UDC 378.147:371.3
DOI: https://doi.org/10.32342/3041-2196-2026-1-31-17

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THE TRANSFORMATIVE POTENTIAL OF SYSTEMIC GAMIFICATION: COMPARATIVE ANALYSIS OF GAMIFIED LEARNING PLATFORMS (LEGENDS OF LEARNING, KAHOOT!, MINECRAFT EDUCATION, AND GRADECRAFT)

В епоху інтенсивної цифровізації та глобальної системної складності, сучасна освіта трансформується у багатовимірний простір, що характеризується концептом «педагогічної гібридності». У цьому дослідженні розглядається трансформаційний потенціал гейміфікації - стратегічної імплементації елементів ігрового дизайну в неігрові контексти - з метою підвищення рівня когнітивної залученості здобувачів освіти та оптимізації їхніх академічних результатів. Попри те, що ігрові методики дедалі частіше застосовуються у дисциплінах, які традиційно сприймаються як складні або абстрактні (зокрема, у математиці та природничих науках), залишається актуальною наукова потреба у систематичному порівнянні механізмів, за допомогою яких сучасні цифрові платформи операціоналізують та стимулюють мотиваційні процеси.

Метою статті є опис обраних ігрових навчальних платформ («Legends of Learning», «Kahoot!», «Minecraft Education» та «GradeCraft») за шістьма аналітичними кодами; представлення опису у вигляді підсумкової таблиці; порівняння основних особливостей обраних ігрових платформ з ключовими принципами створення внутрішньо мотивованих навчальних середовищ, описаних Томасом В. Малоуном та Марком Р. Леппером.

Встановлено, що платформи «Kahoot!» та «Legends of Learning» ефективно активізують зовнішню мотивацію та забезпечують інтенсивну короткострокову залученість через механізми змагальності та миттєвого фідбеку. Натомість «Minecraft Education» та «GradeCraft» фокусуються на формуванні глибокої «ендогенної» мотивації. Це досягається шляхом розширення суб'єктності здобувачів освіти, підтримки їхньої автономії та залучення до вирішення комплексних проблемних завдань.

У висновках доведено, що впровадження «системної гейміфікації» здатне підвищити рівень залученості до 40%. Такий підхід стимулює гнучке мислення та сприяє формуванню установки на розвиток (growth mindset) через рефреймінг помилок як конструктивних етапів ітераційного процесу пізнання.

Дослідження підтверджує, що ефективна сучасна педагогіка потребує стратегічної узгодженості між технічними можливостями гейміфікованих навчальних платформ та конкретними навчальними цілями. Перехід до людиноцентрованої, контекстуально адаптивної моделі дозволяє педагогам створювати сталі інклюзивні освітні екосистеми, які готують здобувачів освіти до формування навичок, необхідних для функціонування в умовах економіки знань.

Ключові слова: *гейміфікація, педагогічна гібридність, внутрішня мотивація, освітні технології, системна гейміфікація*

Problem statement. We are living in the time of accelerated global complex changes, driven by digitalization and automation of all life spheres, new technologies, human-centricity and knowledge creation.

Therefore, the contemporary education is gradually changing into a multidimensional space that can offer diversity of learning opportunities suitable for different types of individual or collective learners. This new "pedagogical hybridity" is focused on the integration of physical, digital, and social learning dimensions. In other words, this new educational paradigm recognizes that effective contemporary pedagogy cannot separate technological and traditional elements but must view them synergistically. Rather than viewing traditional and digital pedagogies as oppositional, their effective implementation is based on their complementary strengths. Technology excels at visualization, simulation, personalization, and immediate feedback, while educators' instruction provides motivation, contextualization, ethical reasoning, and relationship building that remain irreplaceably human.

Within this transformative educational trend, gamification that combines the elements of gaming with traditional learning approaches emerged with the aim to enhance students' engagement and motivation. Particularly strong the impact of gamification - the use of game elements, such as points, badges, leaderboards, competition, quests, achievements in a non-game context - has been reported in subjects like mathematics and science that are often perceived as difficult or abstract by students. By leveraging students' intrinsic motivation to play and compete, gamification has proven to be an effective way to enhance understanding and enjoyment of study material.

Analysis of the latest research and publications. Over the past years, the concept of gamification has increasingly been integrated into educational settings, offering a fresh approach to traditional teaching methods. By embedding gaming elements such as points, levels, and competition into the learning process, gamified platforms have shown to increase students' engagement, motivation, and overall academic performance [Hamari, Koivisto, & Sarsa, 2014].

Game-based learning core characteristics could be summarized as follows: a) multimodality (it combines images, sounds, texts, kinesthetic manipulation); b) interdisciplinarity; c) principle of "5 Rs" - a rapid pace of a game (via different timers, by getting the most correct answers in a space of time, etc.), a random selection (by shuffling cards, rolling dice, deciphering a maze), different roles (e.g. thematic identities or knowledge distribution: "You play a scientist who verifies the reliability of…"), rivals (another student, another team of students, game itself, a teacher), rewards (in the form of game points, candy, extra-credit, etc.); d) learning by doing (experiential learning); e) authenticity (when students are engaged in the tasks that replicate real-life challenges, the tasks are investigated from different perspectives that reflect real-world assessment, there are opportunities to connect the tasks to the real-life contexts); f) motivation (when challenging experiences spark students' curiosity and imagination that keep them engaged and thus promote intrinsic motivation); g) independence and autonomy (when a game requires reflection and decision-making on the part of students, gives students personalized feedback, thus making them aware of what their knowledge is and what they must improve); h) team-working and/or competition (when a game requires team collaboration and open social networks, when mentoring and peer learning take place); i) "playfulness" (when in entertaining environment the learning process is fun, there is "positive" failure, space for imagination and creativity) [Marklund, 2014].

The increased interest in CMC (Computer Mediated Communication) and gamification as an educational means is backed up by ever-growing research involvement. For example, E.H. Fedorenko et al. [2019] analyses the questions of informatization in higher educational institutions (HEIs). W.J. Bramble and S. Panda [2008] present the various distance and online learning models. B.S. Horvitz, N. Dabbagh and B. Bannan-Ritland [2007] focus on online learning concepts, strategies, and application. R.M. Palloff and K. Pratt [1999] describe effective strategies for an online classroom. We can also mention here the scholarly works about educational gamification and educational video games. For example, the definition and the structural characteristics of the gamification phenomenon are discussed by S. Deterding [2012]. Education via gamification is analysed by K. Huotari and J. Hamari [2012]. Professional corporate training based on gamified applications is presented by R.J. Baxter et al. [2017]. More recent studies,

including works of S. Arnab et al. [2015], K. Becker [2017], discuss the formal design paradigm for serious games. P. Wouters et al. [2013] present the analysis of motivational and cognitive effects of video games. Questions related to the game-based curriculum are presented in theses of A.-S. Alkind Taylor [2014] and B.B. Marklund [2015].

Recent comprehensive analysis of CMC and gamification in higher education reveals their emergence as principal characteristics of sustainable educational systems. According to systematic reviews covering 2010-2024, the synergistic integration of these technologies enhances student engagement by up to 40% while reducing the carbon footprint of traditional education through decreased physical infrastructure requirements [Coelho, & Abreu, 2025]. Accordingly, the convergence of CMC and gamification represents a paradigm shift toward environmentally responsible, socially inclusive, and economically viable educational practices that prepare learners for rapidly evolving global challenges [Marengo, et al., 2025; Mushtaq et al., 2025].

The novelty of the study. As gamified learning platforms have gained significant attention in recent years for their ability to engage students and enhance learning experiences, their analysis has become the focal point of our present theoretical work. We have chosen four gamified learning platforms *Legends of Learning*, *Kahoot!*, *Minecraft*, *GradeCraft* and reviewed them along the following guiding lines: 1) platform's aim; 2) target group (groups), 3) materials it offers; 4) accessibility and user-friendliness; 5) learning contexts; 6) opportunities and challenges. The results of our analysis are presented in a summative table and are compared with the key principles of designing intrinsically motivating learning environments as described by Thomas W. Malone and Mark R. Lepper [Malone & Lepper, 1987].

By grounding the analysis in T.W. Malone and M.R. Lepper's Taxonomy, it offers a replicable model for future researchers to evaluate emerging AI-driven educational tools.

The purpose of the article is to describe the selected gamified learning platforms along the six guiding lines (analytical codes); to present the description in the form of a summative table; to compare the principal features of the selected gamified platforms with the key principles of creating intrinsically motivated learning environments as described in the seminal work of Thomas W. Malone and Mark R. Lepper "Making Learning Fun: A Taxonomy of Intrinsic Motivations for Learning".

Methodology. In order to achieve our aims, a qualitative research design centred on thematic analysis and comparative generalization was employed. The methodology was structured into three distinct phases to ensure a rigorous evaluation of the selected gamified learning platforms (Legends of Learning, Kahoot!, Minecraft Education, and GradeCraft).

Phase 1: Interactive Thematic Review: the primary data collection involved direct interaction with each platform, supplemented by an extensive review of official documentation, user manuals, and existing literature (2018–2024). A deductive thematic analysis was applied, utilizing six pre-defined guiding lines (analytical codes) to categorize the data:

1) Platform Aim: the pedagogical intent.
2) Target Demographics: user groups and inclusivity.
3) Key Gamified Elements: avatars, XP, coins, etc.
4) Materiality/Accessibility: language support, licensing, and "learning curves".
5) Critical Affordances: specific opportunities.
6) Critical Affordances: inherent challenges.

Phase 2: Cross-Platform Comparison. Following the initial coding, a comparative generalization was performed. This involved identifying patterns of "pedagogical hybridity". The results were synthesized into a summative table (Table 1) to facilitate a side-by-side assessment of how different game elements (e.g., "5 Rs": Rapid pace, Random selection, Roles, Rivals, Rewards) are operationalized across varying software architectures.

Phase 3: Theoretical Alignment. In the final stage, the generalized characteristics were mapped against the T.W. Malone and M.R. Lepper [1987] Taxonomy of Intrinsic Motivation. This step served as the "theoretical lens" through which the platforms' effectiveness was validated. We analysed how specific platform features act as catalysts for individual motivations (Challenge, Curiosity, Control, and Fantasy), and interpersonal motivations (Cooperation, Competition, and Recognition).

Data Selection and Sampling Logic. The selection of Legends of Learning, Kahoot!, Minecraft Education, and GradeCraft was based on a purposive sampling strategy designed to represent the full spectrum of the current gamification landscape. Rather than focusing on similar tools, we selected these four platforms to provide a "maximum variation" sample. Legends of Learning was chosen to represent curriculum-centric gamification, specifically within the STEM fields. Kahoot! represents synchronous, social-interactive gamification used for immediate classroom feedback. Minecraft Education represents open-world sandbox environments focusing on experiential and collaborative learning. GradeCraft represents systemic gamification, targeting the structural grading architecture of an entire course rather than individual activities. By selecting platforms that operate at different levels of the educational experience - from a single quiz to an entire degree-level grading system - this methodology ensures that the resulting generalizations are applicable across a wide range of pedagogical contexts.

Presentation of the main research material. *Legends of Learning* is an educational platform specializing in mathematics and science content for students in kindergarten through middle school (grade nine).

1. It utilizes elements of play, such as competition, rewards, and personalization. It offers interactive and immersive learning environments in order to enhance students' engagement, comprehension, and retention.

2. The platform supports three user groups: teachers, students, and parents. It allows teachers to customize lessons, assign games, and monitor student progress through a performance-tracking system. The tasks are aligned with the curriculum standards. The platform allows students to create avatars and is adaptable to particular student's abilities. Parents can access their child's progress reports and unlock additional learning opportunities. School or district administrators can oversee teacher accounts, manage licenses, and monitor overall platform usage.

3. There is a diverse range of educational materials for mathematics and science subjects. Visually attractive and highly interactive material such as games, puzzle-solving, simulation-based games, and interactive quizzes. The platform provides motivational feedback throughout the games. After each successful challenge, students are greeted with positive phrases as "Well done!" and "I didn't know you were that strong!". Students earn coins and experience points (XP).

4. The platform is available only in the English and Spanish languages. It can be used outside of school, which provides a high degree of flexibility. This is particularly helpful for students who need to reinforce and practice what they have learned in class. Though a basic free version is available, schools and teachers can purchase premium subscriptions for additional features such as advanced analytics, full game libraries, and integration with external Learning Management Systems (LMS) platforms like Google Classroom. It has a short "learning curve" period.

5. The platform is well-suited for school setting. It can be used by teachers across different subjects, by students learning alone or with friends at home, as a fun educational activity for the whole family.

6. The key strength of the platform is its library of over 2,000 curriculum-aligned games. Interactive features transform learning into a fun and competitive experience. Games adjust to individual student levels, fostering a personalized learning experience. The platform makes use of leaderboards and rankings to promote exogenous competition. This motivates students to try harder and do better. While it can initially motivate students, it is not guaranteed that the motivation will stay this way. It is important for educators to shift from the outcome to the content [McKinney, Strother, & Schneider, 2023; Legends of Learning, 2023].

Minecraft Education is a sandbox type interactive learning platform that aims to develop critical thinking, collaboration, communication, creativity as well as mathematics, science, history and culture, coding, and languages.

1. The core gameplay involves using blocks to build three-dimensional constructions using pixel-picture analogies as well as blocks to create complex machines or environments.

2. The platform supports primary and secondary school students, educators, school leaders, IT admins, parents, camps, clubs, researchers, and other potential partners. Educators use Minecraft to create immersive lesson plans tailored to specific educational goals, promoting

project-based learning, and active engagement. They also have the option to create and upload their own materials. Assessment and reporting tools assist teachers in evaluating students' learning progress.

3. The platform can be used to simulate a wide range of situations and circumstances, such as science, maths, computer science, language arts, history and culture, etc. It also offers pre-made lesson plans. Chalkboards display instructions or objectives, while NPCs (non-player characters) provide guidance, quizzes, or information. The in-game camera lets students document their work, and portfolios organize these records for assessment. Resource packs with custom textures and items add further customization to lessons. The platform also includes activities and challenges for developing collaboration and social-emotional learning (SEL) skills.

4. Certain features are free to use and try. The full accessibility to all features requires a Microsoft 365 account, a technical device and an annual fee. The educational edition of Minecraft is not available for private individuals, it is only purchasable for schools, universities or other public educational institutions. Inclusivity is a key focus, with accessibility features such as text-to-speech, adjustable colour contrast, subtitles, and simplified controls for students with disabilities. The platform's combination of visual, auditory, and kinesthetic elements makes it effective for diverse learning styles.

5. The platform supports learning in various contexts. It can be effectively utilized in schools, extracurricular activities, informal learning, and research.

6. Opportunities and challenges: Minecraft's sandbox nature and flexibility allows it to adapt to diverse educational needs. Its open-ended nature fosters creativity, problem-solving, and critical thinking. The platform supports collaboration and other social skills' development, beyond subject-specific learning. At the same time, teachers unfamiliar with Minecraft or gaming may require significant time and effort to master its tools and create effective lesson plans. It may not be the best choice for schools with limited budgets or technology infrastructure [Nebel, Schneider, & Rey, 2016; Callaghan, 2016].

"Kahoot!" is a leading tool for interactive learning experiences with the aim to make learning engaging and enjoyable for users of all ages and backgrounds.

1. The platform revolves around two main processes: quiz creation and gameplay. The quiz format is combined with a dynamic visual and audio experience.

2. Target group (groups): from kindergarten to 12th grade students, and university learners. Companies and organizations use the platform for employee training, onboarding, and corporate learning. Individual learners can use Kahoot for self-study, test preparation, and general knowledge quizzes. Families and friends use Kahoot for entertainment purposes, such as quiz nights and social events.

3. Materials it offers: mathematics, science, history, languages, skill-based topics such as coding, teamwork. The platform provides an extensive library of pre-made quizzes, which are created by educators, organizations and the Kahoot! team. The material supports memorization, summarization and fun due to the elements of gamification.

4. Accessibility and user-friendliness: easy to set up and use, with no extensive technical knowledge required. Kahoot! does not require participants to create accounts. Kahoot! offers both a free version and several premium plans to suit different needs. The free version includes essential features such as quiz creation, access to a library of public "Kahoots" and basic performance analytics. Premium plans unlock more advanced features: detailed analytics, customization options, shared workspaces for collaborative quiz creation. The platform can be accessed from any internet-connected device.

5. It can be effectively used in various learning contexts. Its flexibility and adaptability make it a valuable tool in formal educational settings such as schools and universities, as well as informal environments. In primary schools, Kahoot! can be used to introduce gamified learning to younger students. Teachers can use the platform to make foundational subjects like maths, reading, and science more engaging and accessible. At the middle school level, Kahoot! is an effective tool for reinforcing concepts and encouraging collaboration. High school students also benefit from Kahoot!'s ability to revise and to prepare for a test or exams. Professors can use it to break up traditional lecture formats by incorporating quizzes, polls, and real-time feedback sessions. Kahoot! supports remote and hybrid learning environments. The platform works well

with virtual meeting tools like Zoom and Microsoft Teams. One of the most valuable applications of Kahoot! in higher education is in flipped classroom models, where students engage with quizzes before attending lectures.

6. One of the standout features of Kahoot! is its ability to foster active participation and collaboration among learners. Its flexibility allows educators to tailor content to specific learning objectives, from reviewing lessons to introducing new topics. It can be used across devices, requires minimal setup. The variety of question types and the ability to incorporate multimedia elements ensure that Kahoot! includes all learner types. The fast-paced and competitive format may be viewed as a challenge. Another potential drawback is dependency on technology and internet access. Also, Kahoot's multiple-choice format may limit deeper learning as it focuses on memorization. It is less effective for essay writing, debate, or detailed analysis [Wang & Tahir, 2020; Plump & LaRosa, 2017].

GradeCraft is the platform that helps educators create more engaging and effective learning, i. e., courses that increase students' intrinsic motivation, engagement, and autonomy by restructuring traditional grading systems and incorporating game elements.

1. GradeCraft encourages students to take ownership of their learning by earning points from zero, making meaningful choices, and receiving immediate feedback while maintaining a transparent and fair grading system.

2. Target group (groups): K-12 teachers, university instructors, and other learning environments, e.g., corporate training programs and informal education spaces, where game-based elements can enhance learning outcomes.

3. Materials it offers: detailed information about gameful pedagogies and gameful learning. There is a guide on how to implement a gameful learning approach, and a guide on grading and assessment structures. GradeCraft provides example syllabi for a range of subjects, such as Astronomy 106: Aliens, Honors 240: The Games We Play, Honors 242: Deep Time: The Science of Origins, Linguistics 370: Language and Discrimination, and Education 333: Video Games and Learning.

4. Accessibility and user-friendliness: well-managed and well-organized platform. To get started, users must purchase a license through the University of Michigan's licensing platform. While users can explore some content for free, full access requires payment.

5. It is well-suited for K-12 education, where it can be used to engage students, promote intrinsic motivation, and foster a growth mindset. Teachers can incorporate game elements like points, feedback, and choices to create an interactive, student-driven learning environment. Instructors use this platform to prepare, evaluate, and come up with new ideas to improve their lessons. GradeCraft is specifically designed for higher education. Beyond formal education, GradeCraft can be applied in extracurricular learning settings, such as workshops, training programs, or non-traditional learning environments. Its adaptability to different types of learning makes it suitable for all kind of educational contexts that focus on skill-building and personal growth.

6. Opportunities and challenges: the ability to enhance student motivation and autonomy through game-like elements, platform's adaptability across K-12 education, higher education, and extracurricular settings. Access to full features requires purchasing a license. The platform's setup and activation process reliance on the University of Michigan's licensing system may be an obstacle for some educators [Holman, Aguilar, & Fishman, 2013; Fishman & Hayward, 2022].

Back in 1987, in their seminal article "Making Learning Fun: A Taxonomy of Intrinsic Motivations for Learning" Thomas W. Malone and Mark R. Lepper tried to analyse how educators can design intrinsically motivating learning environments and make learning more interesting for students. They drew the parallels between intrinsic motivation and instructional effectiveness. The authors define an activity as intrinsically motivating if people engage in it "for its own sake", rather than in order to receive some external rewards or to avoid some external punishment. Thomas W. Malone and Mark R. Lepper [1987] hypothesize that the use of intrinsic, rather than extrinsic appeals and the use of endogenous, rather than exogenous motivational stimuli will produce higher levels of sustained interest in an activity. They distinguish between individual and interpersonal motivations. Individual motivations consist of challenge, curiosity, control and fantasy and interpersonal motivations contain cooperation, competition and recognition, which depends on other people.

Table 1

Summative Table "Gamified Learning Platforms"

Platform	*Aim & Core Pedagogy*	*Target Audience*	*Key Gamified Elements*
Legends of Learning	STEM mastery (Math/ Sciences) via curriculum-aligned play.	K-9 students, teachers, and parents.	Avatars, XP, coins, performance tracking, and competition.
Minecraft Education	Development of 4Cs (Creativity, Collab, etc.) via sand-box simulation.	K-12, Higher Ed, researchers, and clubs.	Interactive building blocks, NPCs, in-game camera, and portfolio assessment.
Kahoot!	Real-time engagement and social learning via competitive quizzes.	All ages (K-Higher Ed, Corporation).	Speed-based points, leaderboards, and immediate feedback loops.
GradeCraft	Systemic gamification of grading to boost student autonomy.	Higher Ed, K-12, and corporate training.	Levelling systems, badges, unlockable achievements, and choice-based paths.
Legends of Learning	English/Spanish; 2,000+ games; LMS integration (Google Classroom).	Strong boost to extrinsic motivation through "exogenous" competition.	Needs a stronger shift toward "endogenous" content to sustain long-term interest.
Minecraft Education	Requires Microsoft 365; high inclusivity features (text-to-speech); fee-based.	Highly adaptable to diverse needs and fosters deep creative problem-solving.	Steep "learning curve" for teachers and high technical infrastructure requirements.
Kahoot!	Minimal setup; free/ premium versions; cloud-based (any device).	Zero entry barrier and excellent for fostering a positive social classroom atmosphere.	Risk of cognitive "shallowing" by focusing on memorization rather than deep analysis.
GradeCraft	University of Michigan license required; includes gameful pedagogy guides.	Effectively converts extrinsic rewards into intrinsic motivation through student agency.	Administrative barrier due to the specific Michigan licensing system.

"Challenge" means that an activity should provide an intermediate level of difficulty for a learner as activities that are too easy or impossibly difficult will be of little intrinsic interest. The activity must provide goals (either clear and fixed or goals that students choose for themselves - short- and long-term). Frequent, clear and constructive feedback on students' performance is required to provide the necessary information for the reformulation of the goals in order to make them more motivating, to engage students and to enhance self-esteem and the feeling of competence.

"Curiosity" means that an activity should have a moderate level of informational complexity different from the learner's current state of knowledge/information. It can be sensory (via sound, visual effects, illustrations, camera movement) or cognitive (to learn and understand a topic due to incomplete or inconsistent information).

"Control" means that an activity should promote a feeling of self-determination via different possible outcomes and options that depend on the choice or response of an individual, responsive learning environment and personalization of an activity.

"Fantasy" means that an activity should promote intrinsic motivation through the use of fantasy elements. A fantasy which is connected with a skill and provides constructive feedback is considered to appeal to the emotional needs of learners and to be advantageous.

Interpersonal motivations, i. e., "cooperation" and "competition" both can be used to engage students. For example, an activity may be enhanced by segmenting a single task into dependent parts (e.g., a jigsaw procedure) or via a combined scoring to bring students to cooperation. In the same way, the appeal of an activity may be enhanced by promoting the motivation to compete with others and creating an activity in which the competitors' actions affect each other or unintentionally help their competitor (e.g., via comparing scoring to that of others, or ranking).

"Recognition" means that the appeal of an activity may be increased if the learner's efforts and accomplishment are recognized and appreciated by others.

If we compare the conditions that stimulate students' individual and interpersonal motivations by Thomas W. Malone and Mark R. Lepper with our analysis of the selected gamified learning platforms, we may conclude that individual motivators, i.e., "challenge" is supported by gamified learning platforms in the form of a) different levels of difficulty; b) adjustability to a particular student's level; c) scoring, performance-tracking systems, progress reports, and chalkboards that provide constant feedback. "Curiosity" is supported by gamified learning platforms in the form of appealing design (visual/audio/kinesthetic); resource libraries and resource packs; unlockable achievements. "Control" is supported by gamified learning platforms in the form of goal-driven decision making; avatars, playable characters' choice; responsive learning environment. "Cooperation", "competition" and "recognition" - interpersonal motivations - are supported in the form of leaderboards; points and badges; "Hall of Fame" rankings that encourage looking at other people's results.

Table 2

Connections Between the Platforms and Psychological Motivators

Platform	Primary Motivators
Legends of Learning	Fantasy (Avatars), Curiosity (STEM Exploration), Competition.
Minecraft Education	Control (Sandbox), Curiosity (Exploration), Cooperation (Building).
Kahoot!	Competition, Recognition, Challenge (Rapid Feedback).
GradeCraft	Control (Student Agency), Challenge (Levelling), Recognition (Badges).

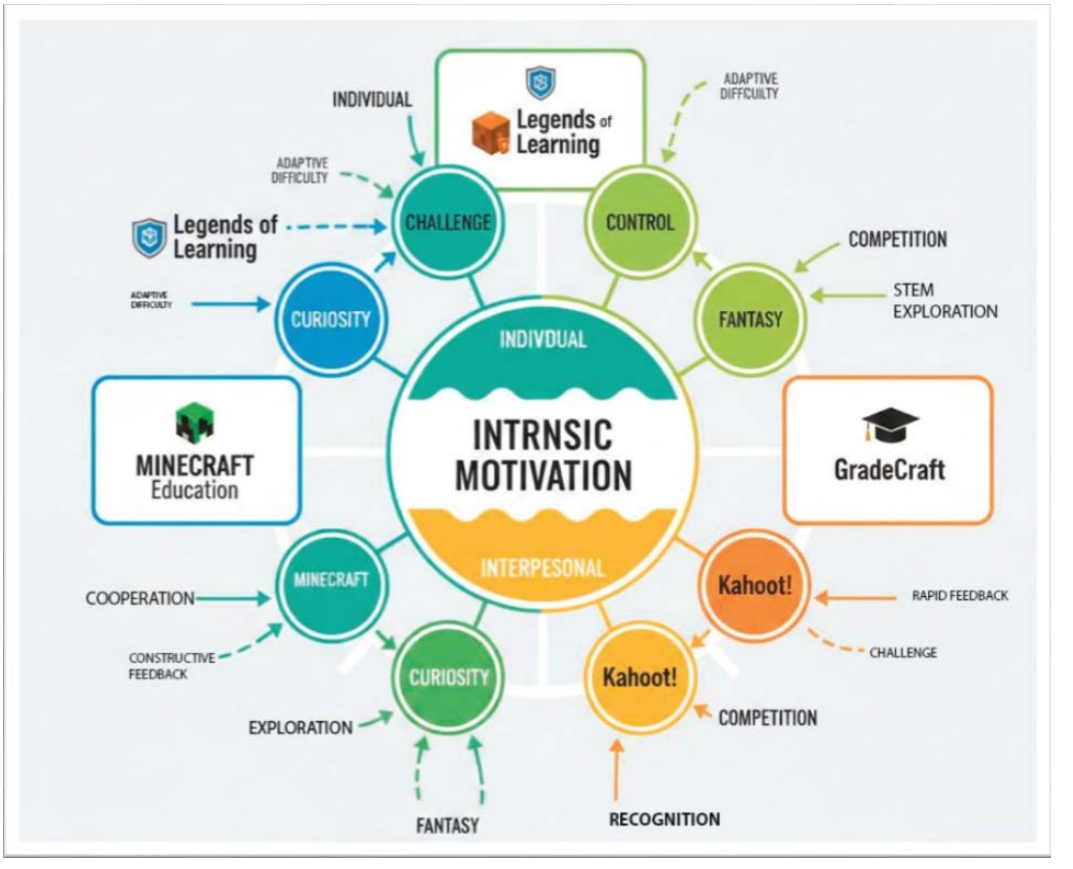

Fig. 1 *Gamified learning platforms: based on Malone & Lepper's intrinsic motivation taxonomy*

In summary, the results demonstrate that gamification elements may convert extrinsic rewards into intrinsic motivation, reduce physical resource use while enhancing learning - the conclusion backed-up by recent meta-analyses of gamification in higher education (2020-2024) that revealed that personalized gamification significantly outperforms one-size-fits-all approaches. Studies show that tailoring game elements to individual preferences results in 35-40% higher engagement rates and 25-30% better learning outcomes compared to generic gamification [Xiao & Hew, 2024; Li, Hew, & Du, 2024]. Furthermore, the integration of AI-driven adaptive gamification systems demonstrates the potential to dynamically adjust difficulty levels and reward mechanisms based on real-time learner performance data, creating more sustainable and effective learning experiences [Marengo et al., 2025].

Table 3

Key Gamification Elements and Their Impact on Learning Outcomes (2019-2024)

Gamification element	Motivation type	Learning impact	Behaviour change
Points and badges	Extrinsic	+10% retention	Moderate (28% increase)
Group quests	Intrinsic	+39% engagement	High (45% increase)
Personalized challenges	Both	+35% performance	High (52% increase)
Leaderboards	Extrinsic	+15% participation	Low (12% increase)
Role-playing	Intrinsic	+42% critical thinking	Very high (64% increase)

Conclusions. The shift toward a "pedagogical hybridity" marks a turning point in contemporary education, where the synergy between human instruction and digital innovation creates a sustainable, inclusive, and highly engaging learning environment. The comprehensive analysis of research from 2018-2024 reveals that institutions implementing integrated CMC-gamification frameworks achieve 45-60% higher sustainability metrics compared to traditional approaches [Mushtaq et al., 2025; Zhang, 2024]. Particularly noteworthy is the emergence of Systemic Gamification Theory (SGT), which provides a human-centred, contextually adaptive framework for inclusive gamified learning [Coelho & Abreu, 2025].

Present research has demonstrated that gamification is not merely a superficial layer of entertainment but a robust structural framework capable of fostering intrinsic motivation and deep cognitive engagement.

By evaluating Legends of Learning, Kahoot!, Minecraft Education, and GradeCraft against the Malone and Lepper Taxonomy, we conclude that these platforms successfully operationalize the core pillars of intrinsic motivation. Individual motivators are involved through adaptive difficulty levels and progress tracking, which provides the necessary challenge and curiosity to sustain effort. Interpersonal motivators come into play by utilizing leaderboards and collaborative quests, which satisfies the human need for recognition, cooperation, and competition.

The comparative analysis reveals that while all four platforms enhance engagement, they serve distinct strategic roles within the "5 Rs" of game-based learning:

a) Content mastery: Legends of Learning and Kahoot! excel in curriculum alignment and rapid-response feedback, making them ideal for STEM literacy and immediate formative assessment.

b) Skill development: Minecraft Education provides a sandbox for "learning by doing", fostering high-level critical thinking and 21st century social-emotional skills.

c) Systemic autonomy: GradeCraft represents a paradigm shift in "systemic gamification", moving beyond the task level to restructure the entire grading architecture, thereby promoting student agency and a "growth mindset".

Across all the platforms, a key implication is the shift in the role of "failure". In traditional grading, failure is a penalty. In these gamified environments, failure is a data point for improvement. Educators are encouraged to use these tools to foster a "fail-forward" culture where students feel safe to iterate and refine their understanding without the immediate threat of a low final grade.

The effective implementation of these platforms requires a move from "one-size-fits-all" approaches toward Systemic Gamification Theory (SGT) - where digital equity, cultural anchoring, and human-centric design converge. When educators balance the technological strengths

of simulation and feedback with the human elements of ethical reasoning and relationship building, they create a learning ecosystem that is not only effective but truly transformative for the modern learner.

Adherence to Ethical Standards. As this study utilized a qualitative research design based on the thematic analysis of publicly available educational platforms and existing academic literature, it did not involve direct intervention, experimentation, or the collection of personally identifiable information (PII) from human subjects. Consequently, formal approval from an Institutional Review Board (IRB) was not required. All platform interactions were conducted using researcher-created accounts for the sole purpose of evaluating pedagogical features and user interface design.

The authors declare no financial or personal relationships with the developers of the analysed platforms (Legends of Learning, Kahoot!, Microsoft/Minecraft Education, or the University of Michigan/ GradeCraft). This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors. The analysis was conducted independently to ensure an objective evaluation of the pedagogical affordance of the tools.

Every effort has been made to represent the features and research findings associated with the selected platforms accurately. The comparative generalizations are based on the state of the platforms at the time of the study (2025) and the body of peer-reviewed literature cited in the references. The theoretical mapping against Malone and Lepper's taxonomy is a result of independent scholarly synthesis.

Bibliography

Alkind Taylor, A.-S. (2014). *Facilitation matters: A framework for instructor-led serious gaming* [Doctoral dissertation, University of Skövde]. DiVA Portal. Retrived from https://www.diva-portal.org/smash/get/diva2:745056/FULLTEXT01.pdf

Arnab, S., Lim, T., Carvalho, M. B., Bellotti, F., de Freitas, S., Louchart, S., Suttie, N., Berta, R., & De Gloria, A. (2015). Mapping learning and game mechanics for serious games analysis. *British Journal of Educational Technology*, 46(2), 391–411. https://doi.org/10.1111/bjet.12113

Baxter, R. J., Holderness, J., Kip, D. L., & Wood, D. A. (2017). The effects of gamification on corporate compliance training: A partial replication and field study of True Office anti-corruption training programs. *Journal of Forensic Accounting Research*, 2(1), A20–A30. https://doi.org/10.2308/jfar-51725

Becker, K. (2017). *Choosing and using digital games in the classroom*. Cham: Springer. https://doi.org/10.1007/978-3-319-12223-6

Bramble, W. J., & Panda, S. (Eds.). (2008). *Economics of distance and online learning: Theory, practice and research* (1st ed.). New York: Routledge. https://doi.org/10.4324/9780203892985

Callaghan, N. (2016). Investigating the role of Minecraft in educational learning environments. *Educational Media International*, 53(4), 244–260. https://doi.org/10.1080/09523987.2016.1254877

Coelho, F., & Abreu, A. M. (2025). Systemic gamification theory (SGT): A holistic model for inclusive gamified digital learning. *Multimodal Technologies and Interaction*, 9 (7), 70. https://doi.org/10.3390/mti9070070

Deterding, S. (2012). Gamification: designing for motivation. *Interactions*, 19(4), 14–17. https://doi.org/10.1145/2212877.2212883

Fedorenko, E. H., Velychko, V. Y., Stopkin, A. V., Chorna, A. V., & Soloviev, V. N. (2019). Informatization of education as a pledge of the existence and development of a modern higher education. *CTE Workshop Proceedings*, 6, 20–32. https://doi.org/10.55056/cte.366

Fishman, B., & Hayward, C. (2022). Gameful learning: Leveraging the learning sciences to improve the "game of learning" (Rapid Community Report Series). Retrived from https://repository.isls.org/bitstream/1/7663/3/Fishman%20and%20Hayward%20Mar%202022.pdf

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

Holman, C., Aguilar, S. J., & Fishman, B. J. (2013). GradeCraft: What can we learn from a game-inspired learning management system? In *Proceedings of the Third International*

Conference on Learning Analytics and Knowledge (pp. 260–264). Leuven, Belgium: ACM. https://doi.org/10.1145/2460296.2460350

Horvitz, B. S., Dabbagh, N., & Bannan-Ritland, B. (2007). Online learning: Concepts, strategies, and application. *Educational Technology Research and Development*, 55(6), 667–669. https://doi.org/10.1007/s11423-007-9071-4

Huotari, K., & Hamari, J. (2012). Defining gamification: A service marketing perspective. In *Proceedings of the 16th International Academic MindTrek Conference 2012: Envisioning Future Media Environments, MindTrek 2012* (pp. 17–22). Tampere, Finland: ACM. https://doi.org/10.1145/2393132.2393137

Legends of Learning. (2023, November 30). *About Legends of Learning*. Retrived from https://www.legendsoflearning.com/about-us/

Li, L., Hew, K. F., & Du, J. (2024). Gamification enhances student intrinsic motivation, perceptions of autonomy and relatedness, but minimal impact on competency: a meta-analysis and systematic review. *Educational Technology Research and Development*, 72, 765–796. https://doi.org/10.1007/s11423-023-10337-7

Malone, T. W., & Lepper, M. R. (1987). Making learning fun: A taxonomy of intrinsic motivations for learning. In R. E. Snow & M. J. Farr (Eds.), *Aptitude, learning, and instruction: Vol. 3. Conative and affective process analyses* (pp. 223–253). Hillsdale, NJ: Lawrence Erlbaum Associates.

Marengo, A., Pagano, A., Lund, B., & Santamato, V. (2025). Research AI: Integrating AI and gamification in higher education for e-learning optimization and soft skills assessment through a cross-study synthesis. *Frontiers in Computer Science*, 7, 1587040. https://doi.org/10.3389/fcomp.2025.1587040

Marklund, B. B. (2014). *Working with educational games: Fundamental guidelines for developers and educators*. Retrived from https://www.diva-portal.org/smash/get/diva2:744438/FULLTEXT02

Marklund, B. B. (2015). *Unpacking digital game-based learning: The complexities of developing and using educational games* [Doctoral dissertation, University of Skövde]. Retrived from http://www.diva-portal.org/smash/get/diva2:891745/FULLTEXT01.pdf

McKinney, D., Strother, S., & Schneider, S. (2023). The association of Legends of Learning usage and science achievement in a large school district in the Southeastern United States. San Francisco, CA: WestEd. https://www.legendsoflearning.com/wp-content/uploads/2023/02/LoL_report_pk_20230111_draft_districtAnonymous.pdf

Mushtaq, N., Nazeer, N., Fayaz, I., & Gulzar, F. (2025). Next-gen learning: Gamifications impact on higher education. *Education and Information Technologies*, 30, 15691–15717. https://doi.org/10.1007/s10639-025-13431-w

Nebel, S., Schneider, S., & Rey, G. D. (2016). Mining learning and crafting scientific experiments: A literature review on the use of Minecraft in education and research. *Educational Technology & Society*, 19(2), 355–366.

Palloff, R. M., & Pratt, K. (1999). *Building learning communities in cyberspace: Effective strategies for the online classroom*. San Francisco, CA: Jossey-Bass.

Plump, C. M., & LaRosa, J. (2017). Using Kahoot! in the classroom to create engagement and active learning: A game-based technology solution for eLearning novices. *Management Teaching Review*, 2(2), 151–158. https://doi.org/10.1177/2379298116689783

Wang, A ., & Tahir, R. (2020). The effect of using Kahoot! for learning – A literature review. *Computers & Education*, 149, 103818. https://doi.org/10.1016/j.compedu.2020.103818

Wouters, P., van Nimwegen, C., van Oostendorp, H., & van der Spek, E. D. (2013). A meta-analysis of the cognitive and motivational effects of serious games. *Journal of Educational Psychology*, 105(2), 249–265. https://doi.org/10.1037/a0031311

Xiao, Y., & Hew, K. F. (2024). Personalized gamification versus one-size-fits-all gamification in fully online learning: Effects on student motivational, behavioral and cognitive outcomes. *Learning and Individual Differences*, 113, 102470. https://doi.org/10.1016/j.lindif.2024.102470

Zhang, F. (2024). Enhancing ESG learning outcomes through gamification: An experimental study. *PLoS ONE*, 19(5), e0303259. https://doi.org/10.1371/journal.pone.0303259

THE TRANSFORMATIVE POTENTIAL OF SYSTEMIC GAMIFICATION: COMPARATIVE ANALYSIS OF GAMIFIED LEARNING PLATFORMS (LEGENDS OF LEARNING, KAHOOT!, MINECRAFT EDUCATION, AND GRADECRAFT)

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DOI: https://doi.org/10.32342/3041-2196-2026-1-31-17

Keywords: *systemic gamification, gamified learning platforms, pedagogical hybridity, intrinsic motivation, educational technology*

The article investigates the shift toward integrated pedagogy, focusing on the synergy between technological advancement and traditional instruction. The study focuses on the transformative potential of systemic gamification - the strategic integration of game design elements into non-game contexts. Specifically, the article seeks to move beyond the superficial discourse of "points, badges, and leaderboards" (PBL) to examine how deep structural mechanics influence learner performance.

The authors perform a comparative analysis of four diverse gamified learning platforms - Legends of Learning, Kahoot!, Minecraft Education, and GradeCraft - to evaluate how they operationalize motivation and engagement. The authors also ***aim*** *to present these platforms through six analytical codes and validate their effectiveness by mapping their features against the Malone and Lepper Taxonomy of Intrinsic Motivation.*

To fulfil this aim, the following ***research tasks*** *were undertaken: 1) to describe selected platforms using six analytical codes: pedagogical aim, target demographics, materials, accessibility, learning contexts, and critical affordances; 2) to synthesize these descriptions into a summative comparative table to facilitate a side-by-side assessment of software architectures; 3) to compare the specific features of each platform with established psychological principles of intrinsic motivation, specifically challenge, curiosity, control, and fantasy, and extrinsic - cooperation, competition, and recognition; 4) to analyse the impact of "systemic gamification" on academic outcomes and the development of a growth mindset.*

The study employs a qualitative ***methodology*** *centered on a three-phase thematic analysis. Phase 1: Interactive Thematic Review: direct interaction with platforms was supplemented by a review of official documentation and academic literature from 2018–2024. Phase 2: Cross-Platform Comparison: utilizing a purposive sampling strategy, the researchers selected platforms that represent a "maximum variation" sample, ranging from task-specific quizzes (Kahoot!) to entire grading architectures (GradeCraft). Phase 3: Theoretical Alignment: the platforms were evaluated through the lens of the Malone and Lepper (1987) Taxonomy, distinguishing between individual and interpersonal motivators.*

The analysis yielded several critical insights regarding the effectiveness of educational technology: a) while Kahoot! and Legends of Learning excel at fostering extrinsic motivation and short-term engagement through competition, Minecraft Education and GradeCraft facilitate deeper intrinsic endogenous motivation by promoting autonomy and student agency; b) systemic gamification was found to increase student engagement by up to 40% and improve learning outcomes by 25-30% when personalized to individual learner preferences; c) gamified environments transform failure from a penalty into a constructive iterative process, allowing students to "fail-forward" and refine their understanding without the threat of a permanent low grade.

Legends of Learning and Kahoot! are identified as ideal for STEM literacy and immediate formative assessment. Minecraft Education acts as a sandbox for experiential "learning by doing" and 21st-century skill development. GradeCraft represents the pinnacle of systemic gamification by restructuring the entire grading architecture to empower student choice. The research highlights a clear hierarchy of effectiveness; while extrinsic rewards like points and leaderboards provide modest gains (12-28% behaviour change), intrinsic mechanics such as role-playing and group quests drive significantly deeper engagement (45-64% behaviour change).

The study ***concludes*** *that effective contemporary pedagogy requires a strategic alignment between a platform's technical affordances and specific learning objectives. By adopting Systemic Gamification Theory (SGT), educators can move past "edutainment" to create sustainable, inclusive learning ecosystems that prepare students for the demands of a 21st-century knowledge-driven society.*

Дата надходження до редакції / Submitted: 11.03.26
Дата прийняття до публікації / Accepted: 21.04.26
Дата публікації / Published: 15.06.26