Gamification Technologies in Virtual Learning Environments: Improving Motivation and Knowledge Retention in Online Courses

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ABSTRACT

Gamification is widely used in virtual learning environments, but the evidence base is uneven across outcomes and sometimes merges closely related constructs. Prior reviews often conflate gamification with game based learning and treat motivation and knowledge retention as interchangeable, which limits the practical value of their conclusions for online courses. Within a VLE bounded scope, this integrative review clarifies outcome definitions and compares studies through a structured lens that differentiates mechanism categories, learner characteristics, and contextual fit, while also tracking novelty effects. Building on this organization, the synthesis indicates more consistent patterns for motivation than for knowledge retention. By contrast, retention findings show more mixed and fragile support, suggesting that some retention claims require tighter interpretation and greater caution in the evaluated settings. Overall, the contribution is a disciplined evidence map that separates stronger, mixed, and weak zones and translates them into bounded design implications for online course design. These findings situate guidance for instructional designers and virtual learning environment practitioners working in online course settings.

Graphical abstract

INTRODUCTION

Virtual learning environments (VLEs), commonly delivered through learning management systems, now mediate a large share of participation in online courses. In this context, gamification refers to adding game-like design elements, such as points, badges, or progress feedback, to non-game learning activities. Interest in these designs has grown with wider digital transformation in online and blended education,[1] and recent syntheses indicate substantial momentum across the research landscape.[2]

However, this growth in volume has not yielded equally strong evidence across outcomes. Many studies focus on participation and self-reported engagement, while fewer clarify whether gamification influences motivation as a sustained driver of learning
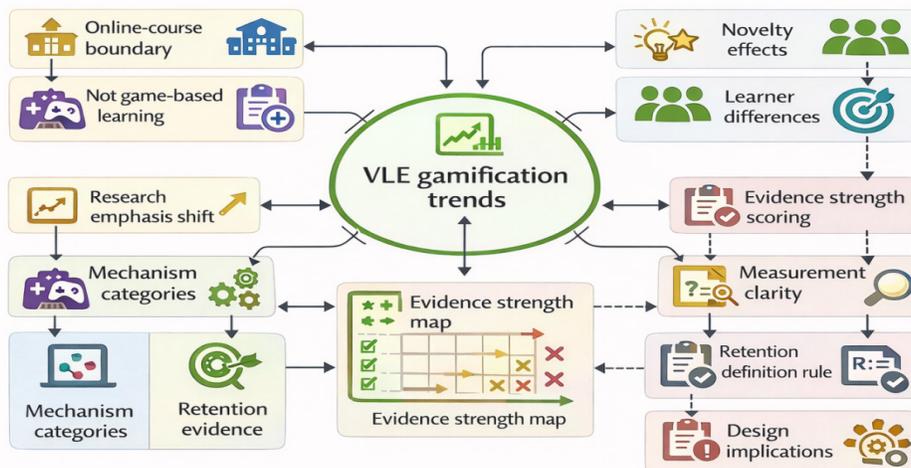
Fig. 1: VLE gamification evidence and claim trends

or improves knowledge retention beyond short-term changes in performance. A VLE-specific, outcome-specific synthesis is therefore needed to differentiate consistent patterns from context-bound or novelty-driven effects and, by contrast, to avoid treating game-based learning and gamification as interchangeable. Recent emphases in claims and outcome focus that motivate this review are summarized in Fig. (1).

Accordingly, this review adopts an evidence-led stance that compares mechanisms, learner and course-context moderators, and outcome definitions before drawing design implications. Motivation and knowledge retention are treated as distinct targets, and retention claims are interpreted conservatively when they depend on immediate post-activity scores rather than more durable demonstrations of learning. This outcome discipline keeps the review focused on sustained learning processes and self-regulation in digital learning settings.[3]

REVIEW SCOPE AND CONCEPTUAL BOUNDARIES

Evidence in this review is limited to gamification technologies in virtual learning environments for online courses, as context conditions how design inputs elicit learner processes and outcomes.[4, 5] Gamification is defined as features added to instruction, differentiated from instructional games and game-based learning in an input-process-output framing.[5] Motivation and knowledge retention are synthesized separately to limit inflated learning claims.[4] Boundaries are listed in Tab. (1).

Inclusion boundaries for VLE and on-line-course evidence

For this review, an online-course VLE context is defined as instruction delivered primarily through a virtual learning environment, typically a learning management system, in which course activities, assessment, and feedback are organized within a single course offering. Studies are included when gamification is implemented within that course space and evaluated during routine online-course participation.

Highly immersive virtual environments are treated as adjacent rather than default VLE evidence because they change the learning setting and interaction model, which reduces comparability with common course VLE designs.[6] By contrast, studies centred on VR classrooms are kept outside the core corpus when the main delivery setting is not a course VLE, to avoid scope drift and to keep conclusions tied to online-course practice.[7]

Conceptual distinctions and outcome definitions

In this review, gamification is defined as the addition of game design elements (e.g., points, badges, levels, and feedback loops) to a non-game online course delivered via a virtual learning environment (VLE), rather than converting the course into a complete game. By contrast, game-based learning uses a game as the primary learning activity and vehicle for content. This distinction is relevant because gamification and game-based learning organize feedback, challenge, and learner activity in different ways.[8]

Table 1: Inclusion boundaries and key definitions

Item	What Counts Here	What Is Not Included	Why It Matters
Gamification	Gamification technologies used in virtual learning environments (VLE) for online courses	Serious-game literature as the main evidence base; game-based learning (kept separate)	Prevents mixing different approaches and keeps comparisons fair
Learning Setting	Online-course settings in VLE (including LMS)	Broad education gamification coverage with no online focus	Keeps the review specific to virtual learning environments
Motivation Outcome	Motivation (treated as its own outcome domain)	Mixing motivation with retention as a single outcome	Supports clear synthesis of stronger vs weaker evidence patterns
Knowledge Retention Outcome	Knowledge retention (treated separately; interpreted cautiously)	Unsupported claims of durable learning improvement	Avoids overstating learning benefits when retention evidence is weaker

Motivation is defined as learners' willingness to begin, persist with, and self-regulate coursework, and is typically operationalized using engagement indicators, goal orientation, or self-report scales. Knowledge retention refers to delayed recall or transfer, not only immediate quiz performance at the end of an activity. Enjoyment may encourage persistence, however it should not be taken as evidence of learning, aligning with experience-quality heuristics that distinguish pleasure from mastery.[9]

ORGANIZING LENS FOR THE LITERATURE

This review groups studies by gamification mechanism, online course context, and outcome (motivation or knowledge retention). The map (2) clarifies where outcomes are stable and where uncertainty remains. Evidence strength is a weighted sum of consistency, context fit, and outcome clarity in Eq. (1).

$$E_{strength} = w_C\,C + w_F\,F + w_O\,O \tag{1}$$

Weights sum to one for comparability in Eq. (2).

$$w_C + w_F + w_O = 1 \tag{2}$$

The score enables consistent cross-study synthesis.

Mechanism groupings used in this review

To differentiate gamification from reward-only schemes, this review groups mechanisms in virtual learning environments (VLEs) by the activity format they impose and by the gaming world type they suggest. Fig. (3) situates these groupings relative to motivation, while the links to retention remain more tentative.

Activity-format mechanisms include escape room and board-style designs described in higher education, where course tasks are embedded in a rule-guided challenge.[10] By contrast, broader immersive course designs are treated as an adjacent family in online learning.[11] Labels are kept consistent so specific formats can be interpreted alongside broader immersive patterns.[10, 11]

Learner and context moderators

Across comparisons of gamification effects in virtual learning environments (VLEs), the review differentiates learner differences as moderators rather than treating them as noise. Baseline motivation, prior knowledge, digital access, and novelty sensitivity are highlighted as key moderators that can shift engagement and measured learning outcomes, helping to account for variability across settings.
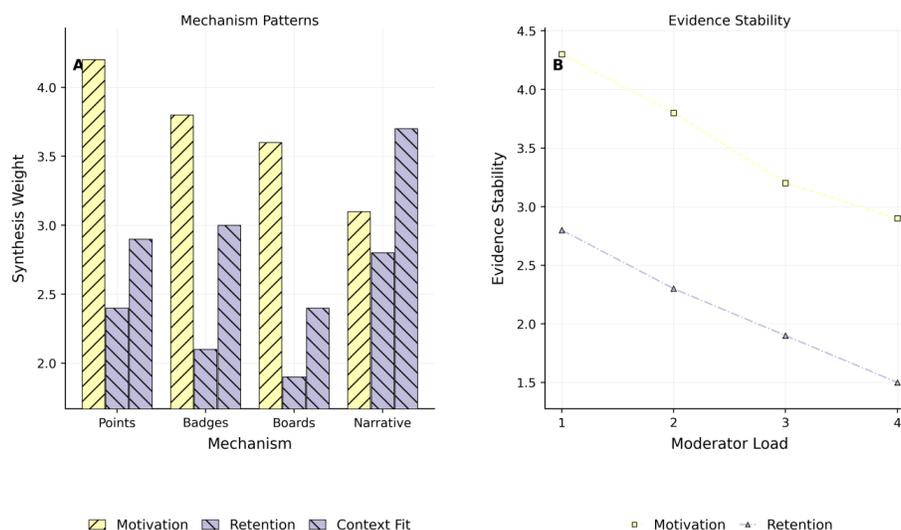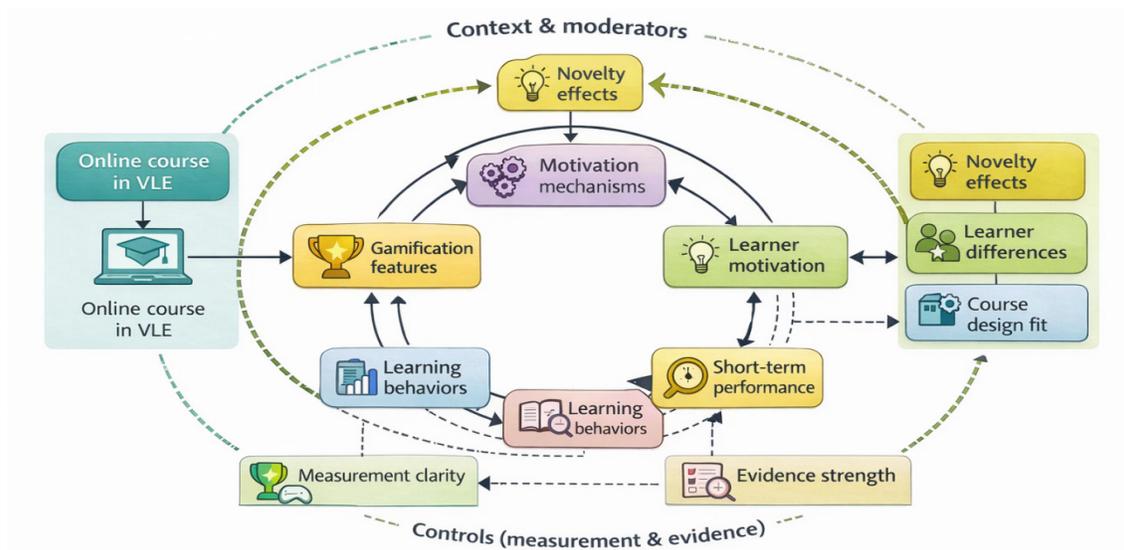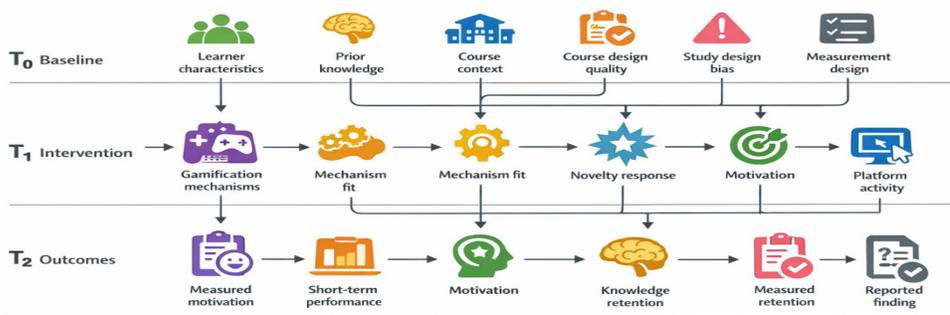
Gamification Review Map

Fig. 2: Gamification Review Map

Fig. 3: Mechanism to outcome pathway

Fig. 4: Moderator structure for mixed findings

Course context is situated as a conditioning layer that shapes both implementation quality and how outcomes should be interpreted, with particular attention to socio-economic and institutional constraints in reform settings[12] and to inclusive-education requirements alongside available support capacity.[13] A causal moderator structure in Fig. (4). clarifies potential confounding paths linking context, uptake, and outcomes.

Interpreting evidence strength and retention rigor

Evidence strength is scored against criteria for consistency, fit to the virtual-learning context, and outcome clarity, and the rubric explicitly differentiates short-term performance change

from more durable retention (Tab. (2)). Fig. (5) summarizes the scoring scheme and the retention logic. Motivation evidence is interpreted in relation to prior experimental syntheses,[14] while recruitment or sampling constraints are recorded as limits on comparability.[15] When reported, study differences may be expressed as a standardized mean difference, Eq. (3).

$$d = \frac{\mu_{gam} - \mu_{ctrl}}{\sqrt{(\sigma_{gam}^2 + \sigma_{ctrl}^2)/2}} \qquad (3)$$

THEMATIC SYNTHESIS OF MOTIVATION FINDINGS

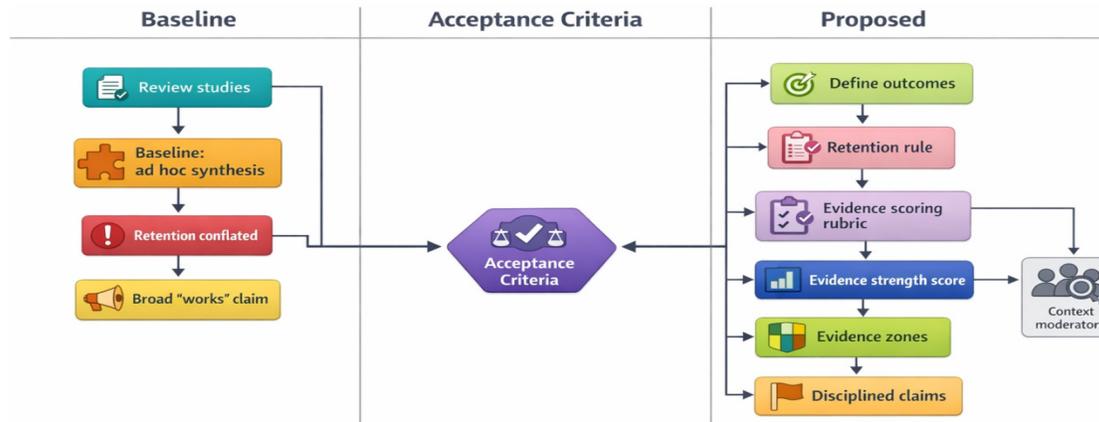Across online courses delivered in virtual learning environments (VLEs), the literature most often links

Fig. 5: Evidence scoring and retention rule

Table 2: Evidence strength scoring rubric

Criterion	Higher Strength When	Lower Strength When
Consistency	Recurring patterns across the literature (not a simple list of positive studies)	Mixed cases or uneven patterns across studies
Context Fit	Evidence is clearly tied to virtual learning environments and online-course settings	Evidence is broad education gamification with no clear online-course focus
Outcome Clarity	Motivation and knowledge retention are treated as separate outcomes, with clear outcome grouping	Motivation and retention are loosely mixed under general learning outcomes or engagement
Retention Interpretation	Claims stay careful and limited; retention is handled separately and cautiously	Retention claims overstate durable learning improvement or treat short-term performance change as retention

gamification features to motivation-related outcomes such as participation, persistence, and perceived value, but effects vary. Patterns are more consistent when mechanics align with course goals and feedback is timely. By contrast, motivation benefits become conditional with heterogeneous learners, novelty effects, or weak integration into assessment. Overall, the evidence treats motivation gains as plausible yet context-dependent rather than guaranteed.

Recurring motivation benefits

Across virtual learning environments (VLEs) used for online courses, the literature reviewed most consistently links gamification to **more consistent motivation effects** than to knowledge-retention outcomes. Reported benefits typically involve heightened initial interest and a greater willingness to continue with course activities, particularly when game-like features are tied to clear goals and timely feedback. However, mixed responses are also common, which clarifies that motivational gains are not uniform across settings or learners.

To keep the synthesis selective, evidence is grouped by mechanism, platform context, learner differences, and novelty effects, as summarized in Tab. (3). Taken together, this organization differentiates two regularities: mechanisms vary in how reliably they support motivation, and some apparent improvements fade when they are driven mainly by novelty rather than sustained instructional value. Overall, motivation benefits are interpreted as context dependent and contingent on alignment between the gamified signals and the course learning structure.

Table 3: Motivation evidence by mechanism and context

Grouping Item	What Gets Grouped	Why It Matters For Motivation
Gamification Mechanisms	Evidence grouped by gamification mechanisms (mechanism-level differences)	Shows which mechanisms have more consistent motivation effects
Online-Course Context	Evidence limited to virtual learning environments and online-course settings	Avoids overgeneralizing beyond the learning platform and course context
Learner Differences	Evidence compared across learner characteristics (learner heterogeneity)	Highlights when the same mechanism motivates some learners but not others
Novelty Effects	Evidence checked for short-lived versus sustained motivation patterns	Helps separate initial interest from longer-term motivational support

Mixed, null, and adverse motivation outcomes

Across VLE gamification interventions, motivation does not consistently increase, and several one-group pre-post implementations document mixed, null, or even adverse shifts on motivation measures [16]. Rather than treating these outcomes as noise, a conservative reading views them as informative, because they can be consistent with ceiling effects, novelty fading, or mismatches between specific features and the motivation measures used within a given course context.

Motivational effects also differ across settings: mechanisms that appear promising in controlled studies can, however, weaken in authentic online courses, where time pressure, social comparison, or delayed feedback alters how rewards and progress cues are interpreted.[17] Taken together, the evidence supports a cautious synthesis in which motivation is context-dependent, with learner heterogeneity and design fit differentiating when gamification supports sustained effort versus when it risks undermining it .[16, 17]

Moderators and boundary conditions for motivation effects

Motivation gains from gamification in virtual learning environments may reflect novelty effects, where a new feature briefly boosts attention and effort before learners adapt. Early measurement can therefore overstate lasting change. By contrast, longer courses may show fading or stabilization. Across-study comparison is difficult when exposure length and measurement timing differ.

Motivation effects also depend on learner heterogeneity, such as prior interest and self-regulation, which shape whether points, badges, or progress cues feel supportive or controlling. Fit with course design is important because misaligned rewards can divert attention from learning goals and lower perceived autonomy.

THEMATIC SYNTHESIS OF KNOWLEDGE-RETENTION FINDINGS

Retention findings in virtual learning environments appear less consistent than motivation effects, largely because retention is often assessed indirectly. Many studies rely on end-of-unit quiz scores or short delays, which primarily reflect immediate performance rather than durable knowledge retention. Stronger evidence typically requires delayed follow-up assessments with comparable content, alongside controls for extra practice, grading incentives, and selective dropout. Where these design elements are missing, gamification is better interpreted as supporting engagement conditions, not as demonstrating lasting learning gains.

What retention means in the reviewed literature

In the reviewed online course studies, knowledge retention is defined as learning that endures beyond the end of instruction rather than as high immediate quiz scores or high platform activity [18]. This distinction clarifies the operational definition: performance measured immediately after learning is compared with performance measured after a delay, and retention is quantified as delayed minus immediate performance, Eq. (4).

$$\Delta_{ret} = S_{delayed} - S_{immediate} \tag{4}$$

However, delayed tests may still be influenced by noise or test familiarity, so retention claims are interpreted conservatively and differentiated from engagement proxies such as logins, time on task, or badge collection [18]. Accordingly, a study is taken to support a retention claim only when the delayed-minus-immediate change exceeds a minimum meaningful amount, Eq. (5).

$$c_{ret} = 1[\Delta_{ret} \geq \delta] \qquad (5)$$

Evidence patterns and where support is weakest

In online courses, retention outcomes are frequently reported together with motivation or engagement measures, making it difficult to differentiate durable learning from short-lived performance shifts linked to gamification. Within the evaluated setting, stronger retention evidence depends on defining retention explicitly, using a delayed test, and keeping it separate from motivational measures, otherwise benefits may reflect immediate enthusiasm or participation effects.

Across proposed mechanisms, interpretation becomes less reliable when gamification is assessed only as an undifferentiated bundle or when course-design details are too sparse to judge mechanism fit. Evidence is also less convincing when results from non-online settings are generalized to virtual learning environments (VLEs), or when studies do not test novelty effects and learner heterogeneity, because early improvements may fade and subgroup responses may offset each other. These weak points are summarized in Tab. (4).

Common threats to retention inference

Retention is frequently defined inconsistently and assessed only immediately after instruction, with delayed follow-up often missing. In this setting, short-term performance gains can be mistaken for retention.[19] Estimates are also vulnerable to novelty effects, differential dropout, and sparse reporting of prior knowledge or the conditions used for comparison .[19] Taken together, this literature does not support strong claims about lasting knowledge retention or far transfer.[19]

CROSS-CUTTING INTERPRETATION AND DESIGN IMPLICATIONS

In virtual learning environments, the literature indicates that motivation gains are reported more consistently than durable knowledge retention. By contrast, this pattern clarifies why motivation and retention should be treated as distinct outcomes in design decisions. Evidence zones are summarized in Tab. (5). Outcome contrasts are visualized in Fig. (6).

Table 4: Retention evidence strength by mechanism

| What Is Being Compared	What Counts As Stronger Retention Evidence	Why Evidence Often Looks Weaker
Retention Outcome Definition	Retention treated separately from motivation; durable knowledge retention, not short-term performance change	Retention claims can be overstated when studies mix retention with engagement or motivation outcomes
Mechanism-Level Differences	Evidence judged by whether retention patterns differ across gamification mechanisms (mechanism fit)	Mechanisms may show different effects depending on online course design and learning context
Context Fit In Online Courses	Evidence judged within VLE and online-course settings (not broad education settings)	Findings may not transfer when context shifts away from online-course VLE conditions
Novelty And Learner Differences	Evidence judged with attention to novelty effects and learner heterogeneity	Initial gains may fade over time; effects can vary across learner characteristics, creating mixed retention patterns
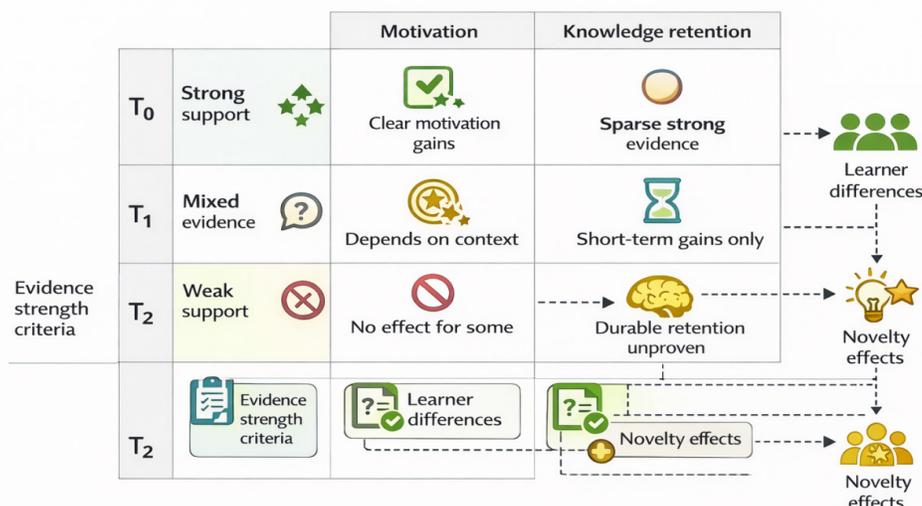
Fig. 6: Evidence map across motivation and retention

Table 5: Evidence zones across outcomes and contexts

Evidence Focus	Where It Applies	Evidence Zone	Main Caution
Motivation effects	Gamification in virtual learning environments (online courses)	Stronger zone	Avoid promotional language; do not treat engagement as proof of learning
Knowledge retention effects	Gamification in virtual learning environments (online courses)	Weaker zone	Retention claims should be careful and limited; separate motivation from retention outcomes
Novelty effects	Early exposure to gamified online-course designs	Mixed zone	Short-term boosts can fade; do not imply durable improvement from short-term change
Learner heterogeneity and context fit	Different learner characteristics and online-course designs	Mixed zone	No one-size-fits-all design; mechanism fit and context dependence can drive uneven results

Taken together, these findings suggest that near-term gamification tools should be paired with careful measurement, and broader improvement claims should be kept cautious.[20, 21]

Mechanism fit with course design and learner needs

In a virtual learning environment, mechanism choice should be a design decision tied to course learning goals and assessment, not an add-on presumed to help across settings. Because gamification mechanisms emphasize different behaviors, the elements chosen should match the intended change (participation, persistence, or practice) and connect to existing instructional supports.

This clarifies why fit also depends on learner profiles. Differences in prior knowledge, self-regulation, and comfort with competition or visibility can make the same design motivating for some learners and, by contrast, discouraging for others, and novelty effects may fade. Course teams should offer options, track learner responses during delivery,

Table 6: Design lessons and claim limits

Design Focus	Design Lesson	Claim Limit
Outcome Target	Treat motivation and knowledge retention as separate outcomes in both design and interpretation	Avoid phrasing that implies motivation gains automatically produce durable knowledge retention
Retention Meaning	Use a strict interpretation of retention that separates short-term performance change from more durable knowledge retention	Do not present short-term learning outcomes as proof of knowledge retention
Mechanism Fit	Compare gamification mechanisms at the mechanism level rather than treating gamification as one uniform approach	Avoid one-size-fits-all claims about effectiveness across different mechanisms
Learner Differences	Account for learner heterogeneity and other moderators when summarizing what appears to work in online courses	Avoid generalizing effects as universal across learners
Context Boundaries	Keep conclusions tied to VLE and online-course settings, and keep gamification distinct from game-based learning	Avoid extending claims to broad education settings or to serious-game evidence

and calibrate the intensity and timing of game elements so that motivation support does not become a substitute claim for knowledge retention.

Claim limits and practical guidance for VLE practitioners

Tab. (6) summarizes practical guidance and the limits of the claims. For VLE-based online courses, analyses should differentiate motivation from knowledge retention and report these outcomes separately. Retention, in particular, should be interpreted narrowly by contrasting short-term performance gains with more durable retention. Evidence is best elaborated at the level of mechanisms and situated with respect to learner differences and other moderators. Overall, conclusions should be bounded to VLE settings and should differentiate gamification from game-based learning and serious games.

Conclusion

Evidence from VLE-based online course studies indicates that gamification most reliably supports motivation, including participation and persistence, when its elements match course goals, feedback is timely, and learner differences and novelty effects are anticipated. However, the same evidence clarifies recurrent failure regimes: outcomes are mixed when design fit is weak or when competitive mechanics undermine autonomy. Knowledge retention claims also need tighter definitions: retention should denote learning that persists beyond immediate post-activity scores and be supported by delayed, comparable assessments that control for extra practice. Overall, gamification is best situated as targeted motivation support rather than a guarantee of durable learning.

References

1. A. A. Shahroom and N. Hussin, "Industrial revolution 4.0 and education," International Journal of Academic Research in Business and Social Sciences, vol. 8, no. 9, Oct. 2018, doi: 10.6007/ijarbss/v8-i9/4593.

2. Kalimuthu, H. (2025). Gamification Technologies in Virtual Learning Environments: A Review of Motivation and Knowledge Retention in Online Courses. International Journal on Research and Development - A Management Review, 14(1), 426–438.

3. J. Voogt, O. Erstad, C. Dede, and P. Mishra, "Challenges to learning and schooling in the digital networked world of the 21st century," Journal of Computer Assisted Learning, vol. 29, no. 5, pp. 403–413, Sept. 2013, doi: 10.1111/jcal.12029.

4. S. A. Barab and K. Squire, "Design-based research: Putting a stake in the ground," Journal of the Learning Sciences, vol. 13, no. 1, pp. 1–14, Jan. 2004, doi: 10.1207/s15327809jls1301_1.

5. R. Garris, R. H. Ahlers, and J. E. Driskell, "Games, motivation, and learning: A research and practice model," Simulation & Gaming, vol. 33, no. 4, pp. 441–467, Dec. 2002, doi: 10.1177/1046878102238607.

6. Heshmati, D. (2025). Enhancing Student Motivation in Online Courses through Gamification: A Comprehensive Review. International Journal on Advanced Computer Engineering and Communication Technology, 14(1), 817–827.

7. A. Marougkas, C. Troussas, A. Krouska, and C. Sgouropoulou, "How personalized and effective is immersive virtual reality in education? A systematic literature review for the last decade," Multimedia Tools and Applications, vol. 83, no. 6, pp. 18185–18233, July 2023, doi: 10.1007/s11042-023-15986-7.

8. Wijesekara, I. (2025). Learning Analytics and Predictive Modelling in E-Learning Platforms: A Review for Early Identification of At-Risk Students. International Journal on Advanced Computer Engineering and Communication Technology, 14(1), 828–839.

9. P. Sweetser and P. Wyeth, "GameFlow," Computers in entertainment, vol. 3, no. 3, pp. 3–3, July 2005, doi: 10.1145/1077246.1077253.

10. Dinkar, S., Jayapriya, K., Pallerla, N., Jadhav, K. D., & Shet, A. R. (2025). Convolutional neural networks for the intelligent and automated detection of mango leaf disease to enhance crop health management. *Agricultural Science Digest, 45*(6), 1004–1010. https://doi.org/10.18805/ag. DF-717.

11. S. Park and S. Kim, "Identifying world types to deliver gameful experiences for sustainable learning in the metaverse," Sustainability, vol. 14, no. 3, pp. 1361–1361, Jan. 2022, doi: 10.3390/su14031361.

12. R. S. Malik, "Educational Challenges In 21st Century and Sustainable Development," Journal of Sustainable Development Education and Research, vol. 2, no. 1, pp. 9–9, May 2018, doi: 10.17509/jsder.v2i1.12266.

13. X. Rosero and E. Inga, "Transforming inclusive education through gamification and active learning strategies," Information, vol. 16, no. 9, pp. 753–753, Aug. 2025, doi: 10.3390/info16090753.

14. Sule, B., & Oruganti, S. K. (2026). EdTech-Microfinance Integration: Designing Intelligent Learning Systems to Enhance Credit Discipline and Enterprise Growth. Enterprise Development and Microfinance, 35(2), 368–389. https://doi.org/10.3362/edm.v35i2.579

15. B. Greiner, "Subject pool recruitment procedures: Organizing experiments with ORSEE," Journal of the Economic Science Association, vol. 1, no. 1, pp. 114–125, May 2015, doi: 10.1007/s40881-015-0004-4.

16. Sule, B., & Oruganti, S. K. (2026). EdTech-Microfinance Integration: Designing Intelligent Learning Systems to Enhance Credit Discipline and Enterprise Growth. Enterprise Development and Microfinance, 35(2), 368–389. https://doi.org/10.3362/edm.v35i2.579

17. Jadhav, K. D., Narayana, A., Chaudhari, L. B., Monisha J., Ambhore, V., & Shelke, G. C. (2026). AI-GENERATED LEARNING RESOURCES FOR CREATIVE FIELDS. *ShodhKosh: Journal of Visual and Performing Arts*, *7*(1s), 147–157. https://doi.org/10.29121/shodhkosh.v7.i1s.2025.7080

18. J. Dunlosky, K. A. Rawson, E. J. Marsh, M. J. Nathan, and D. T. Willingham, "Improving students' learning with effective learning techniques," Gothic.net, vol. 14, no. 1, pp. 4-58, Jan. 2013, doi: 10.1177/1529100612453266.

19. Geetha, K., & Deepika, J. (2025). AI-Driven Environmental Alert and Risk Communication System for Rural Communities. *Journal of Intelligent Assistive Communication Technologies*, 82-88.

20. M. A. Chaudhry and E. Kazim, "Artificial intelligence in education (AIEd): A high-level academic and industry note 2021," AI and Ethics, vol. 2, no. 1, pp. 157–165, July 2021, doi: 10.1007/s43681-021-00074-z.

21. Punam, S. R., & Patel, P. (2025). Cognitive and Neural Optimization Frameworks for Process-Based Environmental Modelling: Enhancing HYDRUS-1D Simulation Accuracy Using Adaptive Learning Algorithms. *Advances in Cognitive and Neural Studies*, *1*(2), 1-8.