
- Cognitive Evaluation Theory
- Habituation Theory
- Causality Orientation Theory
- Self-control

Cognitive and Learning Theories: These theories focus on acquiring knowledge, mental processing, and scaffolding, explaining how learners process and retain information mentally during gamified experiences.

- Cognitive Theory of Multimedia Learning
- Cognitive Evaluation Theory (also bridges motivation)
- Embedded Learning Theory
- Digital Game-Based Learning Theories
- Stimulus-Organism-Response Theory
- Transportation Imagery Theory – The Role of Narrative in Learning.
- Creative Self-Efficacy Theory

Social and Collaborative Theories: Emphasize the social aspects of learning – interaction, cooperation, and shared culture – by fostering community, encouraging comparison, and promoting socio-emotional engagement.

- Collaborative Learning Theories
- Sociocultural Theory
- Social Comparison Theory
- Emotional Attachment Theory

Design and Experience-Centered Theories: These theories analyze how the design elements of gamified tools affect user interaction and experience, emphasizing interface design, utility, enjoyment, and user perception.

- Motivational Affordance Theory
- User Experience / Utilitarian and Hedonic UX
- Technology Acceptance Theory
- Psychological Satisfaction Need Theory
- Prospect Theory

GAME ELEMENTS

An analysis of the studies revealed that various game elements have been used to implement gamification in diverse adult learning environments (Table 5).

Table 5. Game elements per educational level of the selected articles

Educational level	Game element	Studies
Informal Learning	Points	Attali and Arieli-Attali (2015), Feinauer et al. (2022), Feng et al. (2018), Hamari and Koivisto (2015), Jahn et al. (2021), Kim (2021), Mekler et al. (2017), Sailer et al. (2017)
	Leaderboard	Cechetti et al. (2019), Hassan et al. (2019), Jahn et al. (2021), Kim (2021), Landers et al. (2017), Mekler et al. (2017), Sailer et al. (2017)
	Badges	Cechetti et al. (2019), Feinauer et al. (2022), Groening and Binnewies (2019), Hassan et al. (2019), Kim (2021)
	Feedback	Cechetti et al. (2019), Feinauer et al. (2022), Feng et al. (2018), Jahn et al. (2021), Yang et al. (2021)
	Progress bar	Cechetti et al. (2019), Feinauer et al. (2022), Yang et al. (2021)
	Levels	Hassan et al. (2019), Kim (2021), Mekler et al. (2017)
	Narrative scenario	Sailer et al. (2017), Yang et al. (2021)
	Avatar	Jahn et al. (2021), Sailer et al. (2017)

Educational level	Game element	Studies
	Achievement Rewards	Groening and Binnewies (2019), Yang et al. (2021)
	Goals	Yang et al. (2021)
	Performance graph	Sailer et al. (2017)
	No specific game elements reported	Hsu and Chen (2018), Hsu et al. (2017), Xi and Hamari (2019)
Corporate Training	Narrative scenario	Chang et al. (2023), Zhao et al. (2024)
	Points	Zhao et al. (2024)
	Leaderboard	Cheng (2023)
	Adventure, nest, treasure chest, achievement, role-playing, chat room	Chen et al. (2023)
Post-secondary	Role playing, explosive virtual scenes, narrative, providing clues, disclosing the denouement	Cheng (2023)
Higher Education	Points	Aldemir et al. (2018), Bernecker and Ninaus (2021), De-Marcos et al. (2016), Huang and Hew (2018), Kauppinen and Choudhary (2021), Martí-Parreño et al. (2016), Özdener (2018), Thomas and Baral (2023), Yildirim (2017), Yildiz et al. (2021)
	Leaderboard	Aldemir et al. (2018), Cao et al. (2023), De-Marcos et al. (2014), De-Marcos et al. (2016), Huang and Hew (2018), Kauppinen and Choudhary (2021), Murillo-Zamorano et al. (2023), Van Roy and Zaman (2018), Yildirim (2017), Yildiz et al. (2021)
	Badges	Aldemir et al. (2018), De-Marcos et al. (2014), De-Marcos et al. (2016), Ding (2019), Huang and Hew (2018), Murillo-Zamorano et al. (2023), Van Roy and Zaman (2018), Yildirim (2017)
	Challenges	Aldemir et al. (2018), De-Marcos et al. (2014), De-Marcos et al. (2016), Hu et al. (2023), Martí-Parreño et al. (2016), Murillo-Zamorano et al. (2023), Van Roy and Zaman (2018)
	Levels	De-Marcos et al. (2014), De-Marcos et al. (2016), Huang and Hew (2018), Murillo-Zamorano et al. (2023), Yildirim (2017)
	Feedback	Cao et al. (2023), Huang and Hew (2018), Kauppinen and Choudhary (2021)
	Narrative - Scenario	Bernecker and Ninaus (2021), De-Marcos et al. (2016), Murillo-Zamorano et al. (2023)
	Achievement/rewards	De-Marcos et al. (2014), Ding (2019)
	Goals	Bernecker and Ninaus (2021), Huang and Hew (2018)
	Progress bar	Ding (2019)

Educational level	Game element	Studies
	Avatar	Hu et al. (2023)
	Quests	Aldemir et al. (2018)
	Group competition	Van Roy and Zaman (2018)
	Immersion	Bernecker and Ninaus (2021)

As Table 5 shows, the most frequently used game elements are points, badges, and leaderboards; however, other game elements are also utilized, such as levels, goals, rewards, progress bars, scenarios, avatars, and role-playing, among others. Game elements operate through the psychological mechanism of goal achievement, directing users' attention and effort toward accomplishing goal-related activities within cognitive and behavioral contexts (Groening & Binnewies, 2019).

The game elements used in gamification are crafted to motivate users to learn through engagement. This results in improved performance and a sense of self-efficacy (Groening & Binnewies, 2019). Self-efficacy (Bandura, 1977) is a subjective self-evaluation process that denotes an individual's belief in their ability to organize and execute the actions necessary to manage future situations. An individual's experience in self-evaluation is reflected in the ratio of successful to unsuccessful actions taken to achieve a goal (Feng et al., 2018).

Game elements, such as points and badges, influence psychological mechanisms that guide and enhance user performance, serving as progressive indicators (Mekler et al., 2017). Leaderboards also serve as progressive indicators that contribute to the improvement of academic performance (Aldemir et al., 2018; Landers et al., 2017). Additionally, storytelling, as a dynamic component, enhances learners' self-efficacy (Aldemir et al., 2018; Sailer et al., 2017). When a narrative is thoughtfully designed and integrated into the game, it can not only assist in guiding the players but also "immerse" them in it, in terms of concentration, thereby offering a more engaging gaming experience (Attali & Arieli-Attali, 2015; Cheng, 2023).

In general, incorporating elements that appeal to users' senses in digitally gamified learning boosts their intrinsic motivation to participate more. Consequently, various components can be integrated to make a game more engaging. These include graphics, such as virtual characters (avatars) and 3D images, or the creation of a virtual reality environment (Attali & Arieli-Attali, 2015; De-Marcos et al., 2016; Hu et al., 2023). Moreover, research on virtual characters has demonstrated a strong relationship between users and the characters they create. This relationship influences different psychological mechanisms that enhance further engagement with the game and improve learners' self-efficacy, in line with self-determination theory (Aldemir et al., 2018; Jahn et al., 2021).

Finally, every digital gamified application includes elements that provide feedback, allowing users to stay informed about their progress. This feedback can enhance either learners' awareness of their performance or the development of self-improvement strategies, motivating them to engage in the game and boost their self-efficacy in achieving established goals and tasks (Aldemir et al., 2018; Huang & Hew, 2018; Jahn et al., 2021). Systematic and continuous narrative-based feedback may serve as a personalized motivator for learners (Aldemir et al., 2018), while non-player characters (NPCs) can function as a feedback mechanism through the interaction between them and users' avatars within the game context (Cheng, 2023).

According to Table 5, the different game elements utilized for gamification can be categorized into five major groups based on their underlying functionality, as follows:

Points, Progress, and Performance: These elements focus on monitoring achievements and advancements to offer ongoing feedback on efforts and outcomes.

- Points
- Progress Bar
- Levels
- Performance Graph

Recognition and Competition: Mechanics that enhance motivation through competition and status while promoting social comparison, visibility of success, and extrinsic motivation.

- Leaderboard
- Badges
- Achievements/Rewards
- Challenges
- Group Competition

Narrative and Storytelling: Mechanics that integrate learning within a fictional or real-world context and foster engagement through storytelling and identity development.

- Narrative/Scenario
- Role Playing
- Adventure, Clues, Denouement
- Quests
- Immersion

Personalization and Representation: Factors related to user identity and interaction that enhance personal agency, social identity, and embodiment.

- Avatar
- Chat Room/Social Features

Feedback and Goals: Elements that offer information or guide cognitive scaffolding, focus, and self-regulation.

- Feedback
- Goals

Learning Outcomes

An analysis of the studies revealed a range of learning outcomes associated with the instructional designs used to implement gamification in different adult learning settings (Table 6).

Table 6. Learning outcomes per educational level of the selected articles

Educational level	Outcomes	Studies
Informal Learning	Improved performance in mathematics assessments.	Attali and Arieli-Attali (2015)
	Gamification has increased patient engagement and motivation in health treatment by fostering involvement, curiosity, and enjoyment.	Cechetti et al. (2019)
	Gamification (simulation) enhanced motivation to learn the provided information and facilitated the development of mental models and trust in automated driving.	Feinauer et al. (2022)
	Participation and motivation in crowdsourcing applications were enhanced by incorporating game elements.	Feng et al. (2018)
	Achievements improve performance more than goal setting over time and are more effective when designed with high difficulty and low quantity.	Groening and Binnewies (2019)

Educational level	Outcomes	Studies
	Utilitarian and social motivations have a positive direct association with attitude, utilitarian motivations' association with continued use is mediated by attitude, and hedonic motivations have a positive direct association with continued use.	Hamari and Koivisto (2015)
	Gamification in a mobile motivational information system for health is positively associated with experiences of affective feedback, quantified self, and social networking, with experiences of both affective and informational feedback. Experiences of affective feedback are further strongly associated with user-perceived benefits and continued use intentions, whereas experiences of informational feedback are only associated with continued use intentions.	Hassan et al. (2019)
	Perceived mobility, as well as utilitarian and hedonic features, significantly affect user experience in online gamification, which in turn influences the perception of benefits, value, and brand equity.	Hsu and Chen (2018)
	Both utilitarian features and hedonic features have a significant impact on users' experiences on websites, which in turn affects their perception of value and attitude. Users' perceptions of information and transaction value also significantly affect their attitude, and in turn affect their behavioral intentions.	Hsu et al. (2017)
	Gamification elements satisfy reuse intentions and psychological needs through various working mechanisms, which reveal unique relationships with reuse intentions. Differentiating between autonomy of decision freedom and task meaningfulness reveals converse correlational patterns.	Jahn et al. (2021)
	Commitment moderates the success of leaderboards, and leaderboards are approximately as effective as difficult-to-impossible goals to increase task performance.	Landers et al. (2017)
	Gamification acts as an extrinsic incentive, does not affect intrinsic motivation or competence needs satisfaction, and increases performance.	Mekler et al. (2017)
	Gamification is not inherently effective; however, various game design elements can trigger different motivational outcomes. Competence and autonomy regarding task meaningfulness were influenced by badges, leaderboards, and performance graphs. Social relatedness was positively affected by avatars, a meaningful story, and teammates.	Sailer et al. (2017)
	Immersion-related gamification features were only positively associated with autonomy need satisfaction in Xiaomi and Huawei online gamified communities. Achievement-related features were not only positively associated with all kinds of need satisfaction, but also the strongest predictor of both autonomy and competence	Xi and Hamari (2019)

Educational level	Outcomes	Studies
	need satisfaction. Social-related gamification features were positively associated with autonomy, competence, and relatedness need satisfaction.	
	Gamification improves information discernment regardless of the intellectual civic skills level, and the quiz fosters information discernment when the intellectual civic skills level is high.	Yang et al. (2021)
Corporate Training	Gamification significantly enhanced students' learning achievement, learning attitude, critical thinking awareness, and learning satisfaction. Trainers achieved better results in the dimensions of structure, accuracy, appearance, innovation, and interaction of their teaching plans.	Chang et al. (2023)
	Gamification helped in-service employees' willingness to use the system to facilitate Japanese learning during their daily lives, enhancing active learning behavior.	Chen et al. (2023)
	Gamification strategies (Competition, Challenge, Compensation, Relationship, and Usability) affect Flow and Continuous usage intention in a mobile social learning platform (MSLP) to train personnel.	Kim (2021)
	Gamification is a successful approach for training conducted in a hybrid work mode while providing authentic and immersed experiences that empower and raise cybersecurity awareness of current and future software professionals.	Zhao et al. (2024)
Post-secondary	Gamification in immersive virtual reality environments for narrative reading, utilizing an epistemic curiosity-evoking approach, cultivates the skills of self-direction, self-monitoring, and self-regulation of work or learning progress.	Cheng (2023)
Higher Education	Enhancement of learning performance boosts the sense of competence in goal attainment and enhances self-confidence, development of communication, collaboration and problem-solving skills, and promotion of constructive competition.	Aldemir et al. (2018)
	Game elements improved subjective experience and task performance accuracy indirectly via a positive effect and subjective effort.	Bernecker and Ninaus (2021)
	Competition enhances learning performance and promotes constructive competition.	Cao et al. (2023)
	Comparing gamification and social networking, it was found that better performance in skill acquisition with gamification, but better performance in knowledge acquisition with social networking.	De-Marcos et al. (2014)
	Comparing educational games, gamification, social networking, and social gamification, it was found that social networking and social gamification produced better results even at early stages of the course.	De-Marcos et al. (2016)

Educational level	Outcomes	Studies
	Gamification helped engagement and performance, but failed to promote a sense of community in online discussions.	Ding (2019)
	Significantly higher levels of students' learning motivation, ethical decision-making, and significantly higher scores on post-tests.	Hu et al. (2023)
	A goal-access-feedback-challenge collaboration (GAFCC) gamification design model significantly motivated learners to complete more out-of-class activities and attempt more difficult tasks in flipped courses.	Huang and Hew (2018)
	Kahoot! affects entrepreneurship students' motivation and course satisfaction, but does not improve recall performance.	Kauppinen and Choudhary (2021)
	Positive attitude towards gamification from HEIs' staff (higher in private HEIs), limited use of gamification on HEI courses.	Martí-Parreño et al. (2016)
	Gamification directly influences students' engagement and knowledge, but does not directly affect students' satisfaction; it indirectly affects it through knowledge and engagement.	Murillo-Zamorano et al. (2023)
	Wiki-based activities positively affect student academic success, long-term effects of the gamification could not be observed, teacher candidates have displayed positive attitudes towards wikis and gamification.	Özdener (2018)
	In a gamified management course, both behavioral and emotional engagement are significantly higher during the gamified sessions; no significant change was found in learners' cognitive engagement. Flow was found to mediate the relationship between gamification and engagement.	Thomas and Baral (2023)
	Game elements impact motivational effects, illustrate the benefits of using a long-term systematic exploration of motivation, the motivational impact of gamification is person-specific, and no evidence is found for a novelty effect of gamification.	Van Roy and Zaman (2018)
	Gamification-based teaching practices have a positive impact on student achievement and attitudes.	Yildirim (2017)
	Motivation of the pre-service teachers increased significantly, with positive opinions about the lessons in social studies.	Yildiz et al. (2021)

Based on existing research, it is not possible to definitively determine the effectiveness of gamification in adult education. Some studies report a low or short-term effect on the learning process and learners' abilities (Murillo-Zamorano et al., 2023). However, most scientific publications on educational gamification report positive learning outcomes for adult learners when gamified elements and activities are implemented in the learning process (Table 6). These benefits originate from psychological mechanisms activated when digital gamified tools are used for learning. Such mechanisms, reinforced by learners' motivation, enjoyment, entertainment, sense of teamwork, and self-improvement within the game context, help maintain a focus on established learning goals (Xi & Hamari, 2019).

One of the learning outcomes is based on Goal-Setting theory and relates to the transfer of knowledge acquired within the game to environments outside the game context (i.e., real life). Users formulate and implement goal achievement strategies within the game, which can also be applied to solving practical problems in real-world situations. Additionally, in Self-determination Theory, by satisfying the psychological needs for independence and autonomy within the game context, users gain self-confidence, and their feelings of competence in attaining goals are enhanced, both within and outside the game context (Cechetti et al., 2019; De-Marcos et al., 2016; Feinauer et al., 2022; Hassan et al., 2019; Kim, 2021; Yang et al., 2021; Yildiz et al., 2021; Zhao et al., 2024).

Additionally, through gamified learning, users learn to direct, monitor, and regulate their progress in comparison to their teammates. This way, their self-efficacy in achieving their set goals is enhanced, leading to improved learning, work, or task performance (Aldemir et al., 2018; Cao et al., 2023; Cechetti et al., 2019; Chang et al., 2023; Chen et al., 2023; De-Marcos et al., 2016; Hassan et al., 2019; Hu et al., 2023; Landers et al., 2017).

Furthermore, research has shown that gamification can also be utilized in work environments to enhance employee efficiency and productivity. Cooperative learning in gamified educational contexts helps learners develop their communication and collaboration skills to address practical problems together (Chang et al., 2023; Hu et al., 2023; Kim, 2021; Özdener, 2018; Yildiz et al., 2021; Zhao et al., 2024). Furthermore, when the challenges included in a gamified activity are team-based, constructive competition is enhanced as participants work cooperatively to achieve a common goal, primarily improving their performance so that they feel competent members of the team to which they belong (Aldemir et al., 2018; Cao et al., 2023; Huang & Hew, 2018; Kim, 2021; Murillo-Zamorano et al., 2023; Van Roy & Zaman, 2018; Xi & Hamari, 2019; Yildirim, 2017; Yildiz et al., 2021).

Based on Table 6, the learning outcomes can be grouped into five major categories, as follows:

Motivation, Engagement, and Attitudes: Gamification boosts emotional involvement, curiosity, attitudes, and willingness to participate.

- Increased motivation, engagement, and positive attitudes
- Enhanced flow, immersion, and affective experience
- Improved reuse intention and continued use
- Strengthened commitment, challenge appreciation, and interest

Learning Performance and Achievement: Gamification is associated with academic or training success.

- Improved test scores or task performance
- Better learning outcomes in skills or knowledge
- Self-confidence, self-direction, and self-regulation
- Impact on behavioral and emotional engagement

Cognitive and Critical Thinking Skills: The development of higher-order thinking, problem-solving abilities, and mental models.

- Critical thinking awareness
- Improved information discernment
- Support for mental model development
- Enhanced epistemic curiosity

Social, Emotional, and Collaborative Outcomes: Gamification can influence communication, relationships, and social learning.

- Collaboration, communication, and constructive competition
- Mixed results on community sense
- Social feedback & networking experiences

System Use and User Experience: Gamified systems enhance usability, adoption, and satisfaction.

- Positive influence on system adoption, intention to use, UX, attitude, and value perception
- Role of utilitarian and hedonic motivations

DISCUSSION

Although gamification has emerged as a promising instructional design, aligning well with adult learners' expectations for engaging, flexible, and self-directed learning experiences, the literature often overlooks informal and corporate adult learning contexts. These areas are increasingly important due to their direct relevance to workforce development and personal skill enhancement. This systematic review aims to address this research gap by thoroughly investigating how gamification has been implemented across the entire spectrum of lifelong learning environments.

It appears that gamification can be applied across a wide range of scientific fields in the context of adult education. In their review, Subhash and Cudney (2018) examined the prevalence of gamification in various scientific fields in tertiary education. This research revealed a growing trend in the application of this method in business and scientific studies, a trend supported by the correlation between enhanced engagement incentives and increased productivity.

Further supporting this trend, Hao et al. (2023) reported that of 23 articles, three explored the application of gamification in business and management environments, highlighting its promising potential in these sectors. These findings are corroborated by the literature review, particularly within the formal educational framework, where gamified learning is extensively applied in economics, business administration, management education, and entrepreneurship education.

Most research studies analyzed in our review relate to formal learning, as they were conducted within the framework of higher education, with academic students participating as research subjects. Metwally et al. (2021) also reported that research in the field of tertiary education is predominant. Moreover, Hao et al. (2023) found that out of 23 articles, twelve focused primarily on higher education. This underscores the growing trend of gamification in this area. According to Metwally et al. (2021), this trend could be attributed to the increasing popularity of fast-publishing platforms.

TOOLS AND TECHNOLOGIES

In terms of tools and technologies that support gamification, a scoping review of related studies (Perryer et al., 2016; Subhash & Cudney, 2018; Tay et al., 2022; Zainuddin et al., 2020) indicates that various digital games and applications, such as Kahoot (Kauppinen & Choudhary, 2021; Murillo-Zamorano et al., 2023) and Ribbonhero (De-Marcos et al., 2016), have been used in gamified adult education. Platforms with built-in digital games or game elements, such as Moodle (Thomas & Baral, 2023), Blackboard (De-Marcos et al., 2014), and Edmodo (Aldemir et al., 2018), have also been utilized. This is supported by this literature review, which documents applications and open learning platforms of the same or similar philosophy.

However, in this research, we report additional tools utilizing emerging technologies, such as robot-based digital storytelling (Chang et al., 2023) and immersive virtual reality systems for reading stories (Cheng, 2023). This highlights the necessity for an ongoing literature review to enrich research sources with new, contemporary data (Metwally et al., 2021).

LEARNING THEORIES

Regarding the learning theories that support gamification, the results of this review indicate that Self-Determination Theory and Goal-Setting Theory are the two primary theories driving gamification design. Both are categorized under motivational theories and are mentioned in most studies, a finding that aligns with the review of Krath et al. (2021), who recorded 118 learning theories associated with gamified learning. The connection between engagement with the game and the enhancement of internal motivations justifies using these specific learning theories as the basis for designing courses that employ the method of gamification.

Self-Determination Theory aligns with adults' learning characteristics, and research consistently shows that when gamification is designed based on this theory, adult learners feel they possess self-

control, autonomy, and competence throughout the learning process. This, in turn, enhances their self-efficacy (Krath et al., 2021; Metwally et al., 2021; Perryer et al., 2016; Zainuddin et al., 2020).

Equally important for adults' self-efficacy is Goal-Setting Theory, as adult learners in the context of digitally gamified learning can set their own goals and develop strategies to achieve them. This ability enhances their learning motivation, as their self-confidence grows through the rewards they receive from an integrated reward system (e.g., points, badges, leaderboard rankings, etc.) for each successful completion of a goal (Subhash & Cudney, 2018; Zainuddin et al., 2020).

Game Elements

In terms of game elements, as mentioned in similar literature reviews (Metwally et al., 2021; Tay et al., 2022), attention is given to the design of reward systems to ensure they align with learning goals and foster the development of internal learning motivations. In this regard, Metwally et al. (2021) highlighted that an overemphasis on reward elements in the application of gamification in higher education, compared to other game elements, can lead to misconceptions about the design of game mechanics. They even coined the term "pointification" to describe this trend.

However, some researchers argue that external elements of competition can limit learners' internal motivation and self-efficacy (Metwally et al., 2021), as their positive or negative impact depends on the percentage of user achievements. Therefore, competitive game elements must be thoughtfully designed to motivate even non-competitive personalities without undermining the cooperation needed for the joint resolution of practical problems (Perryer et al., 2016).

In any case, the common finding between this review and other similar studies is that theories used in gamification also promote experiential learning, making the learning process enjoyable, attractive, and effective. This contributes to enhancing self-direction, self-observation, self-control, and self-perception among adult learners (Krath et al., 2021; Subhash & Cudney, 2018).

Studies have demonstrated that points and badges influence psychological mechanisms that guide and enhance user performance, serving as progressive indicators (Mekler et al., 2017). Specifically, when rewards are presented in team games or within a community of users, they act as motivational learning tools, enhancing the prestige of the user who receives them (Aldemir et al., 2018; Ding, 2019; Murillo-Zamorano et al., 2023).

Leaderboards also serve as progressive indicators, and as research has indicated, they can enhance academic performance (Aldemir et al., 2018; Landers et al., 2017). The improvement in performance through game elements that function as progressive indicators is rooted in boosting users' enthusiasm and focusing on a specific activity for which they need to refine their skills.

One of the most significant challenges in designing game components is aligning their features with the cognitive profiles, characteristics, abilities, and capabilities of the users. If the challenges of a game are too demanding, it can lead to frustration among learners, causing them to abandon the game without achieving the learning goals (Aldemir et al., 2018; Bernecker & Ninaus, 2021).

Another challenge related to the design of game elements is the escalation of difficulty in tasks and challenges. If there is not a gradual increase in the game's difficulty, users may lose interest, as the activities will no longer be challenging for them (Aldemir et al., 2018; Thomas & Baral, 2023). Additionally, when designing game elements for adult education, it is crucial to systematically guide users so that the educational process through the gamification method results in successful outcomes (Aldemir et al., 2018). Finally, regular feedback on trainees' progress is crucial because it increases their interest in continuing to achieve their learning goals and enhances their self-efficacy (Hassan et al., 2019; Jahn et al., 2021).

Additionally, if leaderboards promote constructive competition, they can positively influence learners' intrinsic motivation as they engage in communities of practice where they connect with one another, share values, and support each other's learning efforts (Ding, 2019).

Motivations can be classified into the following categories (Hamari & Koivisto, 2015):

- *Utilitarian motivations are driven by the rewards users earn for completing tasks, such as points and badges.*
- *Hedonic motivations, such as fun and entertainment, experienced through storytelling and avatars, and*
- *Social motivations, including social acceptance, recognition, and a sense of belonging to a group, can be enhanced through badges and leaderboards.*

Self-efficacy is a subjective self-evaluation process that refers to an individual's belief in their ability to organize and execute the actions necessary to handle future situations. The individual's experience in self-evaluation is reflected in the percentage of successful or unsuccessful actions taken to achieve a goal (Feng et al., 2018). Notably, users' self-efficacy tends to increase more when digital games incorporate elements of interaction with other players, as this inspires them to excel either for personal gain or for the advantage of the group to which they belong (Aldemir et al., 2018).

Therefore, when game elements are awarded in an online community, they stimulate users' intrinsic motivations to fulfill their social needs and encourage them to become more efficient within the group of which they are a part (Xi & Hamari, 2019). Therefore, if game elements are designed in accordance with appropriate learning theories, they can increase users' intrinsic and extrinsic motivation to learn. This also enhances the self-efficacy of adults who use digital gamified tools for learning (Groening & Binnewies, 2019).

Learning Outcomes

In general, learning outcomes can be categorized into three types (Sailer & Homner, 2020):

- *Cognitive outcomes* pertain to the acquisition of conceptual or application-based knowledge.
- *Motivational outcomes* include aspects such as intrinsic motivation, attitudes, preferences, engagement, and feelings of self-efficacy and confidence.
- *Behavioral outcomes* are related to the development of technical or motor skills and competencies, such as a learner's performance in a specific task.

Learning outcomes arise from psychological mechanisms triggered by gamified learning. These mechanisms, bolstered by learners' motivation, enjoyment, entertainment, a sense of teamwork, and self-improvement within the game context, help sustain focus on established learning goals (Xi & Hamari, 2019). Learning outcomes grounded in Goal-Setting theory relate to the transfer of knowledge acquired within the game to environments outside of it (i.e., real life). Users develop and apply strategies for achieving goals within the game, which can also be applied to address practical problems in real-world situations. Learning outcomes based on Self-determination Theory enhance users' self-confidence and feelings of competence in reaching goals by fulfilling psychological needs for independence and autonomy within the game context, both in and out of the game (Cechetti et al., 2019; De-Marcos et al., 2016; Feinauer et al., 2022; Hassan et al., 2019; Kim, 2021; Yang et al., 2021; Yildiz et al., 2021; Zhao et al., 2024).

Most articles reported in this review indicate a positive impact, observed both cognitively and behaviorally. This assertion aligns with the findings of prior reviews that examined similar empirical studies or literature on gamified learning for adults (Hao et al., 2023; Majuri et al., 2018; Metwally et al., 2021; Ratinho & Martins, 2023; Sailer & Homner, 2020; Subhash & Cudney, 2018; Tay et al., 2022; Torresan & Hinterhuber, 2023; Zainuddin et al., 2020). However, according to the research results of Perryer et al. (2016), students in traditional classrooms achieved better learning outcomes due to the perceived relevance of the content. Therefore, the effectiveness of gamified learning may rely on various factors, such as the type of reward used, the relevance of the content, and the context in which it is implemented. The meta-analysis conducted by Sailer and Homner (2020) indicates that gamification, as currently utilized in empirical studies, clearly serves as an effective instructional method. This remains true despite the specific factors contributing to the success of gamification, particularly in terms of cognitive learning outcomes, being somewhat ambiguous.

The conclusions drawn in our review align with the findings of other studies.

Fostering engagement in the educational process leads to positive student behavior, stimulates advanced critical thinking skills, and encourages the enrichment of meaningful learning experiences, as suggested by Zainuddin et al. (2020).

Positive outcomes are associated with the application of gamification in educational settings, underscoring the potential of gamification as a beneficial tool for enhancing learning experiences. This finding is consistent with the results of systematic reviews conducted by Majuri et al. (2018) and Zainuddin et al. (2020), which further validate the beneficial impact of gamification on learning.

Applications involving team-based, gamified learning activities structured around constructivist learning theories enhance trainees' skills in collaboration and problem-solving. They are beneficial in developing skills, including verbal communication and negotiation in conflict situations, as indicated by Pei and Harun (2023) and Hao et al. (2023) in their reviews.

Competition and collaboration lead to enhanced behavioral learning outcomes and serve as a motivator for engagement and self-improvement, in line with the meta-analysis results of Sailer and Homner (2020).

Leaderboards could foster social connections among users, but at the same time, competition, while influential, can inadvertently lead to heightened anxiety and diminished motivation among learners who fail, as Ratinho and Martins (2023) posited in their review.

Gamification yields effective motivational and behavioral learning outcomes when implemented in settings that blend competition and collaboration, rather than in purely competitive environments, to avoid the unattainable effort required by less-skilled learners.

The ability of adult learners to set goals and develop strategies for their achievement can foster motivation, as adult learners generally strive for their perceived optimal outcome. This pursuit naturally leads to the enhancement of their skills as they devise strategies to achieve this outcome, while sustaining a high level of motivation.

Feedback plays a crucial role in amplifying the sense of success and diminishing the inclination to discontinue, especially among learners who harbor self-doubts about their abilities and competencies to attain their objectives, as Torresan and Hinterhuber (2023) also suggested.

Adult learners, through gamified learning activities, develop their self-direction, self-monitoring, and self-regulation skills, which are fundamental characteristics of adults: their ability to direct their self-learning according to their learning style. In their review, Tay et al. (2022) found that combining self-directed theory with digital game-based learning resulted in participants experiencing increased autonomy and control over their learning pace and duration.

Finally, gamification can also be applied in work environments to enhance employee efficiency and productivity. Cooperative learning in gamified educational contexts helps learners develop their communication and collaboration skills for solving practical problems together, as suggested by other reviews (Chang et al., 2023; Hu et al., 2023; Kim, 2021; Özdener, 2018; Yildiz et al., 2021; Zhao et al., 2024).

CONCLUSION

This study examines 36 empirical studies through a systematic literature review, aiming to identify the benefits and challenges of implementing gamification in online adult education across formal, non-formal, and informal learning contexts. The findings indicate that gamified learning is applicable in various subjects, primarily in areas related to business administration, economics, and pedagogical studies, as supported by prior research (Subhash & Cudney, 2018). Notably, most of these studies were conducted in tertiary education (Metwally et al., 2021).

The application of gamified learning is diverse and depends on several factors, including the educational purpose, the learning profile, the established learning objectives, and the desired learning outcomes. These factors guide the selection of appropriate game elements, a claim that is also supported by prior research (Metwally et al., 2021; Perryer et al., 2016; Subhash & Cudney, 2018; Tay et al., 2022).

The educational interventions and research studies outlined in the reviewed papers developed gamified learning applications by incorporating game elements into non-game contexts for educational purposes, such as interactive websites, open education platforms, or Learning Management Systems. Some studies even utilized emerging technologies and innovative digital tools (Chang et al., 2023; Cheng, 2023).

The primary theories that emerged from this research were motivation theories, primarily the theory of self-determination and goal setting, as well as game design element theories (Flow Theory), thereby validating previous related research (Krath et al., 2021; Zainuddin et al., 2020).

According to the results of this review, gamified learning produces significant learning outcomes for adult learners. The key outcomes relate to improved learning performance and the acquisition of practical knowledge and skills applicable in real-world scenarios, such as work environments. In these settings, adults will be able to address practical problems and enhance their work performance and productivity. These findings align with those of similar studies (Hao et al., 2023; Majuri et al., 2018; Pei & Harun, 2023; Torresan & Hinterhuber, 2023; Zainuddin et al., 2020).

The implications for the theory presented in this review are significant, as it demonstrates a fascinating variety of underlying theories that support instructional design for gamification. Furthermore, it indicates a positive development in research efforts in recent years: studies are not only focused on explaining "whether" but, more importantly, on "how" and "why" gamification influences motivation, behavior, and learning across various contexts, digital environments, and educational levels.

Implications for practice are also crucial, as this review demonstrates that gamification has significant potential for enhancing motivation, engagement, and learning in key areas such as formal education at the higher education level, corporate training, health, work, and sustainability. Furthermore, when a designer integrates game elements into non-game environments, it is essential to consider certain design parameters. Research shows that when game elements are thoughtfully crafted to align with the learning characteristics of adult learners and are grounded in specific learning theories related to gamified education, they boost motivation to participate in learning activities. This results in an increase in learners' self-efficacy. This finding has also been highlighted in previous related literature reviews (Krath et al., 2021; Metwally et al., 2021; Perryer et al., 2016; Subhash & Cudney, 2018; Tay et al., 2022).

In higher education, gamification should focus on aligning with academic goals while enhancing critical thinking, collaboration, and intrinsic motivation through thoughtfully designed challenges and ongoing feedback. Educators are encouraged to integrate gamified features into Learning Management Systems, utilizing components such as badges, leaderboards, and story-driven scenarios to deepen student engagement, boost self-efficacy, and ultimately drive higher academic success and retention rates. In corporate training and work-based learning settings, gamification must be carefully structured to closely resemble real workplace activities, reinforcing practical skills and motivating employees with reward systems that reflect professional achievements. Successful implementations often involve scenario-based learning and customizable challenges tailored to employees' career roles and development paths. In informal learning scenarios, gamification can significantly enhance lifelong learning efforts by encouraging self-directed exploration and social interactions. Educators should apply game mechanics that offer autonomy, nurture social connections, and recognize informal accomplishments, thereby boosting intrinsic motivation and ongoing engagement outside formal teaching environments.

However, despite the positive impact of gamification on adult education, it is important not to overlook the limitations of further research. This literature review has identified several limitations and areas for future inquiry in the field of gamification and its applications in adult education. Initially, the unique nature of research questions RQ1 and RQ2, which focus on the application areas of gamification and digital gamified learning in adult education, made it impossible to conduct a meta-analysis. This would have resulted in more valid data. Nevertheless, the diversity of the studies examined allowed for a consolidated recording of their components, despite the inability to extract statistical results due to the small number of research findings.

Another limitation of this study is the insufficient number of research articles on gamification in non-formal adult education contexts. Therefore, this issue should be further explored through a systematic review of empirical and applied research in corporate training and work-based learning. This would occur within the context of professional development and training for employees and professionals, aimed at highlighting the effectiveness of gamification as a learning technique in adult education.

A significant limitation of this review, which was also one of the inclusion criteria for the research articles, was the exclusive use of digital tools in applying gamified education for adults. Consequently, research utilizing non-digital tools in a classroom context was excluded. According to Metwally et al. (2021), the effort to include games integrated into non-digital environments in the classroom during their research was problematic, indicating a need for further investigation.

Further investigations into the application of gamified adult education through Learning Management Systems (LMS) are necessary. This includes evaluating the effectiveness and sustainability of advanced applications of adaptive and personalized gamification with embedded artificial intelligence in open learning environments, which appears to be a new trend (Metwally et al., 2021). As research continues to validate the benefits of gamification in learning, additional investigation is required regarding (a) different educational levels to encompass the continuum of lifelong learning, and (b) emerging technologies, particularly generative AI tools.

REFERENCES

Aldemir, T., Celik, B., & Kaplan, G. (2018). A qualitative investigation of student perceptions of game elements in a gamified course. *Computers in Human Behavior, 78*, 235–254. https://doi.org/10.1016/j.chb.2017.10.001

Attali, Y., & Arieli-Attali, M. (2015). Gamification in assessment: Do points affect test performance? *Computers & Education, 83*, 57–63. https://doi.org/10.1016/j.compedu.2014.12.012

Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. *Psychological Review, 84*(2), 191-215. https://doi.org/10.1037/0033-295X.84.2.191

Bernecker, K., & Ninaus, M. (2021). No Pain, no Gain? Investigating motivational mechanisms of game elements in cognitive tasks. *Computers in Human Behavior, 114,* 106542. https://doi.org/10.1016/j.chb.2020.106542

Cao, Y., Gong, S.-Y., Wang, Y.-Q., Zheng, Q., & Wang, Z. (2023). How to provide competitors in educational gamification: The roles of competitor level and autonomous choice. *Computers in Human Behavior, 138*. https://doi.org/10.1016/j.chb.2022.107477

Cechetti, N. P., Bellei, E. A., Biduski, D., Rodriguez, J. P. M., Roman, M. K., & De Marchi, A. C. B. (2019). Developing and implementing a gamification method to improve user engagement: A case study with an m-Health application for hypertension monitoring. *Telematics and Informatics, 41*, 126–138. https://doi.org/10.1016/j.tele.2019.04.007

Chang, C. C., Hwang, G. J., & Chen, K. F. (2023). Fostering professional trainers with robot-based digital storytelling: A brainstorming, selection, forming and evaluation model for training guidance. *Computers & Education, 202*, 104834. https://doi.org/10.1016/j.compedu.2023.104834

Chen, C.-M., Ming-Chaun, L., & Kuo, C.-P. (2023). A game-based learning system based on octalysis gamification framework to promote employees' Japanese learning. *Computers & Education, 205*, 104899. https://doi.org/10.1016/j.compedu.2023.104899

Cheng, K.-H. (2023). An epistemic curiosity-evoking model for immersive virtual reality narrative reading: User experience and the interaction among epistemic curiosity, transportation, and attitudinal learning. *Computers & Education, 201*, 104814. https://doi.org/10.1016/j.compedu.2023.104814

Crompton, H., Burke, D., Jordan, K., & Wilson, S. (2021). Learning with technology during emergencies: A systematic review of K-12 education. *British Journal of Educational Technology, 52*(4), 1554–1575. https://doi.org/10.1111/bjet.13114

Dahalan, F., Alias, N., & Shaharom, M. S. N. (2024). Gamification and game based learning for vocational education and training: A systematic literature review. *Education and Information Technologies, 29*, 1279–1317. https://doi.org/10.1007/s10639-022-11548-w

De-Marcos, L., Domínguez, A., Saenz-de-Navarrete, J., & Pagés, C. (2014). An empirical study comparing gamification and social networking on e-learning. *Computers & Education, 75*, 82–91. https://doi.org/10.1016/j.compedu.2014.01.012

De-Marcos, L., Garcia-Lopez, E., & Garcia-Cabot, A. (2016). On the effectiveness of game-like and social approaches in learning: Comparing educational gaming, gamification & social networking. *Computers & Education, 95*, 99–113. https://doi.org/10.1016/j.compedu.2015.12.008

Dempsey, J. V., Haynes, L. L., Lucassen, B. A., & Casey, M. S. (2002). Forty simple computer games and what they could mean to educators. *Simulation & Gaming, 33*(2), 157–168. https://doi.org/10.1177/1046878102332003

Deterding, S., Dixon, D., Khaled, R., & Nacke, L. (2011). From game design elements to gamefulness: Defining gamification. *Proceedings of the 15th International Academic MindTrek Conference: Envisioning Future Media Environments* (pp. 9–15). Association for Computing Machinery. https://doi.org/10.1145/2181037.2181040

Ding, L. (2019). Applying gamifications to asynchronous online discussions: A mixed methods study. *Computers in Human Behavior, 91*, 1–11. https://doi.org/10.1016/j.chb.2018.09.022

European Union. (2019). *Key competences for lifelong learning.* https://data.europa.eu/doi/10.2766/291008

Feinauer, S., Schuller, L., Groh, I., Huestegge, L., & Petzoldt, T. (2022). The potential of gamification for user education in partial and conditional driving automation: A driving simulator study. *Transportation Research Part F: Traffic Psychology and Behaviour, 90*, 252-268. https://doi.org/10.1016/j.trf.2022.08.009

Feng, Y., Ye, H. J., Yu, Y., Yang, C., & Cui, T. (2018). Gamification artifacts and crowdsourcing participation: Examining the mediating role of intrinsic motivations. *Computers in Human Behavior, 81*, 124–136. https://doi.org/10.1016/j.chb.2017.12.018

Fink, A. (2005). *Conducting research literature reviews: From the internet to paper*. Sage.

Gouvias, D., Vitsilakis, C., & Kostas, A. (2019). E-moving forward – Emerging issues regarding e-learning in non-formal education in Greece. *European Journal of Open Education and E-learning Studies, 4*(1), 23–43. https://oapub.org/edu/index.php/ejoe/article/view/2251

Groening, C., & Binnewies, C. (2019). Achievement unlocked! The impact of digital achievements as a gamification element on motivation and performance. *Computers in Human Behavior, 97*, 151–166. https://doi.org/10.1016/j.chb.2019.02.026

Haddaway, N. R., Page, M. J., Pritchard, C. C., & McGuinness, L. A. (2022). PRISMA2020: An R package and Shiny app for producing PRISMA 2020-compliant flow diagrams, with interactivity for optimized digital transparency and Open Synthesis. *Campbell Systematic Reviews, 18*(2), e1230. https://doi.org/10.1002/cl2.1230

Hamari, J., & Koivisto, J. (2015). Why do people use gamification services? *International Journal of Information Management, 35*(4), 419–431. https://doi.org/10.1016/j.ijinfomgt.2015.04.006

Hamari, J., Koivisto, J., & Sarsa, H. (2014, January). Does gamification work? A literature review of empirical studies on gamification. *Proceedings of 47th Hawaii International Conference on System Sciences, Waikoloa, HI, USA,* 3025–3034. https://doi.org/10.1109/HICSS.2014.377

Hao, T., Winn, J. G., & Qiang, Q. (2023). Unlocking potential: Systematic review of the use of gamification in leadership curriculum. *Education and Information Technologies, 29*, 12305-12346. https://doi.org/10.1007/s10639-023-12332-0

Hassan, L., Dias, A., & Hamari, J. (2019). How motivational feedback increases user's benefits and continued use: A study on gamification, quantified-self and social networking. *International Journal of Information Management, 46*, 151–162. https://doi.org/10.1016/j.ijinfomgt.2018.12.004

Hattie, J. (2009). *Visible learning: A synthesis of over 800 meta-analyses relating to achievement*. Routledge.

Hattie, J. (2023). *Visible learning: The sequel: A synthesis of over 2,100 meta-analyses relating to achievement.* Routledge. https://doi.org/10.4324/9781003380542

Hsu, C.-L., & Chen, M.-C. (2018). How does gamification improve user experience? An empirical investigation on the antecedences and consequences of user experience and its mediating role. *Technological Forecasting and Social Change, 132*, 118–129. https://doi.org/10.1016/j.techfore.2018.01.023

Hsu, C.-L., Chen, Y.-C., Yang, T.-N., & Lin, W.-K. (2017). Do website features matter in an online gamification context? Focusing on the mediating roles of user experience and attitude. *Telematics and Informatics, 34*(4), 196–205. https://doi.org/10.1016/j.tele.2017.01.009

Hu, Y.-H., Yu, H.-Y., Tzeng, J.-W., & Zhong, K.-C. (2023). Using an avatar-based digital collaboration platform to foster ethical education for university students. *Computers & Education, 196*, 104728. https://doi.org/10.1016/j.compedu.2023.104728

Huang, B., & Hew, K. F. (2018). Implementing a theory-driven gamification model in higher education flipped courses: Effects on out-of-class activity completion and quality of artifacts. *Computers & Education, 125*, 254–272. https://doi.org/10.1016/j.compedu.2018.06.018

Jahn, K., Kordyaka, B., Machulska, A., Eiler, T. J., Gruenewald, A., Klucken, T., Brueck, R., Gethmann, C. F., & Niehaves, B. (2021). Individualized gamification elements: The impact of avatar and feedback design on reuse intention. *Computers in Human Behavior, 119*, 106702. https://doi.org/10.1016/j.chb.2021.106702

Kauppinen, A., & Choudhary, A. I. (2021). Gamification in entrepreneurship education: A concrete application of Kahoot! *The International Journal of Management Education, 19*(3), 100563. https://doi.org/10.1016/j.ijme.2021.100563

Kim, S. (2021). How a company's gamification strategy influences corporate learning: A study based on gamified MSLP (Mobile Social Learning Platform). *Telematics and Informatics, 57,* 101505. https://doi.org/10.1016/j.tele.2020.101505

Knowles, M. S., Holton, E. F., III, Swanson, R. A., & Robinson, P. A. (2020). *The adult learner: The definitive classic in adult education and human resource development* (9th ed.). Routledge. Group. https://doi.org/10.4324/9780429299612

Krath, J., Schürmann, L., & Von Korflesch, H. F. (2021). Revealing the theoretical basis of gamification: A systematic review and analysis of theory in research on gamification, serious games and game-based learning. *Computers in Human Behavior, 125,* 106963. https://doi.org/10.1016/j.chb.2021.106963

Lame, G. (2019). Systematic Literature Reviews: An Introduction. *Proceedings of the Design Society: International Conference on Engineering Design, 1*(1), 1633–1642. https://doi.org/10.1017/dsi.2019.169

Landers, R. N. (2014). Developing a theory of gamified learning: Linking serious games and gamification of learning. *Simulation & Gaming, 45*(6), 752–768. https://doi.org/10.1177/1046878114563660

Landers, R. N., Bauer, K. N., & Callan, R. C. (2017). Gamification of task performance with leaderboards: A goal setting experiment. *Computers in Human Behavior, 71*, 508–515. https://doi.org/10.1016/j.chb.2015.08.008

Majuri, J., Koivisto, J., & Hamari, J. (2018). Gamification of education and learning: A review of empirical literature. In J. Koivisto, & J. Hamari (Eds.), *Proceedings of the 2nd International GamiFIN Conference* (pp. 11-19). CEUR-WS. http://urn.fi/urn:nbn:de:0074-2186-5

Martí-Parreño, J., Seguí-Mas, D., & Seguí-Mas, E. (2016). Teachers' attitude towards and actual use of gamification. *Procedia – Social and Behavioral Sciences, 228*, 682–688. https://doi.org/10.1016/j.sbspro.2016.07.104

Mekler, E. D., Brühlmann, F., Tuch, A. N., & Opwis, K. (2017). Towards understanding the effects of individual gamification elements on intrinsic motivation and performance. *Computers in Human Behavior, 71*, 525–534. https://doi.org/10.1016/j.chb.2015.08.048

Merriam, S. B., & Baumgartner, L. M. (2020). *Learning in adulthood: A comprehensive guide* (4th ed.). Jossey-Bass.

Merriam, S. B., & Bierema, L. L. (2013). *Adult learning: Linking theory and practice* (1st ed.). Jossey-Bass.

Metwally, A. H. S., Nacke, L. E., Chang, M., Wang, Y., & Yousef, A. M. F. (2021). Revealing the hotspots of educational gamification: An umbrella review. *International Journal of Educational Research, 109,* 101832. https://doi.org/10.1016/j.ijer.2021.101832

Murillo-Zamorano, L. R., López-Sánchez, J. Á., López-Rey, M. J., & Bueno-Muñoz, C. (2023). Gamification in higher education: The ECOn+ star battles. *Computers & Education, 194*, 104699. https://doi.org/10.1016/j.compedu.2022.104699

OECD. (2021). *OECD Skills Outlook 2021: Learning for life*. https://doi.org/10.1787/0ae365b4-en

Oliveira, W., Hamari, J., & Shi, L. (2023). Tailored gamification in education: A literature review and future agenda. *Education and Information Technologies, 28*, 373–406. https://doi.org/10.1007/s10639-022-11122-4

Özdener, N. (2018). Gamification for enhancing Web 2.0 based educational activities: The case of pre-service grade schoolteachers using educational Wiki pages. *Telematics and Informatics, 35*(3), 564–578. https://doi.org/10.1016/j.tele.2017.04.003

Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., Shamseer, L., Tetzlaff, J. M., Akl, E. A., Brennan, S. E., Chou, R., Glanville, J., Grimshaw, J. M., Hróbjartsson, A., Lalu, M. M., Li, T., Loder, E. W., Mayo-Wilson, E., McDonald, S., & Moher, D. (2021). The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. *BMJ, 372*(71). https://doi.org/10.1136/bmj.n71

Pei, C. S., & Harun, J. B. (2023). Gamification elements and students' collaborative problem-solving skills: A literature analysis. *International Journal of Academic Research in Business and Social Sciences, 13*(4), 652–661. https://doi.org/10.6007/IJARBSS/v13-i4/16541

Perryer, C., Celestine, N. A., Scott-Ladd, B., & Leighton, C. (2016). Enhancing workplace motivation through gamification: Transferrable lessons from pedagogy. *The International Journal of Management Education, 14*(3), 327–335. https://doi.org/10.1016/j.ijme.2016.07.001

Petticrew, M., & Roberts, H. (2006). *Systematic reviews in the social sciences: A practical guide*. Blackwell. https://doi.org/10.1002/9780470754887

Prensky, M. (2003). Digital game-based learning. *Computers in Entertainment, 1*(1), 21. https://doi.org/10.1145/950566.950596

Ratinho, E., & Martins, C. (2023). The role of gamified learning strategies in student's motivation in high school and higher education: A systematic review. *Heliyon,* 9(8), e19033. https://doi.org/10.1016/j.heliyon.2023.e19033

Sailer, M., Hense, J. U., Mayr, S. K., & Mandl, H. (2017). How gamification motivates: An experimental study of the effects of specific game design elements on psychological need satisfaction. *Computers in Human Behavior, 69*, 371–380. https://doi.org/10.1016/j.chb.2016.12.033

Sailer, M., & Homner, L. (2020). The gamification of learning: A meta-analysis. *Educational Psychology Review, 32*, 77-112. https://doi.org/10.1007/s10648-019-09498-w

Saldana, J. (2015). *The coding manual for qualitative researchers*. Sage.

Salen, K., & Zimmerman, E. (2003). *Rules of play: Game design fundamentals*. MIT Press.

Somova, E., & Gachkova, M. (2016). An attempt for gamification of learning in Moodle. *International Conference on e-Learning, Bratislava, Slovakia,* 201–207.

Subhash, S., & Cudney, E. A. (2018). Gamified learning in higher education: A systematic review of literature. *Computers in Human Behavior, 87*, 192–206. https://doi.org/10.1016/j.chb.2018.05.028

Tay, J., Goh, Y. M., Safiena, S., & Bound, H. (2022). Designing digital game-based learning for professional up-skilling: A systematic literature review. *Computers & Education, 184*, 104518. https://doi.org/10.1016/j.compedu.2022.104518

Thomas, N. J., & Baral, R. (2023). Mechanism of gamification: Role of flow in the behavioral and emotional pathways of engagement in management education. *The International Journal of Management Education, 21*(1), 100718. https://doi.org/10.1016/j.ijme.2022.100718

Torresan, S., & Hinterhuber, A. (2023). Continuous learning at work: The power of gamification. *Management Decision, 61*(13), 386–412. https://doi.org/10.1108/MD-12-2020-1669

Trinoskey, J., Brahmi, F. A., & Gall, C. (2009). Zotero: A product review. *Journal of Electronic Resources in Medical Libraries, 6*(3), 224–229. https://doi.org/10.1080/15424060903167229

UNESCO. (2022). *Reimagining our futures together: A new social contract for education.* https://doi.org/10.54675/ASRB4722

Van Roy, R., & Zaman, B. (2018). Need-supporting gamification in education: An assessment of motivational effects over time. *Computers & Education, 127*, 283–297. https://doi.org/10.1016/j.compedu.2018.08.018

Vrcelj, A., Hoić-Božić, N., & Dlab, M. H. (2022). Use of gamification in primary and secondary education: A systematic literature review. *International Journal of Educational Methodology, 9*(1), 13–27. https://doi.org/10.12973/ijem.9.1.13

Werbach, K., & Hunter, D. (2012). *For the win: How game thinking can revolutionize your business.* Wharton Digital Press.

Xi, N., & Hamari, J. (2019). Does gamification satisfy needs? A study on the relationship between gamification features and intrinsic need satisfaction. *International Journal of Information Management, 46*, 210–221. https://doi.org/10.1016/j.ijinfomgt.2018.12.002

Yang, S., Lee, J. W., Kim, H.-J., Kang, M., Chong, E., & Kim, E. (2021). Can an online educational game contribute to developing information literate citizens? *Computers & Education, 161*, 104057. https://doi.org/10.1016/j.compedu.2020.104057

Yildirim, I. (2017). The effects of gamification-based teaching practices on student achievement and students' attitudes toward lessons. *The Internet and Higher Education, 33*, 86-92. https://doi.org/10.1016/j.iheduc.2017.02.002

Yildiz, İ., Topçu, E., & Kaymakci, S. (2021). The effect of gamification on motivation in the education of pre-service social studies teachers. *Thinking Skills and Creativity, 42*, 100907. https://doi.org/10.1016/j.tsc.2021.100907

Zainuddin, Z., Chu, S. K. W., Shujahat, M., & Perera, C. J. (2020). The impact of gamification on learning and instruction: A systematic review of empirical evidence. *Educational Research Review, 30*, 100326. https://doi.org/10.1016/j.edurev.2020.100326

Zhao, T., Gasiba, T., Lechner, U., & Pinto-Albuquerque, M. (2024). Thriving in the era of hybrid work: Raising cybersecurity awareness using serious games in industry training. *Journal of Systems and Software, 210*, 111946. https://doi.org/10.1016/j.jss.2023.111946

AUTHORS

Apostolos Kostas is an Assistant Professor in the Department of Primary Education at the University of the Aegean, Greece. His research interests encompass e-learning, AI in education, distance education, communities of practice, social networks in education, initial teacher education, and teacher professional development. He has participated in numerous European and nationally funded research projects. Currently, he serves as the Director of the Lifelong Learning Center at the University of the Aegean.

George Koutromanos is an Associate Professor of Information Communication Technologies (ICT) in Education at the Department of Primary Education, Section of Mathematics and Informatics, at the National and Kapodistrian University of Athens (NKUA). Additionally, he serves as the Director of the Information Technologies Laboratory in his department. His current research interests encompass the impact of ICT on education, the utilization of ICT in education and its influence on teacher education and children's learning, the development and evaluation of computer-assisted learning materials, flipped learning, the application of augmented reality in education, the incorporation of mobile games in formal and informal learning environments, and the integration of wearable technologies and drones in education.

Ioanna Lagopati is a state-certified secondary education teacher holding a degree in Greek Philology from the National & Kapodistrian University of Athens, along with postgraduate studies in Special Education from the University of Nicosia and Educational Technology from the University of the Aegean. She is currently a Postgraduate Student at the National and Kapodistrian University of Athens. Her academic interests center on inclusive education, digital learning, and language acquisition. She is certified in Greek Sign Language and possesses C2-level proficiency in English. She is married and has one child.