

## **Personalised Generative Ai And Gamification In Higher Education: A Systematic Review of Their Role In Supporting Student Learning Autonomy**

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**ABSTRACT**

The growing use of personalised generative artificial intelligence (AI) and gamification in higher education is reshaping how learning environments are designed and experienced. While both approaches are often linked to enhanced learner engagement and self-regulated learning, their role in supporting student learning autonomy remains fragmented across the literature. This systematic review brings together existing research to better understand how these technologies contribute to autonomy in university contexts. Guided by PRISMA protocols, peer-reviewed studies published between 2020 and 2025 were identified and analysed from major academic databases. The review focuses on studies that examine generative AI-driven personalization, such as adaptive feedback, intelligent tutoring, and AI-supported content generation, as well as gamification elements, including points, badges, leaderboards, and narrative-based challenges, where learning is considered as a key outcome.

The findings suggest that generative AI can support the development of learning autonomy when it is designed to scaffold and gradually shift control to students. At the same time, gamification appears to strengthen motivational regulation, particularly when it is grounded in pedagogical principles rather than relying on superficial reward systems. However, the review also highlights inconsistencies in how autonomy is conceptualised and measured, pointing to important gaps in theory-driven design and evaluation. Overall, this study identifies key design principles and offers directions for future research, emphasising the need for more theoretically grounded and context-sensitive approaches in integrating generative AI and gamification in higher education.

Overall, the review highlights the importance of theory-driven and context-sensitive approaches in integrating generative AI and gamification to support autonomous learning in higher education

**Keywords:**

Generative AI; Gamification; Learning Autonomy; Higher Education; Self-Regulated Learning; Personalised Learning; Educational Technology; Systematic Review; PRISMA

## Introduction

Digital technologies are increasingly transforming how learning environments are designed and experienced in higher education. Among the most significant developments are personalised generative artificial intelligence (AI) tools and gamification strategies, both of which have attracted considerable attention for their potential to create more engaging, adaptive, and student-centred learning experiences. In recent years, generative AI has emerged as a powerful educational technology capable of personalising content, feedback, and learning pathways according to individual learner needs. At the same time, gamification has gained prominence as a pedagogical approach that incorporates game design elements such as points, badges, leaderboards, and challenges to enhance student motivation and participation. While both approaches have been associated with positive educational outcomes, their role in supporting student learning autonomy remains insufficiently understood.

Learning autonomy is widely recognised as an important goal of higher education. It refers to learners' ability to take responsibility for their own learning by setting goals, monitoring progress, making decisions, and regulating learning strategies. Closely linked to self-regulated learning, autonomy enables students to become active participants in the learning process rather than passive recipients of information. As universities increasingly seek to prepare graduates for lifelong learning and rapidly changing professional environments, fostering learner autonomy has become an essential educational objective.

Within this context, personalised generative AI offers considerable potential to support autonomous learning. Through adaptive feedback, intelligent tutoring, personalised recommendations, and real-time content generation, AI systems can provide learners with tailored support that encourages independent learning and decision-making. Similarly, gamification has been shown to influence learner motivation, persistence, and engagement by creating meaningful learning experiences that encourage students to take greater ownership of their learning. When grounded in sound pedagogical principles, gamification can promote self-regulation and sustained participation rather than merely rewarding task completion.

Despite these potential benefits, existing research has largely examined generative AI and gamification as separate educational innovations. Studies often focus on outcomes such as academic performance, engagement, satisfaction, or technology acceptance, while learning autonomy receives comparatively less attention as a central outcome variable. Furthermore, there is considerable variation in how autonomy is conceptualised, measured, and evaluated across studies. These inconsistencies make it difficult to establish a coherent understanding of how personalised generative AI and gamification contribute to the development of autonomous learners in higher education.

Another challenge lies in the limited theoretical integration across the literature. Research on generative AI frequently draws on personalised learning and adaptive learning frameworks, whereas gamification studies are often grounded in motivational theories such as Self-Determination Theory. As a result, the relationship between these technologies and learning

autonomy remains fragmented, limiting the development of evidence-based design principles for higher education practice.

Given these gaps, a systematic synthesis of current research is needed. Therefore, this study systematically reviews recent literature on personalised generative AI and gamification in higher education, with particular attention to their role in supporting student learning autonomy. By synthesising empirical evidence, identifying key design principles, and highlighting areas for future research, the review seeks to provide a more comprehensive understanding of how these technologies can be effectively integrated to promote autonomous learning in contemporary higher education environments.

## **2. Conceptualising Learning Autonomy In Higher Education**

Learning autonomy has become an increasingly important concept in higher education, particularly as universities seek to prepare students for lifelong learning in rapidly changing social, technological, and professional environments. Rather than viewing learners as passive recipients of knowledge, contemporary educational approaches emphasise the importance of students taking an active role in directing, managing, and evaluating their own learning processes. As a result, learning autonomy is now widely recognised as a key educational outcome that supports academic success, personal development, and professional adaptability.

The concept of learning autonomy is commonly associated with the ability of learners to take responsibility for their learning by setting goals, selecting appropriate learning strategies, monitoring progress, and reflecting on outcomes [1]. Early work by Holec [2] described learner autonomy as the capacity to take charge of one's own learning, while subsequent research has expanded the concept to include self-regulation, motivation, metacognition, and independent decision-making. In higher education contexts, autonomous learners are generally characterised by their ability to identify learning needs, manage resources effectively, and engage in continuous self-improvement beyond formal instructional settings.

Learning autonomy is closely related to the concept of self-regulated learning (SRL). According to Zimmerman [3], self-regulated learners actively participate in their learning through processes such as goal setting, self-monitoring, self-evaluation, and strategic adaptation. These behaviours enable students to manage learning challenges effectively and maintain motivation throughout the learning process. Consequently, autonomy and self-regulation are often viewed as complementary constructs that contribute to successful academic outcomes.

The growing emphasis on learner autonomy reflects broader changes in higher education. Contemporary graduates are expected not only to possess disciplinary knowledge but also to demonstrate adaptability, critical thinking, problem-solving abilities, and a commitment to lifelong learning. Such expectations have become increasingly important in digitally mediated learning environments where students must navigate large volumes of information, make independent learning decisions, and engage with diverse technological tools [4]. In this

context, learning autonomy serves as a foundation for helping students manage increasingly complex educational experiences.

Motivation also plays a central role in the development of learning autonomy. Self-Determination Theory (SDT), proposed by Deci and Ryan [5], suggests that autonomous learning is strengthened when learners experience autonomy, competence, and relatedness. Students are more likely to engage deeply with learning activities when they perceive themselves as having control over their learning decisions and when educational environments support their psychological needs. This perspective is particularly relevant when considering the role of educational technologies such as generative AI and gamification, both of which have the potential to influence learner motivation and engagement.

Despite its importance, learning autonomy remains a complex and multidimensional construct. Different studies conceptualise autonomy in various ways, including self-directed learning, independent learning, self-regulated learning, learner agency, and personalised learning. These overlapping perspectives contribute to inconsistencies in how autonomy is measured and evaluated across educational research [6]. Consequently, understanding how emerging technologies support learning autonomy requires careful consideration of the theoretical foundations that underpin the concept.

Recent technological developments have created new opportunities for fostering autonomous learning. Digital learning environments increasingly provide learners with personalised content, immediate feedback, flexible learning pathways, and opportunities for self-paced learning. Such features align closely with the principles of learner autonomy by enabling students to exercise greater control over their learning experiences. However, technology alone does not automatically promote autonomy. Educational technologies must be designed and implemented in ways that encourage active participation, critical reflection, and independent decision-making rather than passive consumption of information [7].

Within this context, personalised generative AI and gamification have emerged as two influential educational innovations with significant potential to support learner autonomy. Generative AI can provide adaptive feedback and personalised learning support, while gamification can enhance motivation and persistence through carefully designed learning experiences. Understanding how these technologies contribute to autonomous learning requires a closer examination of their individual and combined roles within higher education environments. The following sections therefore explore the relationship between personalised generative AI, gamification, and learning autonomy in greater detail.

### **3. Personalised Generative Ai And Learning Autonomy**

The emergence of generative artificial intelligence (AI) has introduced new possibilities for personalised learning in higher education. Unlike earlier educational technologies that primarily delivered static content or predefined feedback, generative AI systems can produce

contextually relevant responses, generate learning materials, provide explanations, and adapt interactions according to individual learner needs. These capabilities have positioned generative AI as a potentially powerful tool for supporting learning autonomy by enabling students to engage in self-directed learning beyond the traditional classroom environment.

Personalisation is a key characteristic of generative AI applications in education. Through technologies such as large language models, conversational agents, and intelligent tutoring systems, learners can receive tailored feedback, customised learning resources, and immediate responses to their questions [8]. Such personalised support allows students to progress at their own pace, revisit difficult concepts, and explore topics according to their interests and learning goals. From the perspective of autonomous learning, these features can strengthen learners' sense of control over their educational experiences and encourage greater responsibility for learning outcomes.

One of the most significant contributions of generative AI is its ability to provide continuous and immediate feedback. Feedback has long been recognised as a critical factor in supporting self-regulated learning because it helps learners monitor their progress, identify knowledge gaps, and adjust learning strategies accordingly [9]. Traditional educational settings often limit the frequency and availability of feedback due to time and resource constraints. Generative AI addresses this limitation by offering on-demand support that is available whenever learners require assistance. As a result, students can engage in iterative learning processes that promote reflection, self-correction, and independent problem-solving.

Generative AI also has the potential to function as a personalised learning companion. Through conversational interactions, learners can seek clarification, explore alternative explanations, and engage in dialogue that supports deeper understanding of complex concepts. Unlike static educational resources, AI systems can respond dynamically to learner inputs and provide multiple pathways for knowledge acquisition. This flexibility aligns closely with learner-centred educational approaches that emphasise active participation and individual learning preferences [10].

Another important contribution relates to learner agency. Agency refers to learners' capacity to make informed decisions about their learning and to act intentionally in pursuing educational goals [11]. Personalised generative AI can support agency by providing learners with greater choice regarding what, when, and how they learn. Students are able to select learning pathways, request additional explanations, and customise learning experiences according to their specific needs. In this sense, AI can function as a scaffold that supports autonomous decision-making while encouraging independent learning behaviours.

Despite these potential benefits, concerns have emerged regarding the extent to which generative AI genuinely promotes autonomy. While AI systems can facilitate independent learning, excessive reliance on AI-generated content may reduce opportunities for learners to engage in critical thinking, reflection, and knowledge construction [12]. There is a risk that learners may become passive consumers of AI-generated answers rather than active participants in the learning process. In such cases, technology may create a form of dependency that undermines rather than strengthens learning autonomy.

The quality and reliability of AI-generated feedback also remain important considerations. Although generative AI systems are capable of producing sophisticated responses, inaccuracies, hallucinations, and biased outputs continue to present challenges [13]. Learners who lack sufficient subject knowledge may find it difficult to evaluate the accuracy of AI-generated information, potentially affecting the quality of autonomous learning decisions. Consequently, the effectiveness of generative AI in supporting autonomy depends not only on technological capability but also on learners' critical evaluation skills and digital literacy.

Recent studies further suggest that the relationship between generative AI and learning autonomy is influenced by instructional design. AI tools appear to be most effective when they are used to scaffold learning processes rather than replace them entirely [14]. Educational designs that encourage reflection, self-assessment, goal setting, and critical engagement with AI-generated content are more likely to promote genuine autonomy. In contrast, approaches that encourage learners to rely solely on AI-generated answers may weaken self-regulatory behaviours over time.

Overall, the literature suggests that personalised generative AI offers considerable potential for supporting learning autonomy in higher education. Through adaptive feedback, personalised learning pathways, and flexible access to learning resources, AI can empower students to take greater control of their learning experiences. However, the benefits of these technologies are not automatic. Their effectiveness depends on thoughtful pedagogical design, critical AI literacy, and the extent to which they encourage active rather than passive engagement. Understanding these conditions is essential for maximising the role of generative AI in fostering autonomous learners within contemporary higher education environments.

#### **4. Gamification And Learning Autonomy**

Gamification has emerged as a widely adopted pedagogical approach in higher education, driven by the need to enhance student engagement, motivation, and participation in learning activities. Broadly defined, gamification refers to the application of game design elements in non-game contexts to encourage desired behaviours and improve user experiences [15]. In educational settings, these elements commonly include points, badges, leaderboards, progress indicators, challenges, rewards, and narrative-based activities. Although gamification is often associated with increased engagement, its relationship with learning autonomy is more complex and warrants closer examination.

The theoretical foundations of gamification are closely linked to Self-Determination Theory (SDT), which emphasises the importance of autonomy, competence, and relatedness in fostering intrinsic motivation [16]. According to SDT, learners are more likely to engage meaningfully with learning activities when they experience a sense of ownership over their actions, believe they are capable of succeeding, and feel connected to others within the learning environment. Effective gamification strategies seek to support these psychological needs by creating learning experiences that are both motivating and personally meaningful.

One of the primary ways gamification supports learning autonomy is by encouraging goal-oriented behaviour. Game elements such as progress tracking, achievement badges, and level advancement provide learners with clear indicators of progress and accomplishment. These mechanisms help students monitor their own learning, establish personal goals, and evaluate their achievements over time [17]. Such processes align closely with self-regulated learning principles, where learners actively monitor and manage their learning behaviours.

Gamification can also enhance learner motivation by increasing engagement and persistence. Traditional instructional approaches sometimes struggle to maintain student interest, particularly in online and blended learning environments where learners are expected to manage their own learning schedules. Gamified learning environments introduce elements of challenge, competition, and achievement that can encourage learners to remain actively involved in learning activities [18]. When designed appropriately, these experiences can strengthen learners' willingness to invest effort and take responsibility for their learning progress.

Narrative-based gamification represents another approach that may contribute to learner autonomy. Rather than relying solely on rewards and competition, narrative-based designs immerse learners in meaningful contexts where they make decisions, solve problems, and progress through learning experiences as active participants. Such approaches encourage learners to take ownership of their learning journey and engage more deeply with educational content [19]. By providing opportunities for exploration and decision-making, narrative-based gamification may foster greater independence and learner agency.

However, the relationship between gamification and learning autonomy is not always straightforward. Critics argue that some forms of gamification rely excessively on extrinsic rewards, such as points, badges, and leaderboards, which may encourage compliance rather than genuine autonomy [20]. In these cases, learners may become motivated primarily by external incentives rather than intrinsic interest in learning. While such approaches can increase short-term engagement, their long-term impact on autonomous learning remains questionable.

This concern has led researchers to distinguish between superficial gamification and pedagogically meaningful gamification. Superficial gamification focuses primarily on reward structures and competition, whereas meaningful gamification seeks to support autonomy, mastery, and purposeful engagement [21]. Meaningful gamification aligns more closely with educational objectives because it encourages learners to reflect on their progress, make informed decisions, and develop self-regulatory skills rather than merely accumulating rewards.

Recent research suggests that the effectiveness of gamification in supporting learning autonomy depends largely on instructional design [22]. Gamified environments are most successful when learners are given meaningful choices, opportunities for self-direction, and tasks that promote mastery rather than simple task completion. In such contexts, gamification serves as a motivational scaffold that encourages learners to take greater ownership of their learning while maintaining engagement and persistence.

The growing adoption of digital learning technologies has further expanded opportunities for gamification in higher education. Online learning platforms increasingly incorporate gamified features that allow learners to track progress, earn achievements, and participate in collaborative challenges. These developments have created new possibilities for supporting autonomous learning while maintaining motivation in digitally mediated learning environments [23].

Overall, the literature suggests that gamification can play an important role in supporting learning autonomy when it is grounded in sound pedagogical principles and informed by motivational theory. While game elements can enhance engagement and persistence, autonomy is most effectively promoted when learners are provided with meaningful choices, opportunities for self-regulation, and experiences that foster intrinsic motivation. Consequently, the value of gamification lies not in the game elements themselves but in how those elements are designed to support meaningful learning and learner development.

## **5. The Intersection Of Generative Ai And Gamification**

While generative AI and gamification have often been examined as separate educational innovations, there is growing recognition that their combined application may offer unique opportunities for supporting learning autonomy in higher education. Both approaches seek to enhance learner engagement and participation, but they do so through different mechanisms. Generative AI primarily contributes through personalisation, adaptive support, and real-time feedback, whereas gamification focuses on motivation, persistence, and behavioural engagement. When integrated thoughtfully, these complementary strengths have the potential to create learning environments that are both highly personalised and intrinsically motivating.

The relationship between generative AI and gamification can be understood through the lens of autonomous learning. Learning autonomy requires learners to take responsibility for their educational decisions, monitor their progress, and regulate their learning behaviours. Generative AI supports these processes by providing personalised guidance, adaptive feedback, and immediate access to learning resources. At the same time, gamification can encourage sustained engagement by creating meaningful goals, progress indicators, and opportunities for achievement. Together, these technologies can create learning experiences that support both the cognitive and motivational dimensions of autonomous learning [24].

One area where this integration is particularly promising is personalised learning pathways. Generative AI can analyse learner performance and provide customised recommendations, while gamified elements can present these recommendations through structured challenges, missions, or achievement systems. Rather than following a uniform learning pathway, students can progress according to their individual needs and interests while remaining motivated through clearly defined goals and feedback mechanisms [25]. This combination may strengthen learners' sense of ownership over their learning while maintaining engagement over extended periods.

The integration of generative AI and gamification may also enhance self-regulated learning. Self-regulated learning involves planning, monitoring, and evaluating one's learning

activities. AI systems can support these processes by providing diagnostic feedback, identifying areas for improvement, and recommending learning strategies. Gamification can reinforce these behaviours through progress tracking, achievement recognition, and reflective learning activities. Together, these features encourage learners to become more aware of their learning progress and take a more active role in managing their educational experiences [26].

Another advantage of combining these approaches lies in the provision of immediate and meaningful feedback. Feedback is a critical component of autonomous learning because it helps learners evaluate their performance and make informed decisions about future learning actions. Generative AI enables personalised and continuous feedback, while gamification provides visual indicators of progress and achievement. The combination of personalised feedback and motivational reinforcement can help learners remain engaged while developing confidence in their ability to manage their own learning [27].

Despite these potential benefits, the integration of generative AI and gamification is not without challenges. One concern is the possibility of creating excessive dependence on technological support. If learners rely too heavily on AI-generated guidance and externally driven rewards, opportunities for independent decision-making and critical reflection may be reduced. Learning autonomy requires learners to exercise judgement and take responsibility for their learning choices, which means that technological support should function as a scaffold rather than a substitute for self-regulation [28].

Another challenge relates to the quality of learning experiences. Poorly designed gamification may encourage learners to focus on rewards rather than meaningful learning, while inaccurate or biased AI-generated feedback may undermine trust and learning effectiveness. Consequently, the success of AI-enhanced gamified learning environments depends heavily on thoughtful instructional design. Educational experiences should be structured to encourage reflection, critical engagement, and purposeful learning rather than merely maximising participation or task completion.

The literature also suggests that theoretical integration remains limited. While many studies report positive outcomes associated with generative AI or gamification individually, relatively few investigations examine how the two approaches interact to support learning autonomy. Existing research often measures engagement, satisfaction, or academic performance, with less attention given to autonomy as a multidimensional construct involving self-regulation, agency, motivation, and independent decision-making [29]. This highlights the need for more theory-driven research that explicitly examines how AI and gamification jointly contribute to autonomous learning.

Based on the evidence reviewed, this paper proposes that the intersection of generative AI and gamification can be understood as a complementary ecosystem for supporting learning autonomy. Within this ecosystem, generative AI provides personalised cognitive support, while gamification contributes motivational support. Together, these technologies can create conditions that encourage learners to take greater responsibility for their learning while maintaining engagement and persistence. However, the effectiveness of this ecosystem

depends on pedagogical design that prioritises meaningful learning experiences, learner agency, and long-term autonomy rather than short-term engagement alone.

The growing convergence of generative AI and gamification represents an important development in higher education. As these technologies continue to evolve, understanding their combined influence on learning autonomy will become increasingly important for educators, curriculum designers, and researchers seeking to create more personalised, motivating, and learner-centred educational environments.

## **6. Challenges And Limitations**

Despite the growing interest in personalised generative AI and gamification as tools for enhancing learning autonomy, the literature highlights several challenges that may limit their effectiveness in higher education. While both approaches offer promising opportunities for personalised and engaging learning experiences, their successful implementation depends on a range of pedagogical, technological, and ethical considerations. Understanding these limitations is essential for ensuring that technology supports rather than undermines autonomous learning.

### **6.1 Overreliance on Technology and Reduced Learner Independence**

One of the most frequently discussed concerns relates to the potential for overreliance on technological support. Generative AI systems are designed to provide immediate answers, explanations, and recommendations, which can significantly reduce the effort required to complete learning tasks. While such support can facilitate learning, excessive dependence on AI-generated assistance may discourage learners from engaging in critical thinking, problem-solving, and independent knowledge construction [30].

Similarly, gamification may encourage learners to focus on completing tasks for rewards rather than developing genuine understanding. When learners become accustomed to external support and reinforcement, their ability to regulate learning independently may be weakened. As a result, technologies intended to promote autonomy may inadvertently foster dependency if not implemented carefully.

### **6.2 Academic Integrity and Ethical Concerns**

The widespread availability of generative AI has introduced new challenges related to academic integrity. AI-powered tools can generate essays, summaries, discussion responses, and other academic content with increasing sophistication. While these capabilities can support learning, they also create opportunities for inappropriate use and raise concerns regarding authorship, originality, and academic honesty [31].

Educational institutions continue to grapple with questions regarding acceptable AI use, assessment design, and ethical guidelines. The challenge is not simply detecting AI-generated content but helping students understand how AI can be used responsibly as a learning aid rather than a replacement for intellectual effort. Consequently, the development of clear institutional policies and AI literacy initiatives has become increasingly important.

### 6.3 Data Privacy and Security

Personalised learning systems often rely on the collection and analysis of learner data to provide adaptive recommendations and customised feedback. While these features contribute to personalisation, they also raise concerns regarding data privacy, security, and informed consent [32]. Students may not always be aware of how their personal information is collected, stored, or utilised by educational technologies.

The increasing use of AI systems in higher education therefore requires institutions to establish transparent data governance practices that protect student privacy while ensuring responsible use of educational data. Failure to address these concerns may undermine trust and limit the adoption of AI-supported learning environments.

### 6.4 Algorithmic Bias and Fairness

Another challenge relates to algorithmic bias. Generative AI systems are trained on large datasets that may contain cultural, linguistic, and social biases. As a result, AI-generated responses may inadvertently reinforce stereotypes, privilege dominant perspectives, or provide uneven support for learners from diverse backgrounds [33].

These concerns are particularly relevant in higher education, where learners come from increasingly diverse linguistic, cultural, and socio-economic backgrounds. Educational technologies that fail to account for this diversity may unintentionally disadvantage certain groups of students. Consequently, issues of fairness, inclusivity, and representation should be considered central to the design and implementation of AI-supported learning environments.

### 6.5 Superficial Gamification and Reward Dependency

Although gamification is often associated with increased engagement, not all gamified learning experiences contribute meaningfully to learning autonomy. Research has shown that poorly designed gamification may encourage learners to focus on accumulating points, badges, or rewards rather than engaging deeply with learning content [34].

This phenomenon, sometimes referred to as reward dependency, can result in short-term behavioural engagement without promoting long-term motivation or self-regulated learning. Learners may participate actively while rewards are available but lose interest once external incentives are removed. Therefore, gamification should be designed to support intrinsic motivation, meaningful choice, and mastery rather than relying solely on competitive reward structures.

### 6.6 Digital Divide and Unequal Access

The benefits of generative AI and gamification are not distributed equally across all learners. Access to advanced technologies often depends on factors such as internet connectivity, digital literacy, institutional resources, and socio-economic background. Students with

limited access to technology may be unable to benefit fully from AI-enhanced learning environments, potentially widening existing educational inequalities [35].

The digital divide remains a significant concern for higher education institutions seeking to implement technology-enhanced learning initiatives. Addressing issues of accessibility and inclusion is therefore essential for ensuring that innovations in educational technology contribute to equitable learning opportunities.

### **6.7 Conceptual and Methodological Limitations in Existing Research**

A final challenge concerns the current state of research itself. The literature reveals considerable variation in how learning autonomy is conceptualised and measured across studies. Some researchers focus on self-regulated learning, while others emphasise learner agency, independent learning, or motivational outcomes. This lack of conceptual consistency makes it difficult to compare findings and establish clear conclusions regarding the effectiveness of generative AI and gamification in supporting autonomy [36].

Furthermore, much of the existing research relies on short-term interventions and self-reported measures of engagement and satisfaction. Longitudinal studies examining the sustained impact of these technologies on learning autonomy remain relatively limited. As a result, important questions regarding long-term learner development, technology dependence, and educational outcomes remain insufficiently explored.

Overall, while personalised generative AI and gamification offer substantial potential for supporting learning autonomy, their effectiveness cannot be assumed. Challenges related to dependency, ethics, privacy, bias, motivation, accessibility, and research design highlight the need for careful implementation and ongoing critical evaluation. Addressing these issues will be essential for ensuring that technology enhances rather than constrains learner autonomy in higher education.

## **7. Implications For Higher Education Practice**

The findings of this review suggest that personalised generative AI and gamification have considerable potential to support learning autonomy in higher education when implemented thoughtfully and within sound pedagogical frameworks. However, the effectiveness of these technologies depends not only on their technical capabilities but also on how they are integrated into teaching, learning, and assessment practices. Consequently, several implications emerge for educators, curriculum designers, and higher education institutions.

### **7.1 Implications for Educators**

The increasing availability of generative AI and gamified learning platforms requires educators to reconsider their role within contemporary learning environments. Rather than

serving primarily as sources of information, educators are increasingly positioned as facilitators of learning who guide students in navigating, evaluating, and applying information effectively. In AI-enhanced environments, educators play a crucial role in helping learners develop critical thinking, reflective learning habits, and responsible technology use.

Educators should encourage students to engage actively with AI-generated feedback rather than accepting it uncritically. Classroom activities that require students to evaluate AI responses, compare alternative perspectives, and justify learning decisions can help strengthen learner autonomy while promoting critical AI literacy. Similarly, gamified activities should be designed to support meaningful engagement rather than merely rewarding task completion.

## **7.2 Implications for Curriculum Design**

The findings highlight the importance of designing curricula that intentionally promote learning autonomy. Generative AI and gamification should not be viewed as standalone technological additions but as components of broader pedagogical strategies that support self-regulated learning.

Curriculum designers should consider incorporating learning activities that encourage goal setting, self-monitoring, reflection, and independent decision-making. Generative AI can be used to provide personalised support and adaptive learning pathways, while gamification can help sustain motivation and engagement throughout the learning process. When aligned with learning outcomes, these technologies can contribute to more flexible and learner-centred educational experiences.

Furthermore, curricula should incorporate opportunities for students to develop AI literacy and digital literacy skills. As AI becomes increasingly embedded within educational and professional contexts, students require the ability to evaluate AI-generated information, recognise potential limitations, and use technology responsibly and ethically.

## **7.3 Implications for Assessment Practices**

The emergence of generative AI presents significant challenges for traditional assessment approaches. Assessment tasks that focus primarily on information recall or standard written responses may become increasingly vulnerable to AI-assisted completion. Consequently, higher education institutions may need to reconsider how learning is assessed.

Alternative assessment approaches, such as reflective journals, project-based learning, portfolios, oral presentations, authentic problem-solving tasks, and collaborative projects, may provide more meaningful opportunities for students to demonstrate autonomous learning. These forms of assessment encourage learners to engage actively with content, apply knowledge in context, and reflect on their learning processes rather than simply producing outcomes.

Assessment practices should also recognise the role of AI as a learning tool. Rather than prohibiting AI entirely, institutions may consider developing assessment frameworks that encourage transparent and ethical AI use while maintaining academic integrity and learner responsibility.

#### **7.4 Building AI Literacy and Digital Competence**

As generative AI becomes increasingly accessible, AI literacy should be considered an essential graduate competency. AI literacy extends beyond technical knowledge and includes understanding how AI systems generate information, recognising potential biases, evaluating credibility, and making informed decisions regarding AI use [37].

Higher education institutions should therefore provide opportunities for students to develop these competencies across disciplines. Equally important is the need for professional development programmes that support educators in understanding the pedagogical applications, benefits, and limitations of AI technologies. Building AI literacy among both students and educators is likely to be critical for ensuring the responsible and effective use of AI in higher education.

#### **7.5 Institutional Support and Policy Development**

The successful integration of personalised generative AI and gamification requires institutional commitment and support. Universities should develop clear policies regarding AI use, academic integrity, data privacy, and ethical technology adoption. Such policies should provide guidance while remaining flexible enough to accommodate rapidly evolving technological developments.

Institutions should also invest in technological infrastructure, staff training, and learner support services to ensure equitable access to AI-enhanced learning opportunities. Particular attention should be given to addressing issues related to digital inclusion so that all students can benefit from technological innovations regardless of their socio-economic or technological circumstances.

Ultimately, the integration of personalised generative AI and gamification should be guided by educational rather than technological priorities. The goal is not simply to increase the use of technology but to create learning environments that empower students to become more autonomous, motivated, and reflective learners. When supported by appropriate pedagogical design and institutional frameworks, these technologies can contribute meaningfully to the development of lifelong learning skills that extend beyond higher education.

### **8. Future Research Directions**

The findings of this systematic review indicate that personalised generative AI and gamification have considerable potential to support learning autonomy in higher education. However, the literature also reveals several conceptual, methodological, and practical gaps that warrant further investigation. As these technologies continue to evolve, future research should move beyond evaluating immediate outcomes and focus on understanding how they influence learner development over time.

### **8.1 Developing a More Consistent Understanding of Learning Autonomy**

One of the most significant challenges identified in the literature is the lack of conceptual consistency surrounding learning autonomy. Researchers have used a variety of related constructs, including self-regulated learning, learner agency, self-directed learning, independent learning, and autonomous learning. Although these concepts share common characteristics, differences in definitions and measurement approaches make it difficult to compare findings across studies.

Future research should work toward establishing clearer conceptual frameworks that distinguish and connect these constructs. Greater consistency in how learning autonomy is defined and operationalised would contribute to more robust evidence regarding the effectiveness of generative AI and gamification in higher education contexts.

### **8.2 Longitudinal Studies on Learning Autonomy**

Much of the existing research relies on short-term interventions that examine immediate changes in engagement, motivation, or academic performance. While these findings provide valuable insights, they offer limited understanding of whether the benefits of AI-supported and gamified learning environments are sustained over time.

Longitudinal research is needed to examine how prolonged exposure to generative AI and gamification influences learning autonomy, self-regulation, and learner agency. Such studies could help determine whether these technologies promote lasting behavioural and cognitive changes or whether their effects diminish once the novelty of the technology declines.

### **8.3 Investigating the Combined Effects of Generative AI and Gamification**

Although both generative AI and gamification have received increasing research attention, relatively few studies have examined their combined application. Existing research tends to investigate these approaches separately, resulting in limited understanding of how they interact to influence learner outcomes.

Future studies should explore integrated learning environments where generative AI and gamification are intentionally combined. Research examining how personalised AI feedback interacts with gamified motivational strategies may provide valuable insights into how these technologies can jointly support learning autonomy, engagement, and self-regulated learning.

### **8.4 Exploring Learner Diversity and Contextual Factors**

The effectiveness of educational technologies is often influenced by learner characteristics and contextual conditions. Factors such as prior digital literacy, academic discipline, cultural background, language proficiency, and learning preferences may affect how students engage with generative AI and gamified learning environments.

Future research should therefore investigate how different learner populations respond to these technologies. Comparative studies across disciplines, institutions, and cultural contexts may help identify conditions under which personalised generative AI and gamification are most effective in supporting autonomous learning.

### **8.5 Examining Ethical and Responsible AI Use**

The rapid adoption of generative AI in higher education has raised important ethical concerns relating to academic integrity, data privacy, algorithmic bias, and transparency. While these issues are increasingly discussed, empirical research examining how students and educators navigate these challenges remains relatively limited.

Future studies should investigate strategies for promoting ethical AI use while supporting learner autonomy. Research exploring AI literacy, responsible technology use, and the development of institutional policies may contribute to more sustainable and equitable approaches to AI integration in higher education.

### **8.6 Strengthening Theory-Driven Research**

The review also highlights a need for stronger theoretical foundations in studies examining generative AI and gamification. Many investigations focus on technological features or learning outcomes without clearly linking findings to established educational theories.

Future research should draw more explicitly on frameworks such as Self-Determination Theory, Self-Regulated Learning Theory, Social Cognitive Theory, and Constructivist Learning Theory. Theory-driven studies can provide deeper explanations of how and why generative AI and gamification influence learning autonomy, thereby strengthening both research quality and practical application.

### **8.7 Emerging Technologies and Future Learning Environments**

As educational technologies continue to evolve, new forms of AI-supported learning are likely to emerge. Advances in conversational agents, immersive learning environments, adaptive learning systems, virtual reality, and agentic AI may further transform how students learn and interact with educational content.

Future research should explore how these emerging technologies contribute to learning autonomy and whether existing theoretical frameworks remain applicable in increasingly intelligent and personalised learning environments. Understanding these developments will be essential for preparing higher education institutions to respond effectively to future technological change.

Overall, future research should move beyond questions of technological effectiveness and focus more deeply on learner development, educational quality, and the conditions that support meaningful autonomy. By addressing these gaps, scholars can contribute to a more comprehensive understanding of how personalised generative AI and gamification can be used responsibly and effectively to support autonomous learning in higher education.

## 9. Conclusion

The rapid growth of personalised generative AI and gamification is reshaping the landscape of higher education, creating new opportunities for more personalised, engaging, and learner-centred educational experiences. This systematic review examined the role of these technologies in supporting student learning autonomy, a capability that has become increasingly important in contemporary higher education. By synthesising recent research, the review explored how generative AI and gamification contribute to learners' ability to take responsibility for their learning, regulate learning behaviours, and engage actively in educational processes.

The findings suggest that personalised generative AI can support learning autonomy through adaptive feedback, intelligent tutoring, personalised recommendations, and flexible learning pathways. These features provide learners with greater control over their learning experiences while supporting self-regulated learning behaviours. Similarly, gamification can strengthen learner motivation, persistence, and engagement, particularly when game elements are designed to promote meaningful participation rather than simply reward completion of tasks. When grounded in sound pedagogical principles, both approaches can contribute positively to the development of autonomous learners.

At the same time, the review highlights several challenges that require careful consideration. Concerns relating to technological dependence, academic integrity, data privacy, algorithmic bias, and reward dependency suggest that the benefits of these technologies are not automatic. The review also identifies significant variation in how learning autonomy is conceptualised and measured, indicating a need for stronger theoretical and methodological consistency within the field.

Importantly, the review suggests that generative AI and gamification should not be viewed as isolated educational innovations. Their greatest potential may lie in their combined application, where personalised AI-driven support is complemented by motivational and engagement-enhancing design elements. Such integration has the potential to create learning environments that support both the cognitive and motivational dimensions of autonomous learning.

Overall, the evidence indicates that personalised generative AI and gamification can play a meaningful role in supporting learning autonomy in higher education when implemented within theory-driven and context-sensitive pedagogical frameworks. As higher education continues to adapt to technological change, the challenge for educators, institutions, and researchers will be to ensure that these innovations enhance rather than diminish learners' capacity for independent, reflective, and lifelong learning. Future developments should

therefore prioritise learner agency, educational quality, and responsible technology use as central principles guiding the integration of emerging educational technologies.

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