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Review

Systemic Gamification Theory (SGT): A Holistic Model for Inclusive Gamified Digital Learning

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Abstract

Gamification has emerged as a powerful strategy in digital education, enhancing engagement, motivation, and learning outcomes. However, most research lacks theoretical grounding and often applies multiple and uncontextualized game elements, limiting its impact and replicability. To address these gaps, this study introduces a Systemic Gamification Theory (SGT)—a comprehensive, human-centered model for designing and evaluating inclusive and effective gamified educational environments. Sustained in Education, Human–Computer Interaction, and Psychology, SGT is structured around four core principles, emphasizing the importance of integrating game elements (1—Integration) into cohesive systems that generate emergent outcomes (2—Emergence) aligned synergistically (3—Synergy) with contextual needs (4—Context). The theory supports inclusivity by accounting for individual traits, situational dynamics, spatial settings, and cultural diversity. To operationalize SGT, we developed two tools: i. a set of 10 Heuristics to guide and analyze effective and inclusive gamification; and ii. a Framework for designing and evaluating gamified systems, as well as comparing research methods and outcomes across different contexts. These tools demonstrated how SGT enables robust, adaptive, and equitable gamified learning experiences. By advancing theoretical and practical development, SGT fosters a transformative approach to gamification, enriching multimedia learning through thoughtful system design and reflective evaluation practices.

Keywords: gamification; Human–Computer Interaction; education; digital learning; inclusion; diversity; design; evaluation

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1. Introduction

Gamification integrates game elements into non-gaming contexts, distinguishing it from traditional gameplay [1,2]. It is a powerful tool in multimedia learning, transforming digital education by enhancing motivation, emotions, and cognitive processes [3–5]. Gamification fosters innovative teaching methods, encouraging students to learn more dynamically and interactively [6]. Importantly, gamification transforms education by making traditional methods more interactive and engaging for teachers and students [7]. Integrating gamification boosts student engagement, motivation, and outcomes through dynamic teaching strategies [8]. As a teaching method, gamification supports multimedia learning by improving digital usability and content design [9]. However, research often combines multiple game elements without a clear theoretical foundation to guide their

selection, complicating the assessment of gamification's impact [10,11]. This highlights the need for theory-driven research to create a model that might clarify the influence of gamification on learning and reduce study heterogeneity [12], prompting us to develop a theoretical model aimed at guiding the design and assessment of educational gamification.

To develop the theoretical model, we adopted a holistic and inclusive approach, aiming to move gamification research beyond basic game element descriptions toward context-specific strategies that support meaningful experiences and motivate individuals to engage across diverse conditions [13]. Gamification outcomes are shaped by the interplay of individual characteristics and surrounding environments, since aspects like cultural background, gender, and age influence personal preferences, while gaming behavior and player typologies further determine how people engage with gamified experiences [14–16]. Gamification provides a complementary strategy to the Universal Design for Learning (UDL), supporting diversity and inclusion by addressing diverse learner needs and enhancing accessibility through inclusive game-based features [17]. Gamification has emerged as a promising tool to promote equity, diversity, and inclusion, supporting fair opportunities, valuing individual differences, and ensuring access for marginalized groups, as part of broader efforts to create environments where everyone can reach their full potential [18]. For example, gamification has been applied as a teaching strategy to support learning and to develop behavioral and social skills in individuals with autism [19]. Gamified programs can support autistic individuals by offering a predictable, structured, and personalized learning environment—adaptable to different levels of the autism spectrum—with repetitive tasks, reduced social demands, minimal distractions, visual aids, and clear, concise audio instructions [20]. Thus, through personalized and adaptive environments, gamification can facilitate the effective implementation of inclusive teaching practices [21] by dynamically adjusting game challenges according to individual performance, modifying content, difficulty, and feedback in real time [22]. As gamification accounts for individual and contextual factors, it is essential to prioritize individual differences, with collaboration between educators, developers, researchers, and parents being crucial to create optimal inclusive strategies for diverse learners [23]. In order to accomplish this, it is important to consider diversity factors, like gender, age, disabilities, disorders, language, sexual orientation, and culture [18].

Therefore, if game elements are combined without a clear theoretical foundation [10,11] and gamification outcomes depend on contextual factors that vary across studies and real-world applications [14–16], the replicability of the results reduces due to differing game element choices and settings, hindering both the predictability and credibility of a scientific finding [24]. Recognizing these gaps concerning the need for theory-driven research and individual and contextual diversity in gamification, our study aims to answer the following question: "How can the selection of game elements tailored to specific contextual factors enhance the effectiveness and replicability of gamification in digital inclusive education?".

To answer this question, we propose the Systemic Gamification Theory (SGT) as a comprehensive model for inclusive and effective digital learning. First, we will present the insights that inspired SGT, based on existing gamification research results. Subsequently, we will put forward a literature review supporting the theory formulation through key relevant scientific fields for learning processes—Education, Human–Computer Interaction (HCI), and Psychology. Finally, we detail the principles and functioning of SGT, explaining how it can be applied to strengthen and advance digital education environments.

2. Theoretical Foundation

2.1. Early Insights

Limited research has directly compared isolated versus combined game elements, with some existing evidence suggesting that incorporating multiple elements tends to enhance motivation and cognitive outcomes [10,25,26], supported by findings showing that their combination fosters a more immersive, game-like experience [27]. To further investigate that context, previous research [28], designed based on a validated study protocol [29,30], analyzed the impact of gamification in education, investigating how individual and combined game elements (e.g., points, badges, and challenges) influenced cognition, emotion, and motivation through a randomized controlled trial (RCT), using a developed digital gamified platform. Following established research guidelines (CONSORT, Cochrane Collaboration, EVAT©) [31–34] and using participant characteristics—sociodemographics (age, gender, marital status, education, and nationality), game habits, and player traits—as control variables to ensure group homogeneity, the findings showed that the combination of the three game elements significantly improved learning outcomes compared to the group without gamification. This may be attributed to the combined game elements offering a more engaging experience, effectively linking goal-setting with feedback [35], and blending internal and external motivational drivers [36]. Conversely, the badge-only group increased cognitive load without enhancing performance, indicating the risks of using game elements in isolation. This may have occurred because gamification must align pedagogy with design, as cognitive load increases with unnecessary learning demands [37]. Also, the findings suggested that badges were not effectively designed, lacking clear goal criteria [38] and context-relevant visuals [39], making their meaning unclear and adding to the cognitive burden. Thus, according to the study [28], the findings highlighted that gamification's effectiveness lies not in the number of elements used, but in how well they are aligned with the pedagogical context and instructional design—pointing to the need for a theory that addresses this relationship while being grounded in key scientific fields related to learning. Considering that scenario, we built the SGT upon an existing theory related to gamification in learning contexts, with the goal of expanding and complementing it, as discussed below.

2.2. Education and Gamified Learning

Gamification in education, whether through gamified or game-based learning, focuses on leveraging entertainment value to enhance learning, and Gamified Learning Theory (GLT) and the expanded Gamification Science (GS) framework are relevant and central to this approach [12,40]. GLT defines gamification as the use of game attributes to indirectly influence learning by triggering behaviors and attitudes that mediate or moderate the impact of game elements on learning outcomes [41]. GS is an updated, refined model that positions game elements as predictors, psychological states and behaviors as mediators, and context as a moderator, providing a structured framework for guiding gamification research [42]. Both previous theories advocate for a rigorous, experimental approach in which individual game elements are purposefully assigned and tested to isolate their effects, avoiding the common but problematic practice of bundling multiple elements, which can compromise internal validity and obscure which specific components drive outcomes, thus limiting both theoretical insight and practical application. GLT and GS are frequently employed within gamification research, as evidenced by multiple studies [43–46]. A recent systematic review indicates that the GLT has emerged as a promising theoretical framework, offering substantial utility for e-learning designers in the identification and selection of appropriate game elements for integration within educational and training contexts [47], leading us to choose these theories as the foundational theory for our theoretical construct. Building on

the foundations of GLT and GS, our new theory (SGT) complements rather than replaces these theories. While embracing their rigorous research approach and focusing on the predictors, mediators, and moderators of gamification effects, SGT adds a distinct perspective. As demonstrated in the previous section, prior research [28] showed that the effectiveness of gamification depends less on the number of elements used and more on their alignment with the pedagogical context and instructional design. Therefore, while the isolated effects proposed by GLT and GS may be valuable for research by allowing the examination of individual game elements, they do not accurately represent how gamification practically functions in real-world educational settings. Thus, rather than isolating components, SGT views each set of elements as a singular configuration with emergent properties, producing outcomes that differ from individual elements, and emphasizing the unique impact of their systemic interaction by considering key aspects of HCI.

2.3. Human–Computer Interaction, Human-Centered Design, and User Experience

The field of HCI plays a crucial role in shaping the design and development of educational tools and digital mental health solutions, aiming to enhance usability, reduce costs, boost adaptability, and increase the perceived value for users [48,49]. Embedded within HCI, the Human-Centered Design (HCD) approach relies on iterative processes that actively involve users to better understand their needs, habits, and preferences, leading to solutions that are not only functional but also efficient and user-friendly, with a strong focus on empathy—an essential factor for education and healthcare applications [50,51]. Central to HCD is creating a positive User Experience (UX), and gamification builds upon this by moving beyond basic technical functionality to enrich the overall experience, taking into account the user's environment, functional goals, social interactions, and emotional responses when engaging with digital platforms [52]. All these concepts aim to meet user needs through direct engagement to create positive, accessible experiences that embrace human diversity by considering an inclusive design for varied perspectives and conditions (e.g., such as disabled people) [53]. Additionally, in HCI, heuristic evaluation is a method for identifying system design and development issues within an iterative design process, and it is widely used due to its low cost, minimal planning requirements, ease of use, and applicability in both early development and evaluation phases, supporting system improvement and refinement [54,55]. By integrating HCI, HCD, and UX principles into our theoretical model, we aimed to sustain SGT in digital design and development and to create a heuristic evaluation, while emphasizing the psychological aspects of the human behind the user and their interaction with the gamified learning experience as a whole complex dynamic between individual conditions and the environment.

2.4. Psychology and Gestalt

Among various psychological theories, Gestalt Theory sees perception as a holistic process, emphasizing meaningful organization and introspective problem-solving in education by presenting all aspects of a problem to spark curiosity, encourage discovery, and help learners explore relationships and build solutions [56]. Gestalt Theory emphasizes that a whole is not just greater than the sum of its parts but fundamentally distinct from them [57,58]. Gestalt theory outlines eight key principles of perceptual grouping and organization, all of which illustrate how we perceive complex stimuli into unified, meaningful wholes: (1) proximity, where elements close together are seen as a group; (2) similarity, where elements alike in color, size, or orientation are grouped; (3) common fate, where elements moving in the same direction are perceived as related; (4) symmetry, which leads us to group mirror-image shapes together; (5) parallelism, where parallel lines or shapes are seen as part of a whole; (6) continuity, where intersecting elements are perceived as

continuous lines rather than disconnected angles; (7) closure, where the mind fills in gaps to perceive complete, closed figures; and (8) figure–ground, where the visual system distinguishes a focused object (figure) from its surrounding context (background) [59,60]. Gestalt principles are extensively applied in design for their focus on perception, emphasizing how the relationships and synergy among elements create a unified, holistic experience within interfaces and systems [61,62]. The Gestalt-based design method fosters the synergy between internal system creation and external real-world analysis, aligning user behavior with intuitive system and interface design—an approach that is essential for designing an inclusive, human-centric educational technology [63]. Grounded in Gestalt principles, our approach sought to reinforce SGT by promoting a cohesive user experience—one that unifies diverse sensory elements (such as visual sensory elements) within the system's architecture while emphasizing the continuous interplay between users and technology.

2.5. Interdisciplinary Foundations and General System Theory

General System Theory (GST) was first introduced by Ludwig von Bertalanffy [64] and was developed to foster interdisciplinary dialogue, advance scientific discoveries in fields with underdeveloped theories, and unify diverse areas of knowledge [65,66]. GST has been applied across a variety of scientific fields, such as physics, chemistry, biology, sociology, economics, and technology, to promote a holistic understanding of phenomena and counter-reductionist approaches [67]. Recent adaptations of GST in education and information science incorporate its principles into learning experiences through educational technology and systems thinking [68,69]. According to GST, although a system can be divided structurally, it operates as a unified whole, with emergent properties—distinct qualities that result from the dynamic synergy of its components and vanish when elements are separated from the system [65,70]. GST is a unified theory for complex systems that spans micro- to macro-scales within environments, shifting focus from objects to relationships, quantity to quality, components to pattern, closed to open systems, and linear to nonlinear performance [71]. Inspired by this theory, we proposed a new perspective in SGT that highlights its interdisciplinarity and promotes the integration of system elements, where emergence and synergy shape a unified whole within an open system that interacts dynamically with its environment beyond linear processes.

3. The Systemic Gamification Theory (SGT)

The SGT was developed from early empirical insights through a subjectivist inductive approach (from data to theory), enhanced by existing theories, leading to a logically structured theoretical model, comprising interconnected concepts and premises, designed as a tool to guide future research [72]. As stated before, our first insight came from prior empirical research that indicated that well-integrated combinations of game elements (points, badges, and challenges) enhanced learning outcomes, whereas badges' use of a single game element only increased cognitive load [28]—highlighting that the impact of combined elements is not merely additive, as the integrated setup improved learning without adding cognitive load. With that insight, grounded in the idea that different game elements distinctly affect psychological states, behavior, and learning—as argued by GLT and GS [41,42]—the need to consider human factors in HCI design [50,51], the Gestalt principle that a gamified system is more than the sum of its parts [57,58], and the holistic, interdisciplinary, and systemic perspective emphasized by GST [71], we formulated the SGT, integrating empirical data with concepts from these foundational theories and related scientific fields. Thus, SGT was developed to align gamification design principles with the specific context of their application by guiding the selection of game elements through a set of structured principles. The principles were developed to address a notable gap in

the existing literature concerning the lack of a clear theoretical foundation for integrating game elements [10,11] and the critical necessity of accounting for contextual factors in gamification analysis, given that its outcomes were found to be significantly contingent upon such variables across diverse studies and real-world applications [14–16]. This led to the development of principles that consider the critical importance of understanding how integrating game elements may have different features and how they might interact in real-world scenarios.

The SGT focuses on four key principles:

(1) Integration: emphasizing the interconnected relationships among game elements;
(2) Emergence: recognizing the unique properties that arise when elements interact as a system;
(3) Synergy: where the combined effect of elements exceeds their isolated contributions;
(4) Context: which shapes and is shaped by the synergistic dynamics of the system, contemplating individual, situational, spatial, and cultural aspects.

This model enables a better understanding, comparison, and application of entire gamification systems rather than isolated elements, identifying key success factors and designing effective and inclusive interventions. Here, we first present the concepts underlying the theoretical model, followed by two practical tools—the SGT Heuristics and the SGT Framework—designed to offer actionable guidance for educational gamification and to serve as practical resources for educators, researchers, and instructional designers. While heuristics are exploratory and practical tools that act as mental shortcuts or experiential guidelines for quick decision-making and the evaluation of system design, frameworks are more rigorous and structured models that offer a systematic approach with defined steps for addressing complex problems [73,74]. Thus, in SGT, they complement each other: the Heuristics offer a broader perspective for guiding system design, development, and evaluation, while the Framework provides a more detailed structure to describe and connect each component of these processes. Figure 1 illustrates the four principles of SGT.

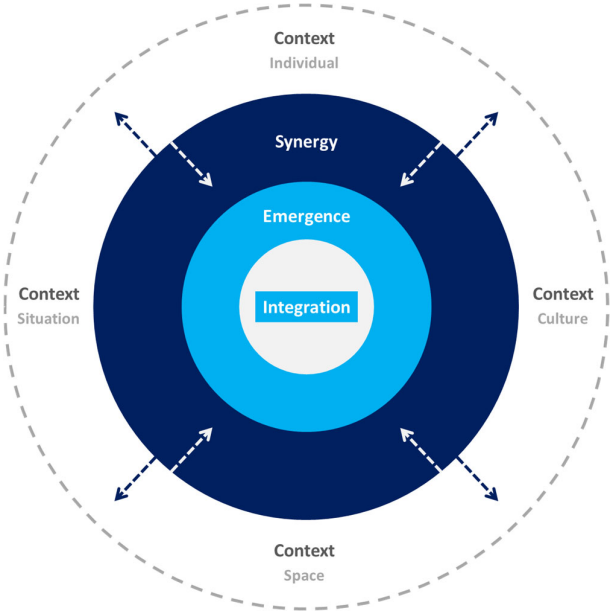

Figure 1. Systemic Gamification Theory principles.

Integration involves combining multiple game elements, which are core components typical of games used in gamification that provide structure by defining rules and goals, and aim to fulfill psychological needs such as competence, autonomy, and relatedness

through mechanisms like rewards, progress tracking, customization, choice, and social interaction [75]. Some studies aim to systematize and categorize the various game elements used in gamification, such as the use of rewards, progress, challenges, badges, and several other elements [76,77]. Nonetheless, games can be understood as multimedia art and an aesthetic expression of interactive systems, creating meaning through player interaction and rule-based possibilities [78]. Thus, since game elements are fundamental components of games, they result from creative processes and allow for vast flexibility and an endless range of possible idealizations and configurations. The first core concept of SGT involves selecting or designing game elements and integrating them into a distinct configuration that gives rise to an emergent effect, distinct from the sum of individual game elements.

Emergence, a concept found across various sciences, refers to the spontaneous development of new effects through the interaction of components, shaped by ongoing activity, external influences, and evolving insights, making it a dynamic, exploratory process that embraces unpredictability, continuous change, and unexpected outcomes [79]. Gamification research frequently merges multiple game elements, making it difficult to isolate their individual effects and compare interventions due to differing configurations [10,14]. Unlike GLT and GS, which promote testing individual game elements in isolation [41,42], we advocate for integrating elements into unique configurations, as different settings may give rise to distinct emergent properties. For example, we hypothesize that different combinations of game elements may lead to distinct outcomes—for instance, "points" combined with "badges" may result in outcome X, while "challenges" with "rewards" may produce outcome Y, and the use of "avatar" alone may lead to outcome Z. However, this does not mean that using "points," "badges," "challenges," and "rewards" together will result in outcome XY, nor that combining "challenges" and "avatar" will generate an outcome equivalent to $Y/2 + Z$. Consequently, comparing isolated elements across interventions may be unrealistic, as combinations can give rise to emergent properties not represented by the sum of individual effects. To ensure meaningful comparisons, it is essential to assess the holistic gamification process, focusing on the unique integration of elements and their specific synergy with the surrounding context.

Synergy is a concept applied across several fields—from biology to economics—referring to the phenomenon where the combined effect of elements surpasses the sum of their individual effects when acting independently within a system [80]. Similarly to how individuals interact with each other within particular social contexts [81], they also engage with computers in ways shaped by specific situations and environments [82]. In this model, synergy refers to the dynamic interaction between two interconnected parts: on one side, the integrated and emergent nature of gamification, which forms a distinct configuration greater than the sum of its elements; and on the other, the context in which it is applied, encompassing individuals, situations, environments, and cultural factors. The interaction between these two parts produces a unique property that cannot be reduced to either side in isolation and may vary if the gamification design or contextual conditions are modified. Synergy is what unifies both parts, giving meaning to the interaction between the system and the context. In this phase, it is essential to systematize diverse users' profiles based on their full context, linking how the gamified system could interact with them—for instance, by using personas from the design thinking approach (i.e., fictional, generalized user representations that offer a broad perspective of the problem by capturing interests, behaviors, needs, and values) [83], different player traits or types [15,16], or the different motivational profiles of learners [84].

Context is a central concept in both education and gamification, where pragmatics explains how learning adapts across settings [85], and individual traits and cultural factors shape user preferences and motivation [14]. To address the multifaceted nature of context, we divided it into four interrelated aspects: Individuals, Situations, Spaces, and Culture.

Individuals are socially formed and contextually situated, shaped by a complex, evolving combination of dispositions and experiences across multiple social environments, embodying both personal singularity and collective influences [86]. Situations can be understood as interactions occurring within specific temporal boundaries in spaces [87]. Spaces can be seen as dynamic environments shaped by social practices and interactions, as fluid territories of meaning-making that can be digital, physical, or both, where blurred online–offline boundaries create multilayered contexts for constructing experience [88]. Culture can be defined as a dynamic system of meaning-making shaped through the interplay between social practices, identifications, and power structures, understood holistically within their historical, political, and relational environments [89].

To illustrate a first simple application of SGT principles, we considered the previously discussed study, focused on the impact of gamification in education using individual and combined game elements (e.g., points, badges, and challenges) through an RCT [28], which is represented in Figure 2. This figure represents how the configuration of the three game elements was integrated into a gamified digital learning platform, producing emergent properties that interacted synergistically within the context of a classroom with individual computers. Through this dynamic, the RCT showed that the game elements of points, badges, and challenges influenced students in educational settings, ultimately contributing to improved learning outcomes.

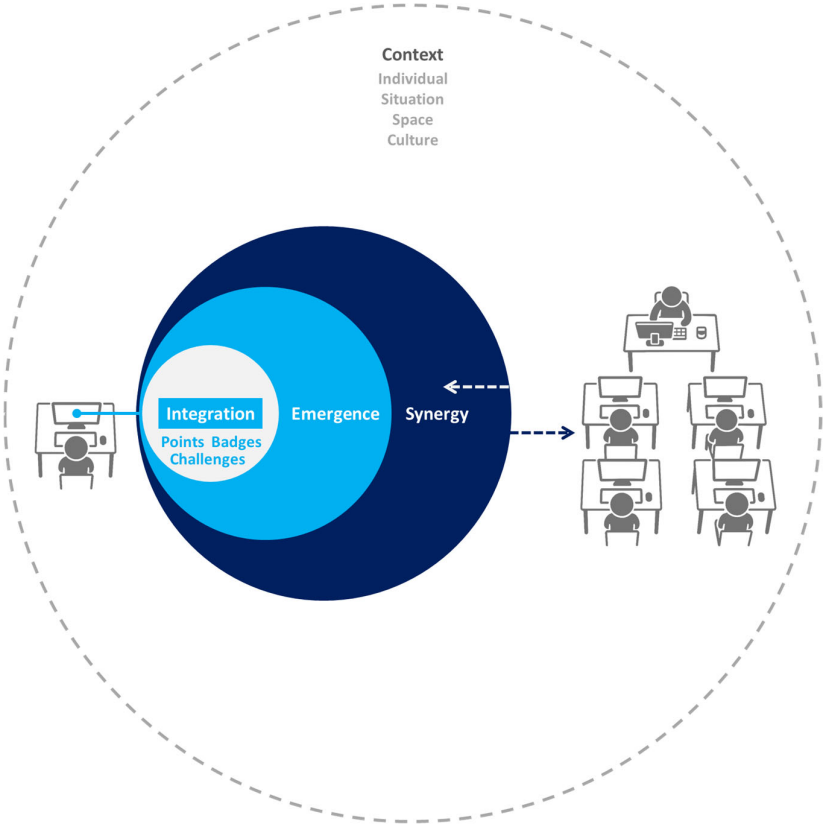

Figure 2. Illustration of Systemic Gamification Theory principles.

The SGT is seen as a methodological tool that enriches education by addressing specific contextual conditions in learning environments. This requires analyzing cultural, spatial, situational, and individual dimensions, and then designing an integrated system of game elements that produces emergent effects aligned with those needs. The resulting synergy between system and context is intended to motivate learners to achieve educational goals. SGT does not replace existing pedagogies or theories; it adds a meaningful, context-sensitive

layer. Thus, gamification under SGT must embed equity, diversity, and inclusion to ensure all individuals are integrated within the system. This involves addressing contextual educational factors linked to participants' mental and physical health, including gender and age (to foster non-stereotypical environments); disabilities, disorders, and atypical conditions (e.g., visual or hearing impairments); language (to support comprehension and linguistic adaptability); sexual orientation (to enhance social connection and health awareness); and experiences of exclusion (to promote cultural integration) [18].

To illustrate this need for contextual understanding, e-learning environments can increase fatigue in deaf and hard-of-hearing individuals due to their simultaneous stimuli, limited interactivity, and poorly structured content presentation on the screen display [90]. Although early deafness affects visuospatial attention, studies show that video game training can improve peripheral response control by helping users manage relevant and irrelevant visual stimuli [91]. Therefore, gamification—the use of elements from games [2]—should use game design to balance screen displays to reduce eventual cognitive overload, preventing fatigue and improving the learning experiences. For instance, game elements—such as animated prompts, choices, feedback, and rewards—in vocabulary learning games for deaf and hard-of-hearing students with sign-supported instructions and consistent visuals have led to high ratings for attention, relevance, confidence, and satisfaction during the educational experience [92]. Considering another example, individuals with Attention Deficit/Hyperactivity Disorder (ADHD) often experience challenges in academic settings due to symptoms such as inattentiveness, impulsivity, and hyperactivity [93]. Research has indicated that incorporating gamified media into educational activities can help improve focus and concentration among students with ADHD [94]. Enhancing digital environments with a broad range of game elements—such as goals, levels, points, and progression—may foster greater engagement and motivation, potentially supporting better symptom regulation in learners with ADHD [95].

Since SGT was developed for digital learning contexts, it can be applied to any educational course, level, and setting involving digital environments, including fully online or hybrid courses, encompassing socio-digital learning spaces that integrate digital, mobile, virtual, online, social, and physical components to support interactive and inclusive learning experiences [96]. Considering digital learning environments, SGT applies to both synchronous and asynchronous formats. Synchronous learning involves real-time interaction between teachers and students on a digital platform, while asynchronous learning offers flexibility, with materials that are accessible at different times and locations [97]. Finally, educational gamification can be classified as structural gamification—which uses game elements to gamify the learning process without changing the content, such as enhancing the educational software—and content gamification—which embeds game-like features such as narrative and exploration to reshape the material for specific goals, often as a customized design [11]. SGT supports both approaches, allowing for the adaptation of structure or content based on the educational context and pedagogical needs.

That said, we begin by presenting the Heuristics, which offer broad guidance for inclusive gamification, followed by the Framework, which provides a more structured and systematic approach to gamified systems.

3.1. Heuristics for Guiding and Supporting Inclusive Gamification

The SGT was developed as a practical model to support the design of inclusive and effective gamification interventions in educational contexts. Sustained by its four core principles, we formulated the 10 Heuristics of SGT, intended to guide the implementation of gamified systems with a critical and reflective approach, as introduced in Table 1. Heuristic development can draw from design principles, literature reviews of prior theories, and

existing heuristics [98]. Thus, the SGT Heuristics were inspired by the four core principles of SGT, which were developed based on prior theories related to GLT, GS, HCI, Gestalt Psychology, and GST, specifically addressing the literature's lack of a theoretical basis for integrating game elements and the necessity of considering contextual factors in gamification analysis. While SGT principles and theoretical foundations have been discussed earlier, it is important now to present existing gamification and usability heuristics that also informed our proposed model. The SGT Heuristics were based on established recommendations for designing and evaluating educational games through heuristics, focusing on the system development and user interaction phases, encompassing usability, pedagogy, content, multimedia, gameplay, aesthetics, social interaction, and user motivation [99]. The Heuristics were formulated to answer five key questions (i.e., "What", "Why", "When", "Where", and "How") to evaluate a proper scientific method [100] and to verify the rationale, scope, context, and modality in gamification research [101]. Considering contextual factors to answer the "Why", "When", and "Where questions, SGT Heuristics 1, 2, 3, and 4 were inspired by gamification heuristics aimed at guiding design application, emphasizing the alignment of the system with real-world contexts, incorporating inclusive design principles, and fostering active user engagement [102,103]. Regarding the selection of game elements for gamification application to answer the "What?" question, SGT Heuristics 5, 6, 7, and 8 were sustained by a gamification heuristic defining 28 game design principles to help specialists assess and identify design gaps, addressing extrinsic and intrinsic motivation along with context-dependent engagement for gameful experiences [104,105], which was later extended by considering gamification as a social phenomenon and incorporating cultural dimensions into the evaluation of motivational and contextual variables [106]. Finally, related to usability aspects of the digital system, aiming to answer the "How" question, SGT Heuristics numbers 9 and 10 were drawn from Jakob Nielsen's 10 Usability Heuristics, a well-known HCI framework for identifying usability issues in system development, which supports improved interface navigation and applies to gamification design [54,55,107].

Based on the four principles (Integration, Emergence, Synergy, and Context), prior theories, and previous heuristics, the 10 SGT Heuristics were formulated for meaningful application, with each requiring careful consideration to ensure alignment with inclusive practices. The SGT Heuristics adopts a top-down methodology—beginning with a deep understanding of the context and progressing toward the system's configuration—emphasizing its human-centered and context-aware orientation. Table 1 presents the 10 proposed Heuristics.

Table 1. Systemic Gamification Theory Heuristics.

Heuristics #	Definition	Description
1	Contextual Analysis and Alignment	Begin with a thorough analysis of the educational context—individual, situational, spatial, and cultural—to ensure that gamification aligns with specific learning environments.
2	Pedagogical Complementarity	Use gamification as a complementary layer to existing pedagogical strategies, enhancing rather than replacing instructional methods.
3	Inclusive and Accessible Design	Address diversity and inclusion by designing systems that support all users, accounting for mental and physical health, language, gender, age, disabilities, and social integration.
4	Equity-Centered Gamification	Ensure the gamified system supports social justice goals by promoting fair access, participation, and representation within learning environments.

Table 1. *Cont.*

Heuristics #	Definition	Description
5	Motivation Across Contextual Scales	Support learner motivation by addressing both micro-level (individual interaction) and macro-level (cultural and institutional) influences, considering intrinsic and extrinsic motivational aspects.
6	Meaningful Integration of Game Elements	Select and combine game elements thoughtfully to create a unique and coherent configuration tailored to contextual needs.
7	Emergence and Systemic Evaluation	Recognize that the integrated system may produce emergent effects that differ from the sum of its parts; evaluate the system as a whole, not just its components.
8	Synergistic Design for Different Profiles	Design for synergy, where the interaction between gamification and context produces added value for different users' profiles, considering the system as a whole that is greater than its isolated elements.
9	Adaptive and Iterative Configuration	Continuously refine the gamified system through feedback loops, adapting to evolving learner needs and contextual shifts, considering usability and user experience aspects.
10	Aesthetic and Expressive Coherence	Treat game elements as creative and aesthetic tools that contribute to user interaction and a meaningful experience.

3.2. Framework for Structuring and Analyzing Inclusive Gamification

As stated before, while heuristics are more practical, experience-based shortcuts for quick design and evaluation, frameworks provide more structured, systematic models with defined steps for dealing with complex problems [73,74]. As the literature emphasizes that selecting appropriate game elements is key to successful gamification and highlights the need for more mature, usable frameworks, given that many designers still rely on custom-built approaches [108], we propose the SGT Framework as a potential solution for this scenario. SGT is conceived as a theoretical framework offering a simplified mapping approach to designing and comparing different gamification interventions. The Framework was developed to design and evaluate gamified systems, as well as to compare research methods and outcomes. Based on its four core principles, we developed a Framework to systematize a way of designing gamified learning and to better understand the conditions under which gamification is effective or ineffective. By enabling systematic comparisons across varied educational environments and disciplinary contexts, the Framework supports more robust analyses, clarifying under which circumstances gamification has an impact. Therefore, we advocate that gamification is not just the addition of several game elements.

The Framework is meant to act as a detailed tool that helps to connect and organize the key components involved in gamification design. It supports the careful selection of game elements (Integration) based on how they work together (Emergence), aiming to create unique outcomes that align meaningfully (Synergy) with the specific context in which they are used (Context). To begin with, all game elements should be identified. Next, these elements should be sorted into distinct groups based on their motivational goals. When it comes to understanding motivation, there are several models available, but we suggest using Self-Determination Theory (SDT), which is widely applied in gamification research [12,109,110]. SDT views motivation as a spectrum that ranges from no motivation to extrinsic and intrinsic motivation, depending on how well external influences match a person's internal needs [111,112]. The theory focuses on intrinsic motivation as doing something out of curiosity or enjoyment, driven by a sense of autonomy, competence, and connection with others, while extrinsic motivation comes from external rewards or the desire to avoid negative outcomes [113]. Gamification often relies on SDT, shaping behavior by using game elements that tap into intrinsic motivations (like tracking progress) or extrinsic ones (like offering rewards) [36]. However, it is important to note that external

rewards can both help and hurt intrinsic motivation. When rewards feel controlling, they may reduce a person's sense of ownership, lowering motivation overall [114]. Still, for people who are not naturally motivated, external rewards can be effective in increasing their motivation [115]. Because of this, designers should aim to include both intrinsic and extrinsic motivators within each group of game elements to reach a broader range of users, supporting those who are already intrinsically motivated while also encouraging those who may need more external reinforcement. Then, after selecting the game elements and grouping them into objectives and motivational purposes, the next step is to show how these elements interact with the real-world through inputs and outputs for different users' profiles, describing the conditions under which these interactions are appropriate while taking into account the specific context where the gamified system will be applied.

While the complexity of human and social variables in SGT means some bias is inevitable, the Framework helps educators, instructors, and researchers identify, assess, and address these biases consciously during the design, implementation, evaluation, or replication of interventions. Table 2 illustrates the Framework.

Table 2. Systemic Gamification Theory Framework.

Principle	Description
Integration	List all the game elements that are being used and describe their features.
Emergence	Describe the interactions among these elements and the main objective of the whole gamification design, together with the motivational purposes of each interaction. Group the previous game elements integration.
Synergy	Highlight the interaction between the gamified system and its context, listing the inputs and outputs of the system that are being gamified, considering different profiles of users related to contextual factors. Relate this interaction between the gamified system and its context with the previous grouping of game elements.
Context	Describe the cultural, spatial, situational, and individual factors within the educational context that shape and are shaped by the gamified experience. Emphasize understanding of the specific environment and users. Use these data to formulate the previous profiles of users.

4. Designing and Evaluating Gamification with SGT

A review of personalized gamification identified several research needs: (1) empirical comparisons between generalized and tailored gamification; (2) qualitative user-centered studies; (3) approaches that include contextual factors; (4) reliance on a clear, comprehensive set of game elements; and (5) conditions to improve research reproducibility [116]. Addressing these gaps, the SGT offers structured tools to support empirical studies grounded in user and contextual data, guiding the purposeful selection of game elements through a replicable methodology. Thus, SGT supports the design and evaluation of gamification in educational settings and research, offering educators, researchers, and designers a path to develop inclusive, effective strategies. Here, we first explore how the SGT Heuristics and Framework can be applied to support gamification design, followed by how these tools can be applied to evaluate gamification strategies within educational technologies and research contexts.

4.1. Heuristics and Framework for Gamification Design and Development

The Heuristics and Framework act as complementary tools for designing and developing gamified systems. We recommend starting with the Heuristics to guide brainstorming and design thinking for creating and improving iterative solutions for a specific need [117], beginning with a more deductive (top-down) approach [118], as the Heuristics offer a broader perspective to identify and refine core ideas. Once the initial concepts are shaped,

the Framework should be applied to provide a more detailed structure, helping to describe and connect each component of the gamified solution. After applying both tools, we recommend using them together and iteratively, allowing for the continuous refinement of the solution until a final proposal is reached.

Following this proposed order, firstly, Table 3 presents the Heuristics with an illustrative example of a new gamified digital course design, based on a hypothetical online university course that serves as a prototype scenario for applying SGT in design practice. The hypothetical course was based on a fully online format with both synchronous and asynchronous video lectures and exercises, incorporating structural and content gamification to reflect the complete range of gamified learning proposed in SGT. We chose to illustrate a fully online course rather than a hybrid model, as including physical school settings would introduce numerous context-specific variables that would increase complexity for this prototype illustration purpose, such as classroom layout, available equipment, internet access, and smartphone policies. We chose to illustrate the course using one discipline, focused on the United Nations Sustainable Development Goals (SDGs), designed for an undergraduate program in Education, as higher education institutions play a key role in advancing the SDGs [119,120], particularly those related to inclusive, equitable, and quality education—central themes of this research. Nevertheless, given the flexibility of SGT, it can be further applied to any course or educational level, as long as a proper contextual analysis is conducted—an essential step in the SGT approach.

This hypothetical course comprises a culturally diverse cohort of students, including deaf or hard-of-hearing participants, autistic participants, people with ADHD, and neurotypical participants. We chose these specific inclusive conditions as the movement toward inclusive public education for deaf and hard-of-hearing students has gained momentum over the past fifty years. This presents challenges as their inclusion relies on accessible settings tailored to their language and communication needs, emphasizing the importance of designing educational systems that support individual needs and aim for success for all learners [121]. Also, there is a lack of adequate support for creating inclusive school environments for students with autism spectrum disorder [122]. As the number of students with autism spectrum disorder in general education classrooms has grown in recent decades, educators must adapt their practices, and schools must provide appropriate resources, including technology, to support their education [123]. Finally, over the last 20 years, there has been a significant rise in interventions targeting children and adolescents with ADHD [124], with gamification emerging as a popular approach due to its potential to improve attention control and enhance task engagement [125,126]. Thus, we considered a hypothetical course involving neurotypical, deaf and hard-of-hearing, and autistic students, as well as people with ADHD, given their specific challenges in inclusive education and the prior use of gamification as a tool to support these groups, as previously discussed [20,92,124]. However, this model can be extended to a broad range of conditions involving diversity factors such as gender, age, disabilities, disorders (like depression and anxiety), language, sexual orientation, and cultural background [18,127]—each of which merits further investigation with the SGT.

Table 3. Application of Systemic Gamification Theory Heuristics.

Heuristics #	Definition	Example Application (Online University Course)	Examples of Game Elements and Practical Design
1	Contextual Analysis and Alignment	Analyze students' learning habits and time zones to adapt the module schedule and activities.	Timezone-adaptive challenges and asynchronous activities.
2	Pedagogical Complementarity	Gamify activities to complement lectures and group discussions rather than replace them.	Progress points based on assessments and group quests.
3	Inclusive and Accessible Design	Provide captions for all videos, ensure screen-reader compatibility, and include customizable visual instructions and notifications for deaf and/or autistic students, and people with ADHD (since participants with these profiles are included in the hypothetical course).	Closed captions, image-based instructions, and text-to-speech tools.
4	Equity-Centered Gamification	Design missions that celebrate cultural diversity and allow all students to contribute equally, regardless of ability.	Quizzes about different cultures' features, fostering cultural understanding and integration.
5	Motivation Across Contextual Scales	Include goal-setting dashboards and reflection tools that help students align personal goals with the course outcomes.	Personalized learning paths, goal-tracking meters, and digital journals.
6	Meaningful Integration of Game Elements	Combine all game elements through a narrative that aligns all interactions in a meaningful way with avatars to represent student diversity.	Narrative-based modules and avatars with cultural and sensory customization allow players to immerse themselves in diverse cultural stories while personalizing their avatars with culturally relevant features, fostering inclusivity by enabling users to explore and blend different cultural backgrounds through interactive and customizable experiences.
7	Emergence and Systemic Evaluation	Monitor the combined effects of all game elements to ensure that engagement is due to the system's design, not just one popular element.	Analytics dashboard tracking user engagement across various features and activities within the digital platform and course, including metrics such as completed tasks and time spent on different screens.
8	Synergistic Design for Different Profiles	Create a system where challenges, feedback, points, narrative, and possible team formations can enhance both learning and social integration.	Cross-cultural quests, peer-recognition points, avatars, and guild formation allow students to create teams, collaborate on activities, and interact with one another directly within the platform through a narrative.
9	Adaptive and Iterative Configuration	Allow automated feedback loops where difficulty and rewards are dynamically adjusted by artificial intelligence based on collective input over time. Permit privacy configuration for status visibility.	Dynamic challenge levels, unlockable rewards based on feedback, automated difficulty adjustments of questions, and privacy configuration.
10	Aesthetic and Expressive Coherence	Use visually balanced interfaces, with a clear separation of primary learning tasks and secondary elements in screen display, consistent iconography, and personalized themes to reduce cognitive overload.	Minimalist user interface themes, icon-based navigation, and soothing color palettes.

Additionally, we assumed a previous use of an established player traits questionnaire administered to the hypothetical participants of the digital course based on a questionnaire that has been widely validated with a large sample of respondents [15,16,128]. This questionnaire was designed to identify individual gaming preferences and motivational tendencies. It includes 25 items rated on a 7-point Likert scale (from strongly disagree to strongly agree), producing scores across five distinct player orientations—Social, Aesthetic, Narrative, Challenge, and Goal—each ranging from 0 to 1. According to the authors of the questionnaire [15,16], individuals with a Social Orientation enjoy multiplayer or collaborative environments, valuing interpersonal connections. The Aesthetic Orientation reflects an appreciation for artistic elements in games, such as visuals and sound, driven by autonomy and exploratory behaviors. Narrative-Oriented players tend to prefer rich storytelling and immersive plots, showing interest in unfolding narratives. The Challenge Orientation is marked by a desire for complex, high-difficulty tasks that fulfill competence needs. Finally, a Goal Orientation is defined by motivation to achieve tasks, complete missions, and track

measurable accomplishments. In the illustrative context of our hypothetical course, the most prominent player orientations among students were Social, Goal, and Narrative, providing valuable contextual insights for applying the SGT model effectively. It is important to highlight that this is merely an illustrative scenario, as different student cohorts may show varying dominant player traits, and other profiling instruments (e.g., personas from the design thinking approach [83]) can be used to categorize users in a gamified digital learning environment.

Secondly, to illustrate the application of the Framework after the Heuristics, we applied it to the same hypothetical online university course involving a culturally diverse student cohort, including deaf, autistic, and neurotypical learners, as well as students with ADHD. Also, the students were mostly Social, Goal, and Narrative-Oriented players. Tables 4–7 present the implementation of the proposed course.

As outlined in the Integration principle of SGT, the selection and creation of the game elements is an inherently creative process, allowing researchers and educators to design them much like a form of art. However, studies on tailored and personalized gamification have helped to systematize commonly used game elements, offering a structured perspective of how different elements can stimulate distinct forms of interaction within gamified experiences [76,77,129]. Drawing on these systematizations, we adapted selected elements for application in our hypothetical example, aiming to align them with the Heuristics and design strategies presented in Table 3. Accordingly, Table 4 outlines the game elements integrated into the proposed hypothetical gamified digital course.

Table 4. Integration.

Game Element	Brief Description
Avatar	Visual representation of the user in the system.
Challenges	Tasks designed to test skills or knowledge.
Dashboard	Interface showing progress and key metrics.
Digital Journal	Space for reflective writing and tracking learning.
Difficulty Adjustment	Allow users to navigate different challenge levels.
Privacy Configuration	Status can be changed to private or public.
Feedback	Information provided on performance or actions.
Group Quests	Collaborative tasks requiring teamwork.
Learning Paths	Structured sequence of content or tasks.
Narrative	Storyline guiding user engagement and context.
Peer-Recognition Points	Points awarded by peers for contributions.
Progress Points Based on Assessments	Scores reflecting performance on assessments.
Quizzes	Short assessments to check knowledge.
Unlockable Rewards	Incentives earned after meeting specific goals.

As highlighted in the Emergence principle, gamification frequently draws on SDT, influencing behavior through game elements that appeal to either intrinsic motivations or extrinsic incentives [36]. While extrinsic rewards can effectively boost engagement in less motivated individuals, they may diminish intrinsic motivation in others [114,115], making it essential to strike a balance. Thus, the selection of game elements was intentionally designed to generate emergent effects by combining features that support both intrinsic and extrinsic motivation, aiming to engage students across a spectrum of motivational

profiles. Table 5 presents the grouping of game elements, the expected interactions they encourage, and the corresponding type of motivation they aim to stimulate.

Table 5. Emergence.

Grouping	Game Elements	Interactions and Motivation
Progression and Performance Feedback	Progress points based on assessments/dashboard/feedback	These elements work together to track learner progression, reinforce accomplishments, and provide personalized, accessible feedback. Intrinsic motivation is related to competence, and extrinsic motivation is related to incentives, tied to external regulation.
Personalization and Identity	Difficulty adjustment/digital journal/learning paths/privacy configuration	Difficulty adjustment and learning paths let students navigate content at their own pace and challenge level, while a digital journal promotes reflective learning, helping students process information. User status visibility settings allow their status to be configured as either private or public. Intrinsic motivation is related to autonomy and competence, and extrinsic motivation is related to the feeling of internal pressure, tied to introjected regulation.
Collaboration and Social Dynamics	Group quests/peer-recognition points/unlockable rewards	These elements foster social motivation and community-building. Group quests promote collaboration, while peer recognition and unlockable rewards stimulate positive reinforcement. Intrinsic motivation is related to relatedness, and extrinsic motivation is related to incentives, tied to external regulation.
Challenge and Skill Development	Challenges/quizzes	These elements enhance engagement by challenging students to achieve structured goals and providing varied assessment types. Intrinsic motivation is related to competence, and extrinsic motivation is related to the feeling of internal pressure, tied to introjected regulation.
Ownership and Representation	Avatar/narrative	Avatars allow learners to represent themselves in inclusive, customizable ways, supporting identity expression across cultures, neurotypes, and accessibility needs. Narrative immerses users into a progressive storyline. Intrinsic motivation is related to curiosity and autonomy, and extrinsic motivation is related to the expression of self, tied to integrated regulation.

As emphasized before, the Synergy principle focuses on aligning the gamified system with student profiles to establish a meaningful connection between the system and its context. To illustrate, we categorized learners in the hypothetical course based on contextual factors. First, we grouped participants by neurotype, classifying deaf, autistic, and ADHD students as neurodiverse (ND) and the remaining students as neurotypical (NT). Then, using a player traits instrument [15,16,128], we further categorized students into three profile types, reflecting the most prevalent traits in our sample—Social, Goal, and Narrative Orientations. These categorizations serve only as an example, as actual profile creation depends on the available contextual data and may include more diverse variations. It is important to highlight that, while certain features were designed for specific profiles, they are not exclusive and can benefit other users unless restricted by system rules. Table 6 shows this application of the Synergy principle of SGT.

Table 6. Synergy.

User Behavior (Input)	Gamified Element (Output)	Game Elements Grouping	Target Profiles
Access the system	Learning Streak on Dashboard, Encouraging Feedback	Progression and Performance Feedback	ND and NT Goal Orientation
Choosing a preferred avatar	Avatar Customization, Narrative Integration	Ownership and Representation	ND and NT Narrative Orientation
Completing a module or lesson	Progress Points, Dashboard Update	Progression and Performance Feedback Challenge and Skill Development	ND and NT Goal Orientation
Scoring high on a quiz	Unlockable Rewards, Progress Points	Progression and Performance Feedback	ND and NT Goal Orientation
Completing a challenge	Challenges Badge, Feedback on Achievement	Challenge and Skill Development	ND and NT Goal Orientation
Writing in a digital journal	Feedback, Journal Progress Marker	Personalization and Identity	ND and NT Goal Orientation
Navigating a higher difficulty level and succeeding	Automatic Dynamic Difficulty Adjustment, Unlockable Reward, Progress Boost, Narrative Progress	Progression and Performance Feedback Challenge and Skill Development Ownership and Representation	ND and NT Goal and Narrative Orientation
Customizing the learning path based on preference	Dashboard Visualization, Feedback on Autonomy	Personalization and Identity	ND and NT Goal Orientation
Participating in a team quest	Peer-Recognition Points, Group Badge	Progression and Performance Feedback Challenge and Skill Development Collaboration and Social Dynamics	ND and NT Social Orientation
Asking a peer for help	Peer-Recognition Points	Collaboration and Social Dynamics	ND and NT Social Orientation
Helping a peer or contributing to the discussion	Peer-Recognition Points, Narrative shoutout	Progression and Performance Feedback Challenge and Skill Development Collaboration and Social Dynamics Ownership and Representation	ND and NT Social Orientation
Finishing a team assignment	Unlockable Rewards, Challenge Completion	Challenge and Skill Development Collaboration and Social Dynamics	ND and NT Goal and Social Orientation
Changing privacy settings	Private or Public Status Showing	Personalization and Identity	ND and NT Social Orientation
Using accessibility tools to complete a task	Feedback, Progress Tracking	Progression and Performance Feedback Ownership and Representation	ND Goal Orientation

Finally, the Context principle plays a central role in both education and gamification, as context accounts for how learning adjusts across environments and how individual traits and cultural influences shape user preferences and motivation [14,85]. Based on the hypothetical course, we developed a contextual scenario that incorporates the four dimensions of the principle—Individual, Situation, Space, and Culture—defining the structure in which the gamified digital course would take place. Table 7 presents these contextual descriptions, concluding the illustrative application of the SGT Framework for design purposes.

Table 7. Context.

Aspects	Description
Individual	The course has 28 students, aged between 19 and 36, with an average age of 24. The class includes 15 women, 11 men, and 2 non-binary students. Among the group are two deaf students who primarily use Brazilian Sign Language (Libras), two autistic students diagnosed with ASD Level 1, who prefer written instructions and quiet environments, and three students with ADHD. All students are undergraduates in their third year. Regarding their player traits, the students predominantly exhibit Social, Goal, and Narrative player orientations.
Situation	All students are enrolled in a mandatory elective that blends theoretical discussion with applied digital collaboration. The course runs from September to December, with weekly asynchronous modules released every Monday. There are two live sessions per month scheduled at 1:00 PM UTC to accommodate time zones. Students must complete four major assignments, complete biweekly quizzes, and participate in a cross-cultural project about diversity and education by Week 10. Students can choose to work individually or in groups, with activity difficulty, feedback, and rewards automatically adjusted based on the number of group members. Each week includes short video lectures, collaborative tasks in group forums, and personal reflection prompts. Deadlines are consistent (Fridays, 11:59 PM UTC), and student activity is tracked through the Moodle Learning Management System (LMS) v. 5.0 dashboard.
Space	The learning space is hosted on Moodle LMS v. 5.0. Students interact through discussion boards, real-time chatrooms, and group channels. All video lectures have captions in English and Portuguese, and written transcripts are available. Deaf students use the integrated sign-language interpreter box, while autistic students can access a “low sensory” interface mode that simplifies visual stimulation, and people with ADHD may customizable alerts to reduce unnecessary notifications and visual distractions. Although asynchronous, students often use WhatsApp, Discord, and Instagram group chats to communicate outside the platform. They access the course using laptops, tablets, and mobile phones from their home, university, or shared co-working spaces.
Culture	Nationalities represented in the course include Portugal (6 students), Brazil (5), Egypt (4), India (4), the U.S. (3), South Korea (3), and Nigeria (3). Cultural references, humor, and attitudes toward feedback vary—some students prefer peer praise, while others value direct, instructor-driven feedback. As cultural factors may affect students’ comfort with social visibility [130], status rewards (like points, badges, or leaderboard positions) can be configured as either private or public.

4.2. Heuristics and Framework for Gamification Evaluation and Comparison

In addition to its use in design, SGT is also suitable for evaluation purposes when analyzing data from other applications or research. Thus, to apply SGT as a tool for evaluating other applications or research, we recommend an approach similar to Jakob Nielsen’s 10 Usability Heuristics application, which includes a severity analysis of usability issues [131], and the Cochrane Collaboration’s Risk of Bias tool for randomized trials

(RoB 2.0), which assesses the seriousness of potential bias [33]. Both tools systematically identify problems within systems or studies, respectively, serving as useful models for SGT-based evaluations.

Unlike when SGT is used for design purposes, where we suggest starting with the Heuristics, followed by the Framework (though both can be used interchangeably), for evaluation purposes, we recommend beginning with the Framework and then applying the Heuristics. This supports a more inductive (bottom-up) approach [115], enabling a systematic interpretation of the data before conducting a structured evaluation. Following this rationale, we suggest that experts or researchers (evaluators) begin by deconstructing the target application or study into smaller components by using those defined in the SGT Framework, through a process similar to reverse engineering, which extracts knowledge from existing systems for analysis, replication, or redesign [132]. Once the structure with the smaller components has been clarified, evaluators should apply the SGT Heuristics to systematically identify potential flaws or gaps related to each specific item. Each item serves as a lens for detecting limitations in how gamification is conceptualized, implemented, and contextualized within the application or research. These issues may reflect broader design shortcomings or research inconsistencies, thereby representing areas for improvement or further investigation. Evaluators should score each heuristic on a 0–4 scale: "0" indicates no issue, "1" a minor issue, "2" a moderate issue, "3" a major issue, and "4" a critical issue. We recommend this five-level scoring system, following the model of the Usability Heuristics [131], rather than the three-tiered approach used in the Cochrane Recommendations [33], as the five levels allow for greater variability in evaluations, which can be particularly useful for comparative analyses.

Lastly, it is essential that evaluators not only assess the severity of issues but also strive for consensus in their ratings. Discrepancies should be discussed collaboratively to achieve agreement. Involving at least three experts or researchers is recommended to ensure reliability and to resolve disagreements when consensus cannot be reached between two evaluators. Higher cumulative scores across the Heuristics indicate a greater number or severity of issues within the evaluated application or study.

5. Conclusions

By developing a theoretical model grounded in concepts from Education, HCI, and Psychology—and complementing foundational theories such as GLT and GS—this critical reflection aims to advance the understanding and application of educational gamification through the SGT. Our model evaluates gamification as a whole system, addressing the challenges of design heterogeneity that complicate the identification of success factors. SGT addresses critical gaps by offering a structured methodology for the design and evaluation of gamification interventions, grounded in the principles of Integration, Emergence, Synergy, and Context. To operationalize this theory, we developed two practical tools for educators, researchers, and instructional designers: SGT Heuristics and SGT Framework. By advancing the theoretical development of gamification, this study proposed a transformative approach to enrich multimedia learning environments through innovative, inclusive, and equitable gamified teaching strategies. SGT proposes the alignment of contextual understanding with system design, development, and research evaluation, emphasizing the importance of considering contextual characteristics when designing gamification and assessing its impact. It advocates for a holistic approach to conducting research and analyzing potential outcomes. Through the integration of game elements with their contextual application, we aimed to strengthen digital education in a rapidly evolving landscape while enhancing research quality and practical impact across various scientific fields.

6. Limitations and Future Research

A robust theory is characterized by (1) consistency with empirical evidence; (2) precision in its concepts' definitions and operationalizations; (3) parsimony in the use of minimal assumptions; (4) generality in its application across diverse contexts; (5) falsifiability via testable predictions that allow for potential refutation or refinement; and (6) progress by stimulating further research and theoretical development [133]. We developed the SGT based on principles that can be operationalized into high-level Heuristics, offering a broad perspective of system design, development, and evaluation, while the Framework serves as a detailed tool for organizing and connecting specific elements of these processes. To illustrate the practical use of our design, we provided a hypothetical example demonstrating how these tools can support both research and educational practice. With this, we aimed to fulfill the theoretical criteria of precision, parsimony, falsifiability, and progress. However, as SGT has not yet been empirically tested, there is a lack of consistency and generality, representing a theoretical limitation.

To meet the requirements of consistency and generality, further empirical studies are needed, especially those that follow rigorous research standards, such as low-bias randomized or non-randomized controlled trials, guided by frameworks like CONSORT, the Cochrane Collaboration, and EVAT© [31–34]. We recommend that future studies apply the SGT alongside existing gamification theories, like the GLT and GS [41,42], which provide foundational insights for SGT and can serve as complementary theories. These future studies should use the proposed Heuristics and Framework to design experiments that assess how different configurations of game elements affect psychological and behavioral factors leading to learning outcomes, depending on contextual variables. In addition to its application in design, SGT is also well-suited for gamification evaluation purposes, contributing to consistency and generality in the analysis of data from other applications or research studies. Accordingly, we recommend the use of the SGT Heuristics and Framework to evaluate and compare diverse applications and interventions, in alignment with the recommendations outlined in Section 4.2: Heuristics and Framework for Gamification Evaluation and Comparison. This approach facilitates the generation of empirical data from real-world implementations, thereby reinforcing the theoretical consistency and generality of SGT.

In alignment with the systemic approach underpinning SGT, it is essential to emphasize that key components must be considered when applying the model for research purposes. Since gamified learning can produce varied outcomes across individuals, gamification should be both adaptive and personalized by aligning user profiles, game elements, and digital platforms like Moodle LMS to optimize the impact [129]. In personalized gamification, it is essential to analyze not just users and game elements—categorized through player types, traits, or learning styles, for example—but also the intervention's outcomes and assessment methods, ensuring meaningful interpretation and application [134]. Therefore, it is important to emphasize that although SGT offers a practical model for designing and evaluating gamification, other research aspects—such as user profile analysis, the chosen technology and platform, research methodology, and the selection of outcomes and instruments—must also be carefully considered and applied to ensure both data quality and effective gamification implementation.

By applying SGT across diverse educational settings, future research can enhance the theoretical consistency with empirical findings, and expand generality by testing the model in varied educational contexts—an essential aim of the SGT. We encourage future empirical research grounded in SGT to promote more theory-driven and comparable studies, supporting the development of shared research models, and contributing to more effective and inclusive digital gamification design in education.

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