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Motivating Learners Through Gamification: Effective Game Elements and Key Factors

Ahmad Nizamuddin Jipli, Ahmad M. S. Elaklouk

Abstract*: Gamification, which incorporates game design principles within non-gaming environments, has garnered widespread interest in bolstering motivation and engagement across various industries and sectors. While gamification has seen extensive adoption and is projected to continue growing, further research is needed to explore its applications in education. This paper aims to investigate the use of gamification in educational contexts through a systematic review approach, identifying practical game elements and factors that contribute to students' motivation and engagement, and providing educators and researchers with guidance on developing impactful educational gamification strategies. Finally, the review identifies gaps and outlines directions for future research in this field, ultimately highlighting various challenges and prospective research avenues within this domain.

Keywords: Gamification, Systematic Literature Review, Education Technology, Motivation, Engagement, Game Design.

I. INTRODUCTION

Gamification motivates and engages users by integrating game elements, namely points, badges, and leaderboards, towards non-gaming contexts[1].Zainuddin et al. [2] Demonstrated that incorporating game-based elements significantly augments student motivation and engagement, improves academic outcomes, fosters interaction and socialization, and aids in the cultivation of autonomous learning capabilities. Gamification has become widely adopted in educational settings to convert traditional learning settings into more interactive and engaging spaces [3]. Tools such as Quizizz [4], Kahoot [5], and Duolingo [6] Exemplify the capabilities of gamified education, providing learners with avenues to accumulate points, badges, and constructive feedback while promoting both competition and cooperative engagement. Although gamification is widely adopted and is expected to grow, further research is needed to explore gamification in education [3]. Balalle posited that further research is needed to investigate the adaptation of educational technology to meet the individual needs of students, thereby enhancing learning outcomes.

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*Correspondence Author(s)
Ahmad Nizamuddin Jipli*, Creative Computing, School of Computing and Informatics, Universiti Teknologi Brunei. Email ID: m20230002@student.utb.edu.bn
Dr. Ahmad M. S. Elaklouk, Assistant Professor, Creative Computing, School of Computing and Informatics, Universiti Teknologi Brunei. Email ID: ahmad.elaklouk@utb.edu.bn

He underscored the necessity of exploring the influence of gamification components such as leaderboards, badges, and rewards on student engagement alongside a deeper inquiry into Augmented Reality (AR), Virtual Reality (VR), and Artificial Intelligence (AI) [7]. Additionally, Lampropoulus & Kinshuk [8] Argued that gamification and virtual reality gain traction in educational settings, so establishing universally recognized standards, guidelines, and dependable assessment tools alongside their contextual validation is essential. On the other hand, Ninaus et al. [9] Discussed that many educational games lack intrinsic integration of learning content with game mechanics, necessitating further investigation to enhance learning outcomes and engagement effectively.

Thus, this paper aims to identify the game elements, design principles, and factors related to students' motivation and engagement, allowing educators and researchers to develop impactful educational gamification strategies. This manuscript is organised into subsequent sections: the methodology underlying the review investigation, followed by the results, discussion, and conclusion.

II. METHODOLOGY

The following Research Question (RQ) formed the foundation for the systematic review conducted and documented in this manuscript:

"What are the key game elements, design principles, and factors that influence students' motivation and engagement, and how can these insights be used to develop effective gamification interventions that sustain student motivation and engagement?"

This review adopted a conventional systematic review approach [10], which involves key steps such as literature search, retrieval, evaluation, extraction, synthesis, and interpretation. Fig. 1 provides a detailed summary of the search and review process.

A. Sources Selection and Procedures

The search utilised four credible databases: ACM, IEEE, SpringerLink, and ScienceDirect. The search process commenced in January 2023. To answer the research questions outlined above, the search query "('Gamification' OR 'Game Elements') AND ('Motivation' OR 'Inspiration) AND (Education ' OR 'Engagement' OR 'Involvement' OR 'Participation')) was utilised on the chosen databases. The search was constricted to publications from 2018 to 2024 to capture the latest developments in design principles (such as Game Elements) and factors related to the student's

motivation and engagement.

Then, the search results were refined to include only journal articles and conference papers. In Table I, the search outcomes are presented.

Table 1: Total Number of Papers Identified Through the Search

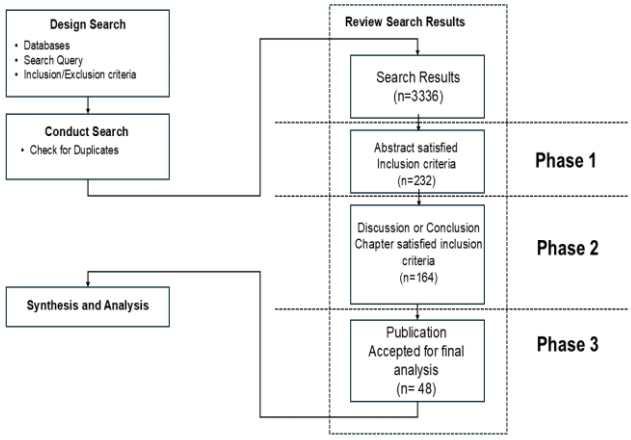
Database	Number of Publications in Search
ACM	1394
IEEE	217
Springer Link	867
Science Direct	858
Total	3336

B. Selection and Review Process

The publications from the search were evaluated according to the following inclusion criteria:

- Gamification model, design guidelines, and framework to create gamification interventions.
- Studies focused primarily on factors and game elements related to students' motivation and engagement.
- The published papers were classified under a gamified educational context.
- Released within the past 6 years (2018-2024).
- English as the composed Language.

Fig. 1. illustrates the three-phase review process applied to the search results: (1) initial screening of titles and abstracts, (2) assessment of discussion and conclusion sections, and (3) full paper detailed review. A total of 232 publications were examined in Phase 1, while Phase 2 involved a further review of 164 publications. In the final phase, 48 publications that fully met the inclusion criteria were selected for the analysis phase.



[Fig.1: Review Process]

III. RESULTS AND DISCUSSION

Based on a literature review analysis of 48 papers, this paper classified game elements and factors related to students' motivation and engagement into three categories: game elements/design, Teaching & Learning (T&L), and Technology, as depicted in Table II.

Table 2: Game Elements and Factors Related to Students' Motivation and Engagement

Category	Game elements and factors	References
Game Elements / Game Design	Challenges, Narrative, Fantasy, Role-Playing, Points, Badges, Progress indicator, Leaderboards /rankings, Medals, Social (Competition, collaboration, recognition), Avatars, Timer, Levels, Feedback, Mission, appealing design, Visual Design	[2],[3],[4],[7],[9],[12], [13],[14],[15],[16],[17], [18],[19],[20],[21],[22], [23],[24],[25],[26],[27], [28],[29],[30],[31],[32], [33],[34],[35],[36],[37]
Teaching & Learning (T&L)	Time (Duration of Gamification Course, Time Limits / Pressure), Progress Tracking/ indicator, Duration of gamified course, Access to the Course/Content, Assessment (Quizzes, assignments)	[2],[5],[6],[38],[39], [40],[41],[42],[43],[44], [45]
Technology-Enhanced Gamification (Hardware & software)	ICT (Virtual Reality (VR), Augmented Reality (AR), Artificial Intelligence (AI), Extended Reality (XR)), Interaction technology (Haptic Glove, communication), Tailoring tools (Customization, Personalized, adaptation), Authoring tools	[7],[8],[11],[26],[46], [47],[48],[49]

A. Game Elements / Game Design

In this category, *challenges* are one of the main game elements that motivate and engage students. Sobrino-Duque et al. [12] Conducted an experimental study of 55 students enrolled in the "User Interface" course and found that the students were engaged in the challenge within gamified tasks. In addition, they argued that strategies for challenges should facilitate attainable tasks while sustaining students' motivation.

On the other hand, Hong et al. [13] Argued that narrative in the fictional dimension was underutilized; however, narratives as a component can enhance the appeal of the content and encourage students to engage with their learning experience.

In addition, Ruiz-Bañuls et al. [14] Conducted a quantitative study involving a gamified interdisciplinary implementation strategy for primary education students and found that implementing transmedia narratives and gamification can enhance students' motivation. Furthermore, Toledo Palomino et al. [15] Integrated theories and data-driven analysis, and developed a "narrative gamification framework for education" to improve the learning experience. They conducted user evaluations to collect qualitative data on learner engagement and motivation, substantiating the proposed narrative-driven gamification framework.

They found that incorporating *narrative* elements (storytelling) can significantly improve learner engagement and motivation. In addition, they also highlighted the need to do further research to Apply the framework in

different educational settings [15].

Furthermore, Bai et al. incorporated an innovative element, *fantasy*, into the initial model (GAFCC). They argued that narrative-driven fantasy facilitates an immersive experience within the storyline, thereby augmenting individuals' attention. Future research should explore the feasibility of applying the GAFCC-F gamification design model across various disciplines by assessing its impact on online students from diverse cultural backgrounds and utilizing collaborative online tools, such as Miro, to monitor student engagement during class activities [16].

On the other hand, Kusuma et al. [17] The role-playing elements allow students to express themselves and enhance their motivation and learning performance. They highlighted the need for further research on utilising gamification strategies to support learners in achieving their learning goals. In addition, Zhan et al. [18] Discussed that role-playing games effectively enhanced students' academic performance in Gamified Programming education. However, their impact on overall learning outcomes was relatively limited.

Alternatively, Imran [19] analyzed the influence of badge awarding on student involvement in gamified online learning settings using Moodle system. The course included both gamified and non-gamified components, with quizzes serving as the primary gamified element. He posited that *time* and obtained *badges* as credible engagement indicators within the online learning context.

Other than that, Denny et al. assessed the impact of two distinct game mechanisms, a *points* system and a *badge system*, both separately and in the grouping, on learning outcomes using an online tool called Peerwise, a digital platform enabling students to formulate and disseminate multiple-choice questions pertinent to their academic curriculum, found that the *badge* system promoted goal-setting behavior and demonstrated greater efficacy compared to the *points* system, which lacked clear objectives and included uncontrollable components; however, their implementation of combining points and badge system did not result in increased levels of student activity, and may not be directly transferable to other contexts without adjustments. Still, they can be easily modified and offer a baseline for comparison with more complex systems [20].

Moreover, Bencsik et al. introduced a custom-designed gamification solution, and its implementation in higher education economics indicated that although the points and badges system minimally influenced motivation and competitiveness, it still enhanced motivation and competitiveness in over 50% of the students. They also found that 67.3% of students reported that the *Progress Indicator* facilitated the evaluation of their progress about their peers, enhancing motivation and fostering constructive competition. Moreover, students encountered no difficulties in managing the Google Classroom interface used in the course, which allowed them to monitor their progress, points, and badges. They quickly and easily adapted to using the platform [21].

Dicheva et al. utilised OneUp, a gamification platform, to enable instructors to design tasks, quizzes, and practice problems, and integrate game elements into them. The study involved 14 undergraduate students, who found that badges encouraged active participation in external learning practices. The study supports the effectiveness of using *badges* to gamify online activities. They also highlighted the need for further research to examine how internal motivation directly influences performance and achievement, and how external engagement tools like *badges* and *leaderboards* can foster internal motivation and create a lasting impact [22].

Leitão et al. [23] Used the Situational Motivational Scale (SIMS) in their application prototype for Ocean Literacy involving secondary school students. They stated that the prototype, which incorporates a leaderboard as its central game element, had a positive influence on intrinsic, extrinsic, and motivational levels, substantially impacting inherent motivation and external regulation.

In contrast, Chan et al. analysed the influence of Points and leaderboards on intrinsic motivation for online learning using the Learning Analytics Networked Tutoring System (LearningANTS). This digital platform enhances personalised educational experiences. They discovered that incorporating leaderboards in online learning can adversely impact intrinsic motivation in the learning process, particularly when a point system is not in place to provide feedback; thus, academic organisations must exercise caution when integrating gamification to avoid impairing learners' intrinsic motivation. Furthermore, they added that Intrinsic motivation is highest when *leaderboards* and *point systems* are absent, as learners are more likely to adopt mastery goals rather than performance goals due to the lack of performance feedback, as focus on mastery enhances intrinsic motivation; conversely, the presence of a *leaderboard* without a *point system* can create feelings of pressure or control to achieve top performance, which diminishes inherent motivation. Therefore, careful consideration is required when analyzing the impact of gamification in education [24].

Manzano-Leon et al. reviewed the impact of educational gamification on motivation and performance. They found that *points, medals*, and *rankings* are prevalent gamification components in academic contexts, aligning with the *points-badges-leaderboard* (PBL) triad in game design. They also highlighted the need for future research to explore more applications of gamification in the education field; on the other hand, future research to consider participant demographics (age, gender, gaming experience, player types, and prior exposure to the game and video games); moreover, to investigate gamification's impact on sustained positive effects [3]. Furthermore, Ballale [7] Underscored the necessity of exploring the impact of gamification elements such as badges, leaderboards, and rewards on student engagement.

In addition, Kumar and Professor explored the domain of High school education. They examined the impact of gamification on student motivation and educational performance from different institutions by collecting empirical data using a mixed-methods strategy. They found that *points, badges,* and *leaderboards* encouraged healthy competition and participation, enhancing student engagement and academic motivation. Moreover, the efficacy of gamification was found to rely on its integration into the curriculum, with successful applications featuring intricately designed quests, challenges, and narratives, while ineffective ones were characterised by their simplicity or

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misalignment with educational goals. They highlighted the need to examine mechanisms for teacher preparation and guidance to optimize the integration of gamification within the curriculum, as enhancing educators' preparedness may significantly improve its efficacy; besides, they highlighted the necessity of addressing ethical concerns related to student data privacy, competitive fairness, and the risks of addiction or excessive dependence on gamification in future research as gamification becomes more widespread [25].

Furthermore, Zainuddin et al. posited that gamification through leaderboards enhances learning outcomes, motivation, and engagement and fosters a competitive learning atmosphere. They also discussed that this element facilitated students' perception of heightened social connectivity through competitive comparisons of points and rankings on leaderboards. They also encouraged future researchers to explore diverse gamification principles beyond mere *points, badges,* and *leaderboards* in gamified learning investigations. Furthermore, game elements like *badges, points, trophies, leaderboards, avatars,* and *virtual gifts* improve students' extrinsic motivation while augmenting their intrinsic appreciation for learning [2]. Bakhanova et al. [26] Discussed that *Avatars, narratives*, and *social interaction* (cooperation and healthy rivalry) significantly fulfil the requirements for independence and connectedness.

Moreover, Khaleghi et al. [27] Conducted a qualitative study using design science research (DSR) for the Gamifying cognitive assessment task. They combined the recent gamification design frameworks to refine them, utilizing insights from 17 experts, and posited that game elements, including *badges, points, levels, leaderboards,* and *avatars,* effectively foster extrinsic motivation and are instrumental in engaging initial user interest; moreover, they found that Gamification enhances intrinsic motivation by incorporating game elements like optimal challenges and positive feedback, which fulfill individuals' needs for competence, as supported by SDT and Flow theory.

Other than that, Liu et al. [28] Used a questionnaire to conduct an experiment involving 1st-year students. They proposed designing and implementing a "Collaborative Educational Gamification Authoring System" (CeGAS), developed for experienced educators who adhere to the 5E learning cycle model. They asserted that numerous studies have found specific game elements, including points, levels, badges, leaderboards, and timers, to be effective in enhancing user engagement in educational gamification within game-based learning contexts.

In addition, Rivera & Garden [29] Integrated existing literature on gamification and student engagement to systematically develop the Gamification for Student Engagement Framework, examining points, badges, levels, leaderboards, and progress indicators as the most prevalent gamified components employed in educational settings.

Apart from this, Tenório et al. [30] Experimented with 15 teachers exploring 20 Design concepts for lecturers to oversee and modify gamification within adaptive learning systems using the HCI-based Speed dating method to authenticate the "gamification analytics model for educators empirically." A lecturer oversaw student interactions in the study and modified the gamification design by creating *missions*. The findings indicate that implementing the gamification analytics model and the discussed design concepts enhances students' learning, engagement, and motivation in real settings [30].

Meanwhile, García Iruela et al. [31] Experimented with 2nd-year undergraduate students in Information Technology enrolled in a database course, and revealed that students highly value *feedback*, deeming it significantly beneficial. At the same time, incorporating *point levels, missions*, and *badges* is also esteemed, potentially enhancing student satisfaction.

Furthermore, Romero-Rodriguez et al. combined a quasi-experimental study using two platforms (MexicoX and MOOC taught on edX). The E-MIGA model was used to evaluate gamified platforms for the influence of gamification strategies in MOOCs on energy sustainability courses and found that the implementation of gamification dynamics (such as *challenges, badges*, and *leaderboards*) effectively fostered a sense of competition among students in MOOCs in a distinct manner [32].

Moreover, Zhan et al. [18] Gamification as a competitive mechanism significantly enhances students' cognitive abilities and inspiration, primarily by employing games as teaching mediums to improve academic performance.

Kaya et al. designed and effectively demonstrated an innovative gamified educational platform called Educhall, a web-based software that implements challenge-based methodologies to enhance student engagement in learning activities and foster collaborative education by intensifying the competitive atmosphere through the application of gamification techniques. They highlighted that the study exhibited limited evidence for the link between challenge-oriented gamified learning and flow state experience, needing additional future practical research [33]. Furthermore, Ratinho & Martins reviewed the impact of gamified learning strategies on student motivation within secondary and tertiary educational contexts and posited that *competition* contributes to the failure of gamified learning systems, thereby necessitating the avoidance of social comparison; however, they discussed that gamification could effectively enhance motivation when implemented under certain conditions, with requiring complex and challenging designs that engage students in advanced applications and video games to attain gameful conditions, thus requiring the designs to be *aesthetically appealing*. Therefore, they highlighted the need for further research in addressing the implications of game-based design principles concerning the novelty effect settings and investigating how gamified designs affect student motivation over time and how personal traits influence the effectiveness of gamification [34].

Furthermore, Panis et al. highlighted that the evaluation of the efficacy of the learning design encompasses several factors: *the effectiveness of the design*, *the appeal of objectives in alignment with student preferences as end-users*, *the engagement in crafting quiz questions*, *the attractiveness of student interests seeking learning content*, *the comfort experienced by students as they absorbed learning materials*, *the pacing of the instructional design*, *instructional design's visual appeal presentation*, *animation precision*, *color*,

user experience design text composition, *content delivery's speed and clarity*, *the accessibility and operability of navigation within the design*, *the captivating arrangement and design layout that fosters display attractiveness*, together with the *design coherence of messaging and material*. The successful design of gamified problem-centred learning as instructional content, characterised by both theoretical and practical elements, has yielded results classified as "very good," indicating that its instructional design is deemed suitable for implementation in educational settings [35].

Aside from that, Ninaus et al. explored the use of game elements, including *visual design*, *narrative*, and a virtual *reward* system (coins and life points), in fostering Fraction Magnitude Understanding. The study involved 85 adult participants in a pre-post design. The results suggested that these game elements can enhance cognitive engagement and influence learning strategies, emphasizing accuracy over speed. Consequently, individuals involved in gamified training may have allocated greater cognitive exertion towards their estimations, thereby revealing levels of mental engagement [9]. Thus, they discussed and indicated that there was insufficient alignment between educational material and gameplay dynamics in many educational games, and further investigation is required to examine the role of intrinsic integration in educational games to improve academic outcomes and engagement efficiently.

Consequently, Tsita & Stratzemi integrated established frameworks and pinpointed essential conceptual elements for Serious Games (SG) design and found that many frameworks, especially those based on flow theory, advocate for serious games to integrate focused attention, clear objectives and a sense of control as fundamental components, as these elements, in conjunction with the game's *challenges*, must align with the user's skills throughout the gameplay as the user enhances their abilities and understanding [36].

Other than that, Nguyen [37] examined students' values influencing their engagement in gamification, identifying six key motivators (Social Recognition, Exciting Life, Sense of Accomplishment, Sense of Belongingness, Self Enhancement, and Self-expression) through interviews with 69 participants utilizing the laddering technique, and posited that students' perceptions of *social recognition* during interviews significantly influence their engagement with gamification.

In addition, Zhang & Crawford investigated the motivational factors of EFL learners within the context of a Gamified Formative Assessment (GFA) to illustrate the substantial impact of an effectively crafted gamified formative assessment platform using Quizizz. He found that the enhanced motivation derived from gamification activities is attributed to individuals' feelings of accomplishment and progress, while social interaction and cooperation foster a sense of belonging and bolster intrinsic motivation [4].

B. Teaching & Learning (T&L)

In this category, Klein [38] reviewed gamification strategies implemented in digital or distance settings, which occurred throughout the global health crisis of the COVID-19 pandemic and suggested the incorporation of familiar game mechanics, including *Time Limits* and *Progress Tracking,* enhanced the instructional nature of the application while simultaneously infusing it with entertainment through gamification [39]. Furthermore, Klein [38] Discussed that user-centred design is integral to discussions surrounding digital learning environments, knowing that gamification design effectively integrates learner characteristics, where the efficacy of the completed gamification intervention necessitates evaluation through a user-centred approach, wherein designers must observe learners' interactions to ensure comprehensibility of instructions, navigation, and multimedia elements.

Moreover, Yamani summarised and analysed previous gamification frameworks, presenting a structure for incorporating gamification into e-learning systems through the instructional design model (ID) to enhance learner motivation and engagement in e-learning courses. He discussed how progress tracking can be effectively implemented in online learning to sustain students' motivation and engagement. In addition, he found that *Time Pressure* is one of the critical game elements for successful games, while the application of gamification design, grounded in the instructional Design (ID) model, enhances student engagement and usability within e-learning contexts by fostering active participation and enjoyment. He highlighted the need for future investigation to define the pedagogical transformations among digital games, game-based learning, and gamification in educational contexts by integrating various learning theories [40].

Other than that, Toda et al. established a comprehensive list of 21 game elements and their equivalents, which were subsequently authenticated via two expert surveys within the domain of gamification in education, with the study's objectives to propose a taxonomy and discussed the deprivation of *Time Pressure* in the Ecological Dimension can induce a sense of boredom in learners due to the absence of challenge or urgency in task completion and the presence of *Time Pressure* in Massive Open Online Courses (MOOCs) may contribute significantly to elevated dropout rates of the students [6]. In addition, Nadi-Ravandi et al. [41] stated that the *duration of a gamified course* may influence cognitive, motivational, and behavioral learning outcomes; moreover, they observed that cultural differences across nations influence learners' attitudes and expectations regarding gamified education, with distinct preferences emerging based on academic disciplines.

Conversely, Hasan et al. conducted an experimental study of students who participated in an MSc & Ph. D course in Management and Information Systems Course (MIS) in setting up gamified collaborative online platform within Moodle (LMS) to augment student participation in higher education, and found that students with frequent *access to the course* were notably more engaged with course activities, suggesting a favorable impact on their overall engagement. They also found that incorporating gamification within online discussion platforms positively enhances student engagement [42]. In addition, Zainuddin et al. [2] highlighted the necessity for further investigation into gamified Learning Management Systems (LMS),

Open-source platforms that integrate game mechanics, such as points, badges, and leaderboards, reveal

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significant opportunities for enhancing digital game-based learning within collaborative environments. Online quizzes are integral *to formative assessment* and crucial for improving learning outcomes and retention.

In addition, Ghawail et al. experimented with 20 randomly selected female pharmacy students for a Chemistry course using Kahoot! Technology. They found that 13 out of 20 participants showed Kahoot! Enhanced their engagement and interaction within lectures, as it promoted interactivity through question-answering and participation in *quizzes* and *discussions*, in contrast to traditional educational environments, where discourse is often monopolized by a select group of extroverted individuals [5].

Apart from that, Lester et al. examined factors influencing gamification and game-based learning applied in Tertiary education from educators' viewpoints and found the various *enablers* and *obstacles* that influenced the implementation of gamification and GBL by educators in the university sectors, which were classified as attitudinal, design-related or administrative, and discussed that educators are inclined to allocate resources towards gamification and GBL if they perceive these methods as beneficial and manageable. Nonetheless, even those with favourable views may face design and administrative obstacles that hinder the adoption of these strategies in universities. They highlighted that future efforts may enhance student learning by fostering collaboration among university professors, educational support staff, and administrative officials in creating strategies addressing facilitators and obstacles of gamification and game-based learning [43].

Furthermore, Rodrigues et al. [44] executed a controlled experiment across three institutions, evaluating gamification designs (One-size-fits-all (OSFA) and Personalized) relative to the learning task and users' gaming habits/preferences and demographics to complete assessments for learning via Eagle-edu courses, as it enables creation of courses in any subject, which have missions comprised of activities, such as multiple-choice questions. Their exploratory analyses indicate that personalisation benefits females and individuals with technical degrees, while hurting those who prefer adventure games or single-player formats. As there is a lack of evidence on changes in participant motivation with frequent gamified assessments, they highlighted the need for future research to compare personalized and OSFA gamification in long-term review assessments—moreover, El-Shorbagy et al. [45] analyzed underutilized gamification elements and asserted that the efficacy of customization and personalization approaches surpasses the generic methods, prompting scholars to tailor educational environments by considering factors such as age, gender, personality traits, user types, and learning styles; consequently, by individualizing design and material, through the delivery of relevant material in suitable formats to specific users, thereby enhancing educational outcomes, significantly increasing user motivation and satisfaction compared to "one size fits all" content.

Moreover, Hong et al. [13] reviewed gamification in educational settings through personalization, adaptation, and recommendations based on students' static and dynamic data and highlighted the necessity to explore relevant domains and equip educators with empirical bases for developing gamified pedagogical approaches. In addition, personalization strategies, such as the "Gamification Journey," facilitate customized experiences that address the specific learners' requirements, preferences, and motivations, which may enhance overall satisfaction and improve educational results [15].

C. Technology-Enhanced Gamification

In this category, Lampropoulus et al. discussed that *virtual reality environments facilitate substantial learning, enhance student motivation and participation, positively influence their emotional states, and* significantly improve students' learning outcomes and knowledge acquisition. Lampropoulus et al. highlighted that gamification and Virtual Reality are gaining traction in educational settings, where establishing universally recognised standards, guidelines, and dependable assessment tools, alongside their contextual validation, is essential. Furthermore, they found that a minority of studies employed objective measures (10.61%), primarily utilizing assessment instruments such as preliminary evaluations, final assessments, or context-specific metrics. Their findings indicate a significant necessity for developing standardized and validated instruments to enhance the evaluation of gamified *virtual reality* and *extended reality (XR)* learning experiences [8]. In addition, Balalle posited that further research is needed to investigate the adaptation of educational technology to meet the individual needs of students, thereby enhancing learning outcomes. He-underscored the necessity of a deeper inquiry into *Augmented Reality, Virtual Reality,* and *Artificial Intelligence* [7].

Furthermore, Bakhanova et al. [26] proposed enhancements to Participatory Modelling (PM) through interdisciplinary integration, especially with game design and gamification, and their analysis found that augmented reality is a proven factor in providing a secure and engaging environment where stakeholders can interact and witness each other's behaviors.

Additionally, Laine and Lindberg presented 54 design principles in 13 categories. One of the design principles (DP 23) in the Feedback class mentioned that the efficacy of feedback can be enhanced through the utilization of diverse modalities, including visual, auditory, and haptic, enabling the recipient to select the most contextually suitable form of *communication*, which should align with real-world scenarios. Laine & Lindberg also posited that this classification, while not exhaustive, provides a foundational framework for future research, as future research may investigate the efficacy of gamification outcomes or examine the game development process [46].

In addition, Edwards et al. introduced the "VR Multisensory Classroom" (VRMC), an immersive educational platform utilizing a *Virtual Reality* headset, enabling students to manipulate hydrocarbon molecules via hand gestures while receiving *haptic* feedback through sensor-equipped gloves and hand-tracking *technology* facilitated by the Leap Motion system. Evaluation of the initial prototype by students from diverse backgrounds indicated that the VRMC effectively facilitated high engagement,

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motivation, and interest, and accommodated various learning styles in organic chemistry education [47].

Moreover, Klock et al. Tailored gamification research primarily investigates user profile modelling, a crucial element for personalisation, adaptation, and recommendation methods. They discussed that customisation is one of the most frequently appearing game elements in recent literature reviews and is distinct from the educational context. Thus, Klock et al. [11] highlighted the need for future research to emphasize alternative foundations for customizing gamification beyond merely the user profile.

Furthermore, Ahmad et al. examined educator-oriented Authoring Tools (AT) technologies for creating Rich Educational Media (REM), detailing the characteristics, operational processes, and evaluative techniques associated with these tools and the resulting REMs. Their review suggested a modest interest in empowering educators to develop diverse resources, including serious games, virtual reality, and augmented reality. They highlighted that future investigations in this domain will prioritize the identification of features and workflows essential for encompassing all dimensions of REMs, including the development of 3D virtual environments, alongside the imperative for meticulously designed end-user evaluations that assess relevant user tasks indicative of the critical functionalities inherent to the REM creation process, utilizing rigorously approved usability questionnaires; additionally, evaluating efficacy of educator-generated REMs are crucial for elucidating the appropriateness of AT technology and its corresponding REM as a comprehensive educational tool [48]. Moreover, Ramli et al. proposed a model for a mobile learning application prototype, m-BioP, incorporating *augmented reality (AR)* and game elements. The model comprises three main components: content, pedagogy and technology, and interaction. An evaluation of the prototype demonstrated a positive learning experience among biology students. Hence, these findings highlight the model's applicability as a framework for academicians and content developers in creating mobile learning applications that improve the learning experience for STEM students [49].

Based on these discussions, we can identify and recommend guidelines for an effective and motivating gamification intervention.

- Avatar: Avatars serve as personalised visual representations of a player's character, enhancing engagement by making the educational experience more relatable and enjoyable for learners. The prototype should enable learners to customise their avatars, fostering a sense of ownership and social connection.
- Customisation & Personalisation: Customisation and Personalisation are essential in improving learner engagement and motivation by enabling individuals to tailor their educational experience to align with their unique preferences, needs, and objectives. Customization involves allowing learners to adjust specific aspects of the system.
- Badges: Badges serve as visual representations of achievements. They act as a form of recognition and have the potential to motivate learners to complete more tasks to earn additional badges. The criteria for badge acquisition should be explicitly defined to correspond with educational goals.
- Challenges and quests: Challenges and quests refer to distinct assignments or missions students must accomplish. Challenges and quests enhance students' engagement by presenting educational activities as exciting adventures or missions, making them more engaging and enjoyable. The prototype must feature missions with varying difficulty levels to accommodate learners of different capabilities.
- Feedback: Feedback is promptly provided to players to assess their performance and task completion, delivered iteratively through interfaces or agents, and considered a form of response. The several types of Feedback include Auditory (employs auditory signals to transmit signals to the user), Instant (Essential for facilitating interaction and enabling users to comprehend the outcomes of their actions promptly), Haptic (employs tactile sensation to convey information), Visual (Uses visuals like colors, shapes, and animations for information), Extrinsic (The information is conveyed clearly and objectively for user comprehension) and Performance Measurement (refers to the environmental reaction to user behavior. It encompasses components such as points, progression, levels, stats, and acknowledgment).
- Appealing Design: A well-structured and visually engaging design enhances user experience and maintains learner motivation. The interface should be intuitive, aesthetically cohesive, and accessible to facilitate seamless navigation and interaction. Effective use of colour schemes, typography, animations, and spatial organisation contributes to cognitive ease, thereby reducing cognitive load while fostering an emotional connection with the learning environment. A thoughtfully designed interface enhances usability and reinforces engagement by making the learning experience more immersive and enjoyable.
- Leaderboards: Leaderboards significantly influence motivation but may undermine intrinsic motivation when implemented independently of a point system, as their competitive nature can be perceived as controlling.
- Levels and progression: Levels serve as a measure of a student's advancement through the material. As learners complete activities, they progress to higher levels, which can foster a sense of progress and achievement. Other than that, the gamified intervention should be made challenging, and the activities should be achievable; otherwise, the learners will become frustrated. However, if it is easy, students will get bored. Thus, an appropriate level of challenge and concise feedback can motivate the students.
- Narratives and Storytelling: Utilizing storytelling and narratives can increase engagement in the learning process. Providing context makes the material more relatable and appealing.
- Points and Scoring Systems: Points and scoring systems motivate learners by rewarding their progress and achievements as they provide instant feedback and a sense of fulfillment, which helps to Drive engagement and perseverance.
- Quizzes: Quizzes are

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potent educational tools that enhance student motivation and engagement by incorporating gamification principles and providing immediate feedback.

- Social support/multiplayer: The gamification system should support social aspects and facilitate both competitive and collaborative tasks among players.
- Technology: Integrating Education Technology and gamification within educational contexts can enhance immersive and interactive pedagogical experiences, revolutionizing conventional education, enriching instructional practices, and facilitating innovative educational frameworks.
- Time Limits: While time limits may increase stress levels, they also enhance students' motivation and time management skills, fostering a heightened sense of urgency and concentration.

IV. CONCLUSION

In this systematic literature review, we examined 48 studies to identify game elements and factors related to students' motivation and engagement and categorized the studies according to their contexts. The study shows that gamification can significantly enhance learning performance while fostering motivation, engagement, and social interaction among learners. By synthesising existing evidence, this study provides practical guidance for educators and instructional designers seeking to integrate gamification into their methodologies and develop more effective strategies that align with diverse educational requirements. The analysis revealed that game elements such as points, badges, leaderboards, challenges, and levels appeared most frequently in widely used research. Additionally, the study highlighted that rarely used game elements, such as narrative, can enhance students' motivation and engagement. Furthermore, Virtual Reality (VR) environments could improve students' motivation and engagement. Even with the growing adoption of gamification in education, this review identified significant gaps in current research, including the necessity for further investigation in educational technologies such as Virtual Reality (VR), Augmented Reality (AR), Extended Reality (XR), and Artificial Intelligence (AI). Additionally, there is a pressing need to explore diverse game mechanics beyond the commonly used points, badges, and leaderboards.

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AUTHOR'S PROFILE

Ahmad Nizamuddin Jipli Born in Brunei Darussalam, he obtained his Bachelor of Science (Hons.) in Digital Media from Universiti Teknologi Brunei (UTB) in 2022. He is a second-year postgraduate student pursuing a Master of Science (by Research) in Creative Computing at UTB. His research interests include game development and gamification. During his undergraduate studies, he completed an internship at Pixelated Enterprise, a game development company in Brunei. As part of his 2021 internship, he developed a 2D mobile game using Unity, creating original 2D assets and implementing C# programming to enhance interactivity. His work was showcased at MSME events at Yayasan during that period. In addition to his programming skills, he is also proficient in 2D character illustration.

Dr Ahmad M. S. Elaklouk is an Assistant Professor at the School of Computing and Informatics, Universiti Teknologi Brunei (UTB), Brunei Darussalam. He holds a Ph.D. in Information Science (Multimedia) from the National University of Malaysia. His research focuses on Human–Computer Interaction, Serious Game Design, Virtual and Augmented Reality, Game-Based Rehabilitation, and Edutainment Systems. With significant academic and research experience, he has led multiple funded projects, supervised postgraduate and undergraduate students, and published in reputable journals and conferences. He has also contributed to curriculum development, gamification in education, and the development of AI-driven educational tools. As an active member of the academic community, he serves as a reviewer, committee member, and session chair for international conferences, advancing research in interactive and immersive learning technologies.