

The Role of Feedback and Progress Tracking in Gamified Learning: A Review of Their Effects on Student Engagement and Learning

Prof. Prasad Muhamuni¹, Yogita Kulkarni², Anushka Patare³, Vaishnavi Khedekar⁴, and Shrutika Jasuad⁵

ASM's Institute of Business Management & Research, Pune, Maharashtra, India

Abstract— Digital gamified learning environments increasingly use feedback and progress-tracking features to make learners' performance visible and to encourage continued participation. Unlike rewards or leaderboards, feedback and progress indicators can directly communicate what a learner has done, where improvement is needed, and how far the learner has moved toward a learning goal. This review examines immediate feedback, corrective feedback, performance information, progress bars, progress dashboards, and related visual indicators in gamified learning. The literature was reviewed with attention to student engagement, motivation, and learning performance. Existing studies indicate that feedback and progress displays can support behavioral, emotional, and cognitive engagement by providing timely information and making learning goals more visible. However, increased participation or enjoyment does not necessarily translate into better retention or academic achievement. Effectiveness depends on the timing, specificity, quality, and purpose of feedback, as well as the design of progress information. Recent evidence also indicates that points and progress bars may improve perceived competence, enjoyment, task value, and goal-setting without producing measurable gains in later recall. The review identifies gaps concerning long-term effects, school-level STEM learning, personalized feedback, comparison of different progress representations, and separation of feedback effects from other gamification mechanisms. It concludes that feedback and progress tracking are most useful when they support reflection, correction, mastery, and meaningful learning goals rather than merely encouraging continued interaction.

Keywords— feedback, progress tracking, gamification, digital learning, progress bars, student engagement, student motivation, learning outcomes, formative assessment.

I. INTRODUCTION

Digital learning has changed how students receive information about their performance. In a traditional classroom, feedback may be provided after an assignment, test, or teacher interaction. Digital learning platforms can instead provide information immediately after an action, such as answering a question, completing a task, or reaching a learning milestone. Gamification adds game design elements to non-game contexts, and feedback and progress indicators are among the elements frequently incorporated into gamified educational environments [1], [2]. Feedback is important because it can help learners understand whether an action is correct, identify errors, and decide what to do next. Progress tracking serves a related but different function: it gives learners a visible representation of movement toward a goal. A progress bar, completion percentage, achievement history, or performance dashboard can make otherwise invisible learning progress more concrete. A 2024 systematic review

of tailored digital gamification identified progress and feedback as recurring performance-oriented game elements and reported that instant responses to learner actions were widely needed in tailored systems [3]. The broader gamification literature generally reports positive possibilities for motivation and engagement, but findings are heterogeneous. Zainuddin et al. [4] identified positive themes involving engagement, motivation, academic achievement, and social interaction, while also noting methodological and theoretical limitations. Sailer et al. [5] showed that different game elements can produce different motivational outcomes rather than gamification being uniformly effective. These findings suggest that individual design mechanisms should be examined instead of treating all gamification features as one intervention. Feedback and progress tracking are therefore important to study separately. A learner may enjoy seeing a progress bar without learning more, while detailed corrective feedback may improve understanding even when it has little effect on visible participation. Recent experimental evidence illustrates this distinction: points and progress bars increased self-reported competence, enjoyment, task value, and goal-setting in adaptive retrieval practice, but did not improve later recall [6]. This distinction between engagement and learning is central to the present review. This paper reviews literature on feedback and progress tracking in gamified learning environments. It examines how these features are designed, how they influence student engagement and motivation, and what evidence exists for their effect on learning outcomes. The review also identifies limitations and research gaps relevant to digital quiz-based learning, particularly in school and STEM contexts.

II. REVIEW OBJECTIVES AND RESEARCH QUESTIONS

The main objective of this review is to synthesize literature on feedback and progress-tracking mechanisms in gamified learning and to distinguish their effects on engagement from their effects on actual learning.

- RQ1: What forms of feedback and progress tracking are commonly used in gamified learning environments?
- RQ2: How do feedback and progress indicators influence student engagement and motivation?
- RQ3: What evidence exists that these mechanisms improve learning performance, retention, or academic achievement?
- RQ4: What design limitations and research gaps remain in the use of feedback and progress tracking for education?

III. REVIEW METHODOLOGY

This paper uses a structured narrative review approach supported by peer-reviewed systematic reviews, meta-analyses, experimental or quasi-experimental studies, and empirical studies. The literature search focused on gamification in education, feedback, progress indicators, progress bars, student engagement, motivation, and learning outcomes. Academic sources considered included ScienceDirect, SpringerLink, Frontiers, PubMed/PMC, and publisher or institutional records for individual studies. Search terms included combinations of “gamification AND feedback AND learning,” “gamification AND progress bar,” “gamified feedback AND student engagement,” “progress tracking AND education,” “instant feedback AND gamified learning,” and “gamification AND learning outcomes.”

The review emphasized studies that explicitly reported outcomes related to feedback, progress tracking, engagement, motivation, or learning. Studies focused exclusively on entertainment games without an educational learning component were not treated as central evidence. The selected literature was organized into four themes: (1) forms and functions of feedback, (2) progress visibility and self-monitoring, (3) effects on engagement and motivation, and (4) effects on learning outcomes. Because the literature varies in learner age, subject, platform, and intervention design, the review uses comparative synthesis rather than a pooled statistical effect estimate.

A limitation of this approach is that it is a structured narrative review rather than a full systematic review with a registered protocol and formal risk-of-bias scoring. Therefore, the paper does not claim to represent every publication on the topic. Instead, it synthesizes representative and directly relevant evidence and uses that evidence to identify patterns and research gaps

IV. FEEDBACK IN GAMIFIED LEARNING

Feedback in digital learning can take several forms. Correctness feedback indicates whether an answer is right or wrong. Corrective feedback can additionally explain the error or provide a hint. Performance feedback reports scores, accuracy, or completion information, while attributional or process-oriented feedback can focus on strategies and controllable aspects of performance. These forms should not be treated as equivalent because they can support different learning processes.

Ding et al. [7] found that a gamified online discussion environment influenced behavioral, emotional, and cognitive engagement, with elements including progress bars contributing to the observed engagement. Their later exploratory study reported positive effects on engagement but also highlighted the influence of badge design, peer behavior, technical factors, and workload [8]. These findings suggest that feedback-like information is embedded in a larger social and technical environment.

He et al. [9] specifically investigated an instant feedback system in gamification learning and reported improvements in course interest and academic achievement across two student classes. While such findings support the educational value of timely responses, feedback should not automatically be interpreted as the cause of every improvement in a gamified system. Other elements, instructional activities, and repeated practice may contribute to the outcome.

More recent research on automated feedback also emphasizes that feedback effectiveness is a process involving the learner's response to information, not simply the delivery of a message. Schiller et al. [10] describe feedback effectiveness from a learner-centered perspective in which behavioral engagement with feedback is important. This is particularly relevant to gamified systems: giving feedback is not enough if learners do not read, understand, or use it to change subsequent behavior

V. PROGRESS TRACKING AND VISIBILITY OF LEARNING

Progress tracking provides learners with a representation of how much of a task, course, or learning pathway has been completed. Common forms include progress bars, completion percentages, levels, performance histories,

achievement maps, and dashboards. Unlike a single feedback message, progress tracking is cumulative: it helps learners interpret their position over time.

The systematic review by Hong et al. [3] identified progress as one of the most frequently used performance elements in tailored digital gamification. The review described progress as a mechanism that allows learners to locate themselves and observe growth or improvement during a gamified process. The authors also found that instant responses to student actions were important across tailored gamification approaches. This combination of immediate feedback and visible progress can create a continuous information loop between learner action and learning goal.

Ding et al. [7] reported that progress bars were among the elements associated with engagement in gamified online discussions. Progress displays may also support goal-setting because students can see how far they are from completion. However, a progress bar is not automatically a learning tool. If progress represents only the number of completed activities, it can measure activity rather than mastery. For this reason, progress tracking should ideally include learning-relevant indicators such as mastery, accuracy, improvement, or completed competencies rather than only the number of screens or quizzes finished.

The distinction becomes especially important in quiz-based applications. A student who completes ten quizzes may appear highly active, but activity alone cannot establish that the student understood the concepts. A well-designed progress dashboard can instead combine completion with accuracy, topic mastery, attempts, improvement, and feedback history. Such a design makes progress more meaningful and supports interpretation of learning rather than simple task completion.

VI. EFFECTS ON STUDENT ENGAGEMENT

Student engagement is multidimensional and commonly includes behavioral, emotional, and cognitive components. Feedback and progress tracking can influence each dimension through different mechanisms. Immediate responses can keep students aware of task consequences, while progress indicators can maintain attention by making goals and remaining work visible.

Ding et al. [7] found positive influences on behavioral, emotional, and cognitive engagement in a gamified online discussion environment. Their findings provide evidence that gamification can influence more than simple participation. However, the study also illustrates that engagement depends on the surrounding design and the interaction between multiple game elements.

A broader systematic review of gamification in higher education by Subhash and Cudney [11] reported that gamified learning has been associated with improvements in attitude, engagement, and performance, while identifying points, badges, and leaderboards as commonly used elements. Similarly, Zainuddin et al. [4] identified engagement and motivation as recurring positive outcomes across empirical gamification studies. These broader findings support the relevance of feedback and progress tracking but do not isolate their individual effects.

Evidence from school-focused literature is also important. A 2024 systematic review of gamification and school engagement examined research in primary and secondary education and treated academic, emotional, and

behavioral engagement as related dimensions [12]. This suggests that gamification research should consider the age and educational setting of learners rather than assuming that findings from university students apply directly to younger learners.

VII. EFFECTS ON MOTIVATION

Feedback and progress tracking can influence motivation by supporting perceptions of competence, clarity of goals, and awareness of improvement. Self-Determination Theory provides one useful framework because perceived competence, autonomy, and relatedness can influence the quality of motivation. Sailer et al. [5] demonstrated that specific game elements affect psychological need satisfaction differently, supporting the argument that game elements should be analyzed individually.

Progress information can contribute to competence when learners can see genuine improvement. Feedback can also support competence when it explains errors and gives learners a clear next step. However, feedback that focuses only on ranking or external performance may shift attention away from mastery. Therefore, the motivational value of feedback depends partly on what it communicates: “you are improving,” “this strategy works,” and “here is what to try next” can serve a different purpose from “you earned more points than others.”

Huang and Hew [13] developed and evaluated a theory-driven gamification model in flipped courses. Across two quasi-experimental studies, the gamified condition completed more pre- and post-class activities and produced higher-quality work. Their model incorporated access, feedback, challenge, collaboration, and other motivational considerations. This suggests that feedback is most useful when integrated into a broader instructional design rather than treated as an isolated visual feature.

VIII. EFFECTS ON LEARNING OUTCOMES

Learning outcomes require more careful interpretation than engagement outcomes. A learner may participate more frequently without retaining more information. Sanchez et al. [14] examined gamified online quizzes using features including a progress bar and encouraging messages. Students in the gamified condition showed an initial performance advantage, but the benefit did not persist across later tests, and the authors discussed novelty effects as one possible explanation.

More directly related to feedback and progress tracking, van den Broek et al. [6] studied gamified feedback in adaptive retrieval practice using points and progress bars. The gamified condition improved self-reported competence, enjoyment, task value, and goal-setting, but did not improve learning behavior or later posttest recall. This is important evidence against assuming that stronger motivation automatically produces stronger learning.

Yang and Lu [15] used a two-tier testing approach to detect misconceptions and provide feedback in digital game-based learning. Their mathematics application was designed to identify misconceptions and provide feedback, and the study reported reductions in mathematical anxiety. The study illustrates a stronger form of feedback design: the system attempts to diagnose the learner’s difficulty instead of simply indicating whether an answer is correct.

Schrader and Grassinger [16] also found that attributional feedback from learning technology can influence achievement emotions and performance. Their findings suggest that the framing of feedback matters. Feedback

that supports adaptive interpretations of errors may be more useful than feedback that simply emphasizes performance status. Thus, future gamified learning systems should consider feedback quality, not only feedback frequency.

IX. FEEDBACK, PROGRESS TRACKING AND PERSONALIZATION

Personalization is an emerging direction for feedback and progress tracking. Learners differ in prior knowledge, pace, confidence, and response to challenge. A single feedback message or identical progress representation may therefore be useful for some learners and less useful for others.

Hong et al. [3] reviewed tailored digital gamification and found personalization, adaptation, and recommendation as major approaches. The review identified 23 game elements across the analyzed literature, with progress and feedback forming part of the performance-oriented cluster. The authors emphasized the importance of collecting dynamic learner data and providing responses to learner actions.

Personalized progress tracking could show topic-specific mastery rather than only total completion. For example, a learner using a STEM quiz platform could see separate progress for physics, biology, and mathematics, along with accuracy and improvement. Feedback could then target the weakest topic. This approach may be more educationally meaningful than a single overall percentage.

X. CHALLENGES AND LIMITATIONS

Despite their potential benefits, feedback and progress features have several limitations. First, excessive feedback can overload learners, especially when every action produces a message or visual response.

Second, generic feedback such as “correct” or “incorrect” may not explain the underlying concept or misconception. Third, progress indicators can encourage completion behavior without guaranteeing conceptual understanding.

Another issue is novelty. Sanchez et al. [14] found that an early benefit of gamified quizzes did not persist for later tests. This indicates that a design may attract attention initially but become less influential as students become familiar with it. Long-term evaluation is therefore necessary.

Fairness and interpretation also matter. Progress dashboards may unintentionally expose differences between learners and create pressure if progress is framed as a public comparison.

For younger learners, feedback should be understandable, constructive, and aligned with age-appropriate learning goals. Teachers also need meaningful data rather than large quantities of raw activity information.

Finally, the evidence base contains substantial variation in intervention length, learner population, subjects, platforms, and outcome measures.

Reviews of gamification have noted methodological diversity and the need for stronger theoretical grounding [4], [11]. Therefore, conclusions about feedback and progress should remain specific to the evidence rather than being generalized to all gamified learning environments.

XI. COMPARATIVE SYNTHESIS OF LITERATURE

Study	Scope	Key Finding	Gap / Limitation
Ding et al. [7]	Online discussions	Positive behavioral, emotional and cognitive engagement; progress bars were among the gamified features.	Multiple elements were used, so individual effects were difficult to isolate.
Ding et al. [8]	Undergraduate online course	Positive engagement was reported; design, peer behavior and workload also influenced outcomes.	Exploratory setting and multiple interacting factors.
Huang & Hew [13]	Flipped higher education	Gamification with feedback and challenge increased activity and quality of work.	Higher-education context and multi-element intervention.
Sanchez et al. [14]	University quizzes	Initial performance advantage was observed, but it did not persist in later tests.	Possible novelty effect; progress was combined with other elements.
Yang & Lu [15]	Mathematics learning	Diagnostic feedback supported misconception detection and reduced mathematical anxiety.	Subject-specific implementation.
Hong et al. [3]	43 tailored gamification studies	Progress and feedback were recurring performance-oriented elements.	Many studies remained focused on modeling, preparation or design.
van den Broek et al. [6]	Adaptive retrieval practice	Points and progress bars improved motivation-related perceptions but not later recall.	Specific retrieval-practice context.
Gan & Duan [17]	Chinese university students	Feedback was positively related to engagement, with flow as a mediator.	Survey/PLS-SEM design and higher-education sample.

XII. RESEARCH GAPS

- **Long-term evidence:** Many studies measure immediate engagement or short-term performance, while fewer examine whether benefits remain after novelty declines.
- **Feedback quality:** More research is needed comparing correctness feedback, explanatory feedback, hints, attributional feedback, and adaptive feedback within comparable gamified environments.
- **Progress representation:** Progress bars, percentages, mastery maps, dashboards, and topic-level indicators may have different effects, but direct comparisons remain limited.
- **Learning versus activity:** Future studies should separate quiz completion, time-on-task, and participation from retention, transfer, conceptual understanding, and delayed performance.
- **School and STEM contexts:** The reviewed evidence includes substantial higher-education research. More controlled studies involving school-aged learners and STEM subjects are needed.
- **Personalization:** Feedback and progress displays could be adapted to learner performance, but the conditions under which personalization improves learning require further empirical testing.
- **Isolation of mechanisms:** Many gamification interventions combine points, badges, feedback, progress, challenges, and rankings, making it difficult to determine the independent contribution of feedback or progress tracking.

XIII. FUTURE RESEARCH DIRECTIONS

Future studies should use controlled experiments in which feedback and progress-tracking mechanisms can be isolated while keeping instructional content constant. A useful design would compare a standard quiz interface with versions that provide immediate corrective feedback, progress tracking, or both. Measures should include not only participation and motivation but also immediate learning, delayed retention, and transfer.

Personalized progress dashboards are another promising direction. Instead of reporting only total points, a system could display topic mastery, accuracy trends, repeated errors, and improvement over time. Feedback could then be generated according to the learner's current difficulty. Such systems should be evaluated for both learning effectiveness and usability.

For school-level STEM education, future studies could compare different feedback formats after the same quiz content. For example, students could receive simple correctness feedback, explanatory feedback, or targeted hints, while progress is displayed through a completion bar or topic mastery dashboard. This would provide stronger evidence about which design features support learning rather than merely increasing interaction.

XIV. DISCUSSION

The literature indicates that feedback and progress tracking can play meaningful roles in gamified learning, but their effects should not be interpreted as universally positive or automatically educational. Feedback is most valuable when it gives information that learners can act upon, while progress tracking is most valuable when it represents meaningful movement toward learning goals. Both mechanisms can increase students' awareness of performance and support continued participation.

At the same time, the reviewed studies show a consistent need to distinguish engagement from learning. Ding et al. [7] reported engagement benefits, whereas van den Broek et al. [6] found motivation-related benefits without later recall gains. Sanchez et al. [14] found an initial learning benefit that did not persist. Together, these findings suggest that gamified feedback can change the learning experience without necessarily changing durable knowledge.

The design of feedback also matters. Diagnostic and attributional feedback may help learners understand errors and develop more adaptive responses [15], [16].

In contrast, a simple correctness signal may be useful for immediate orientation but may not explain why an answer is wrong. Similarly, a progress bar can clarify completion but may not reveal whether the learner has mastered the underlying content.

Therefore, a strong gamified learning system should treat feedback and progress as instructional mechanisms rather than decorative game features. The most useful implementation is one in which feedback guides the next learning action and progress communicates meaningful mastery.

This perspective is especially relevant for quiz-based STEM applications, where each answer can generate immediate evidence about understanding and where topic-level progress can help learners identify areas requiring further practice.

XV. CONCLUSION

Feedback and progress tracking are important components of modern gamified learning environments because they make learner performance and progress more visible. The reviewed literature indicates that these features can support engagement, motivation, goal-setting, and perceptions of competence.

However, the evidence for direct learning improvement is more mixed. Some studies report improvements in performance, while others show that motivation and engagement gains do not necessarily produce better delayed recall or sustained achievement.

The main implication is that feedback and progress tracking should be designed around learning goals. Corrective and explanatory feedback can help students understand errors, while meaningful progress indicators can help learners monitor improvement.

Future research should compare feedback types and progress representations directly, examine long-term learning, include school and STEM populations, and investigate personalized designs. Rather than measuring success only through participation or completion, gamified learning research should evaluate whether students understand, retain, and can apply what they have learned.

ACKNOWLEDGMENT

The authors would like to thank the project guide and the MCA Department for their guidance and support in preparing this review paper.

REFERENCES

- [1] S. Deterding, D. Dixon, R. Khaled, and L. Nacke, "From game design elements to gamefulness: Defining gamification," in Proc. 15th International Academic MindTrek Conference, 2011, pp. 9–15, doi: 10.1145/2181037.2181040.
- [2] M. Sailer and L. Homner, "The gamification of learning: A meta-analysis," *Educational Psychology Review*, vol. 32, pp. 77–112, 2020, doi: 10.1007/s10648-019-09498-w.
- [3] Y. Hong, N. Saab, and W. Admiraal, "Approaches and game elements used to tailor digital gamification for learning: A systematic literature review," *Computers & Education*, vol. 212, art. 105000, 2024, doi: 10.1016/j.compedu.2024.105000.
- [4] Z. Zainuddin, S. K. W. Chu, M. Shujahat, and C. J. Perera, "The impact of gamification on learning and instruction: A systematic review of empirical evidence," *Educational Research Review*, vol. 30, art. 100326, 2020, doi: 10.1016/j.edurev.2020.100326.
- [5] M. Sailer, J. U. Hense, S. K. Mayr, and H. Mandl, "How gamification motivates: An experimental study of the effects of specific game design elements on psychological need satisfaction," *Computers in Human Behavior*, vol. 69, pp. 371–380, 2017, doi: 10.1016/j.chb.2016.12.033.
- [6] G. S. E. van den Broek, S. Scholten, B. van Thuil, H. van Rijn, T. van Gog, and M. van der Velde, "Gamified feedback in adaptive retrieval practice: Points and progress-bars enhance motivation but not learning," *Computers in Human Behavior*, vol. 177, art. 108862, 2026, doi: 10.1016/j.chb.2025.108862.
- [7] L. Ding, C. Kim, and M. Orey, "Studies of student engagement in gamified online discussions," *Computers & Education*, vol. 115, pp. 126–142, 2017, doi: 10.1016/j.compedu.2017.06.016.
- [8] L. Ding, E. Er, and M. Orey, "An exploratory study of student engagement in gamified online discussions," *Computers & Education*, vol. 120, pp. 213–226, 2018, doi: 10.1016/j.compedu.2018.02.007.
- [9] J. He, W. Hao, and J.-W. Kim, "The effects of instant feedback system on course interest and academic achievement in gamification learning," in Proc. 2nd Eurasian Conference on Educational Innovation, 2019, pp. 467–470, doi: 10.35745/ecei2019v2.119.
- [10] R. Schiller, J. Fleckenstein, U. Mertens, A. Horbach, and J. Meyer, "Understanding the effectiveness of automated feedback: Using process data to uncover the role of behavioral engagement," *Computers & Education*, vol. 223, art. 105163, 2024, doi: 10.1016/j.compedu.2024.105163.
- [11] S. Subhash and E. A. Cudney, "Gamified learning in higher education: A systematic review of the literature," *Computers in Human Behavior*, vol. 87, pp. 192–206, 2018, doi: 10.1016/j.chb.2018.05.028.
- [12] J. J. Ramírez Ruiz, A. D. Vargas Sanchez, and O. R. Boude Figueredo, "Impact of gamification on school engagement: A systematic review," *Frontiers in Education*, vol. 9, art. 1466926, 2024, doi: 10.3389/educ.2024.1466926.
- [13] B. Huang and K. F. Hew, "Implementing a theory-driven gamification model in higher education flipped courses: Effects on out-of-class activity completion and quality of artifacts," *Computers & Education*, vol. 125, pp. 254–272, 2018, doi: 10.1016/j.compedu.2018.06.018.

- [14] D. R. Sanchez, M. Langer, and R. Kaur, "Gamification in the classroom: Examining the impact of gamified quizzes on student learning," *Computers & Education*, vol. 144, art. 103666, 2020, doi: 10.1016/j.compedu.2019.103666.
- [15] K.-H. Yang and B.-C. Lu, "Towards the successful game-based learning: Detection and feedback to misconceptions is the key," *Computers & Education*, vol. 160, art. 104033, 2021, doi: 10.1016/j.compedu.2020.104033.
- [16] C. Schrader and R. Grassinger, "Tell me that I can do it better. The effect of attributional feedback from a learning technology on achievement emotions and performance and the moderating role of individual adaptive reactions to errors," *Computers & Education*, vol. 161, art. 104028, 2021, doi: 10.1016/j.compedu.2020.104028.
- [17] C. Gan and L. Duan, "The relationship between challenge and feedback mechanisms in gamified learning experiences and learning engagement: The mediating role of flow," *Acta Psychologica*, vol. 267, art. 107054, 2026, doi: 10.1016/j.actpsy.2026.107054.

