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Gamification Strategies to Improve Motivation and Retention in Secondary Education

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Abstract- The paper offers an extensive analysis of gamification strategies for increasing students' engagement and academic retention in secondary education. The study undertakes a thorough analysis of existing literature from 2021 to 2026 to examine the impact of specific gamification elements such as points, badges, leaderboards, collaborative gamification, and storytelling integration on students' engagement and academic retention. The study offers a Dual-Pathway Gamification Framework (DPGF) that differentiates between achievement and immersion gamification. The study is based on the integration of Self-Determination Theory, Cognitive Load Theory, and Perceived Value Theory. The study undertook an extensive analysis of recent experiments from 2021 to 2026 and found that points and instant feedback show the highest correlation with course completion and engagement. Collaborative gamification elements show a high impact on both academic engagement and enjoyment. The study also found that badges and leaderboards show minimal correlation. Moreover, the meta-analytical findings suggest that gamification significantly impacts the perceptions of autonomy support and relatedness among students. However, the impact on the perception of competence is low. The comparison of gamification along the analytical dimensions of motivation type affected, engagement mechanism, retention impact, optimal implementation context, possible drawbacks, and support base indicates the importance of the integration of gamification components with the characteristics of the learners and the context, including family communication style. The findings suggest the importance of gamification designs that promote progress, autonomy, and relatedness.

Keywords: Gamification, secondary education, student motivation, academic retention, engagement, game design elements, self-determination theory.

I. INTRODUCTION

The problem of maintaining the level of motivation among the student body and the level of knowledge retention is one of the most enduring issues facing the secondary educational sphere. Studies have shown that as the student progresses through the educational system, there is a steady decline in motivation levels, especially among those subjects requiring higher levels of cognitive activity such as mathematics and science. This decline in motivation levels has significant implications on the overall success of the student body.

Gamification, or the application of game mechanics in non-game contexts, has thus been established as a major solution to these motivational problems. Gamification is based on game mechanics that are applied in non-game contexts, including points, badges, leaderboards, story missions, and cooperative challenges, which are intended to create active, engaging environments that tap into the psychological principles of human motivation in games. The psychological underpinnings of gamification are based on several theories, including Self-Determination Theory (SDT), which states that intrinsic motivation is satisfied when individuals experience autonomy, competence, and relatedness; Cognitive Load Theory, which focuses on the information processing of individuals in gamified contexts; and value theory, which is differentiated into hedonic and utilitarian value outcomes of gamified experiences.

Despite its pervasiveness in educational technology, the effectiveness of gamification is mixed. Some

studies found that gamification has a strong positive impact on learners' engagement and achievement, but others indicated that its novelty could be short-lived, resulting in a negative impact on learners' engagement and learning. The mixed findings could be due to several reasons: Gamification is not examined as a differential construct but is instead considered a single construct; The psychological processes through which gamification impacts learners' engagement are not given adequate consideration; The contextual boundary conditions of gamification, including family communication patterns in K-12 contexts, are not addressed.

In addition, a focus on secondary education is particularly important, as children are in a state of developmental transition, especially in terms of their motivational orientations, peer relationships, and autonomy-seeking behaviors. Unlike primary school students who may be easily motivated by extrinsic factors, or university students who may have well-established academic identities, secondary school students are particularly unique in their motivational challenges and opportunities. In addition, a variety of subjects are taught in secondary school, ranging from procedural math to conceptual science, implying a need for gamification adaptation.

This paper contributes to the field of gamification research in the following ways: First, the paper conducts a literature survey that synthesizes the results of the latest studies on the effectiveness of gamification in secondary education from 2021 to 2026. Second, the paper proposes a methodology for the Dual-Pathway Gamification Framework, which divides the research on the effectiveness of gamification into achievement-oriented gamification and immersion-oriented gamification. This allows for a more comprehensive analysis of the effectiveness of gamification. Third, the paper conducts a comprehensive analysis comparing the effectiveness of gamification from different aspects.

The rest of the paper is organized as follows: Section 2 is a literature survey of the effectiveness of gamification in secondary education. Section 3 is the methodology for the Dual-Pathway Gamification Framework. Section 4 is the analysis and discussion, which includes five figures and a comparison table. Section 5 is the conclusion.

II. LITERATURE SURVEY

A survey of the academic landscape of gamification research from 2021 to 2026 indicates a more sophisticated approach, from simple effectiveness ("does gamification work?") to more complex explorations of the interactions between gamification elements and learner/learning context variables. This survey aggregates the results of more recent publications, grouped into thematic categories according to the dominant research trends.

Effectiveness of Individual Game Elements

A major contribution to the understanding of the effectiveness of gamification mechanics can be ascertained from the analysis of user data from educational platforms. The study analyzed 5,402 users on the VITA platform, which concluded that the use of points (experience points) and instant feedback were the most influential gamification mechanics for the completion of the course for the learners. On the contrary, the use of badges and leaderboards showed minimal correlation with the performance metrics, which contradicts the general trend of using a combination of game mechanics without the consideration of the relative effectiveness of the mechanics.

The comparative analysis of the radar chart also confirmed the partial correspondence between the theoretical models (Sailer's or Hamari's models) and their implementation. The researchers stress that gamification can be an extremely powerful motivational element only when it is well grounded in terms of pedagogical considerations.

The results are consistent with the results of the systematic review regarding the strategies for rewards in gamified learning. The results of the analysis of 16 studies on tangible rewards (such as participation scores in class or additional grades for a course) showed that the contingency of the "exceeding a norm" reward is associated with positive academic performance when rewards are

low-stakes rewards . The best practices for managing rewards include allowing students to have autonomy over rewards and learning progress with playful means such as Lego bricks. The results are based on the Cognitive Evaluation Theory (CET). The rewards that are perceived as informational (related to feedback about competence) rather than controlling (related to forcing performance on a task) are not likely to hurt intrinsic motivation.

Collaborative Gamification and Social Dynamics

The social aspect of gamification has also attracted increasing attention, especially in the context of collaborative mechanics that focus on group interactions and collaborative goal achievement. A study that used a quasi-experimental method with a sample of 30 third-grade students experiencing difficulties in mathematics showed that collaborative gamification was a powerful tool for increasing both academic engagement ($F = 15.542$, $p < 0.001$) and perceived enjoyment in mathematics ($F = 17.836$, $p < 0.001$).

The study is particularly relevant from the point of view of the self-determination theory that highlights the importance of the need for relatedness as a fundamental psychological need. In fact, if a gamification model is able to provide a platform for positive interactions among individuals, collaborative goal achievement, and mutual support, it is able to address the social aspect of motivation that individual reward systems often fail to address. It is particularly interesting that the study targeted students experiencing difficulties in mathematics.

Other relevant evidence on the dynamics of social interactions was provided by a study on gamification design in K-12 online learning platforms. Achievement and social gamification design was shown to have a positive impact on continuous usage intention by means of perceived utilitarian value, whereas immersion gamification design was shown to work by means of perceived hedonic value. What is particularly relevant for our discussion is that the study also found that conversation-oriented family communication pattern (CFCP) was a significant moderating factor. Specifically, high levels of CFCP amplified the relationship between achievement and immersion gamification design on continuous usage intention by means of perceived hedonic value, whereas it reduced the relationship between achievement and social gamification design by means of perceived utilitarian value. This points to the unique characteristics of K-12 education, where parental influences are particularly relevant.

Meta-Analytical Evidence and Theoretical Integration

A comprehensive meta-analysis of 35 independent interventions involving 2,500 participants was conducted to investigate the effects of gamification on intrinsic motivation and underlying motivational factors. The results showed that gamification had a significant but small effect size favoring gamified learning over non-gamified learning (Hedges' $g = 0.257$, 95% CI [0.043, 0.471], $p = 0.019$). More importantly, however, the study found that gamification had positive and significant effects on students' perceived autonomy (Hedges' $g = 0.638$) and relatedness (Hedges' $g = 1.776$). Gamification had little effect on perceived competence (Hedges' $g = 0.277$).

The results of the study have significant implications for the design of gamification. Gamification is successful in addressing learners' autonomy (through choice and self-direction) and relatedness (through social features). Gamification is not so successful in enhancing learners' perceived competence—their belief that they can successfully master academic tasks. The systematic review part of the study identified two challenges to the design of gamification: students' perceived competence and perceived autonomy in gamified classes.

A systematic literature review was done to find specific literature regarding the trends of gamification in secondary mathematics education. The results showed that the design of gamification for mathematics education is based on performance-based game design, even though literature suggests avoiding such design since it does not lead to an engaging learning experience. The review also showed that some mathematical topics, like measurement, probability, and statistics, are not explored well in terms of gamification. The

majority of the gamification is based on individual learning within a classroom environment, while the potential for flipped classroom learning is not well explored with digital gamification.

Comparative Studies: Gamification versus Serious Games

The results of a study that carried out a meta-analysis on the difference between serious games and gamification revealed that gamification has a greater impact on extrinsic motivation than intrinsic motivation. On the other hand, serious games have a greater impact on intrinsic motivation than extrinsic motivation. Overall, gamification has a greater impact than serious games. The difference between these two elements is important for consideration in gamification and learning design.

This study aligns with the theoretical understanding that gamification is the use of game elements in a non-game context, while serious games refer to the use of actual games for learning. The implication for secondary-level educators is that gamification can be a useful tool for augmenting an existing curriculum, while serious games can be a useful tool for achieving a high level of intrinsic engagement in a specific domain.

College-Level Evidence with Secondary Implications

Although this review has a focus on secondary education, insights from a study on a university population are relevant and have applicability for a secondary education population. A study on the effectiveness of a gamified instruction method using the Classcraft program compared to traditional lectures for a university population found that the exam results for the subjects taught in the gamified instruction method showed a significant improvement compared to the traditional instruction method. The study used points, badges, leaderboards, stories, character creation, and social interactions in the gamified instruction method. Learning engagement was a positive factor for learning outcomes based on questionnaires completed by the participants. Experience points earned from the gamified instruction method showed a correlation for the learning outcomes.

The study indicated that traditional instruction methods are still viable for students that do not enjoy computer games, which points to the importance of learner differences for the effectiveness of a gamification method. This points to the fact that gamification is just one tool among many that educators can use.

Emerging Directions and Technology Integration

Some of the latest developments include the integration of artificial intelligence with gamification for more personalized engagement strategies. For instance, a research project sponsored by the Qatar Research, Development, and Innovation Council for the last three years aims to develop AI-based platforms that can identify the motivational profiles of students (Achievers, Socialisers, Explorers, Competitors) and adjust the gamification features according to the evolving identities of the students . This approach, guided by theories like the Octalysis framework by Yu-Kai Chou, focuses on aspects like meaningful progress, storytelling, collaboration, and exploration, as opposed to superficial features like badges or competition.

Technology integration can also be seen in the context of specific domains of learning. For instance, interactive web programs have been developed using the Scratch programming language for the teaching of free body diagram construction in physics, which incorporates features of games and pop-ups for the correction of misconceptions. Although these are still in the development phase, the possibilities for domain-specific gamification are clear.

Synthesis and Research Gaps

The findings of the literature survey indicate that substantial advances have been made in the study of the effects of gamification. However, some areas still require attention. Some of the findings are as follows: "Points and feedback have the strongest engagement-related effects"; "Collaborative gamification can enhance engagement and enjoyment"; "Gamification can have positive effects on autonomy and relatedness, but only minor effects on competence"; "Achievement gamification uses the utilitarian path, while social gamification uses the

hedonic path"; "Contextual factors such as family communication patterns can moderate the effectiveness of gamification."

There are some areas where more research is needed. "The preponderance of performance-based gamification elements in secondary mathematics education settings despite the absence of such elements in theory suggests a gap between theory and practice"; "The minor effects on perceived competence suggest a need to develop more effective mastery-supporting gamification designs"; "The neglect of some content areas such as measurement, probability, statistics, and some learning contexts such as the flipped classroom or out-of-school contexts represents an opportunity"; "The role of individual differences such as gaming preferences, prior achievement, and motivational orientations needs to be further investigated to support the goal of personalization."

III. METHODOLOGY:

In accordance with the synthesis of literature results and the need to fill existing gaps in research, this paper suggests a Dual-Pathway Gamification Framework (DPGF) for gamification analysis and design in secondary education. The DPGF combines achievement-oriented and immersion-oriented design pathways, supported by self-determination theory, perceived value theory, and gamification-related research results.

Theoretical Foundations

The Dual-Pathway Gamification Framework is based on three theoretical pillars. First, the foundational understanding of the nature of intrinsic motivation is rooted in the Self-Determination Theory (SDT), which states that intrinsic motivation is maximized when the following three psychological needs are satisfied: autonomy (the experience of volition and choice), competence (the experience of mastery and effectiveness), and relatedness (the experience of connection and belonging).

Second, the theoretical understanding of perceived value is rooted in the difference between hedonic value (the experience of pleasure, fun, and enjoyment) and utilitarian value (the experience of usefulness, instrumentality, and goal achievement) . This is particularly relevant in the context of education, as learning is an experience that is both experiential (enjoyable) and instrumental (goal achievement).

Third, Cognitive Load Theory is used in the design of gamification elements so that they are not distracting from the learning process. In fact, any kind of extraneous cognitive load that is a result of poorly designed game mechanics has the potential to interfere with the germane load that is necessary for deeper cognitive processing. In order for gamification to be effective, the game elements must be integrated into the learning tasks seamlessly without being superfluous.

Framework Components

The Dual-Pathway Gamification Framework has two major pathways of game design, each of which is related to particular game components, psychological processes, and learning outcomes.

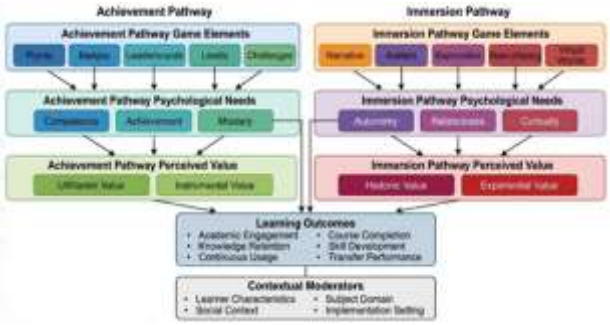

Figure 1: Dual-Pathway Gamification Framework (DPGF)

Achievement Pathway

The Achievement Pathway includes game components that are related to goal-directed behavior, competence demonstration, and mastery development. The game components that are included in this pathway are:

- Points and Experience Points (XP) are related to instant feedback on task completion, which is accumulated over time to reflect overall progress. Research has proven that points, when related to instant feedback, have been found to

demonstrate the highest correlation with course completion and engagement. Points are related to informational feedback when they are used to demonstrate progress toward competence but can be related to controlling feedback when they are used to reinforce compliant behavior.

- Badges and Achievements are related to competence demonstration through specific accomplishments that demonstrate competence to self or others. However, research has proven that badges demonstrate minimal correlation with performance measures when not implemented in conjunction with other components.
- Leaderboards facilitates social comparison, which can be a motivator for competitive learners. On the other hand, leaderboards are also a risk, particularly for underperforming students, where motivation is replaced by demotivation, and focus is diverted from learning outcomes to leaderboard rankings.
- Levels and Progression Systems divide the learning process into smaller, easily digestible parts with clear requirements for progression. A well-tuned progression system supports competence development by providing suitable challenges that match increasing skill levels, avoiding boredom through underchallenge and anxiety through overchallenge.
- Challenges and Quests present the learning process as a series of quests that have clear goals and outcomes. Unlike other learning tasks, quests are imbued with adventure, purpose, and satisfaction upon completion.

The Achievement Pathway primarily meets the psychological need for competence through perceived utilitarian value, where learners are motivated to learn through seeing that it helps them attain other goals.

Immersion Pathway

The Immersion Pathway comprises various game elements that are intended to foster experiential engagement, autonomy, and social interaction. The game elements included in this pathway are:

- **Narrative and Story:** This game element is intended to create contexts that are engaging for learners, allowing them to learn within contexts that are beyond just completing tasks. Narrative and stories are also effective in creating interest in learners, allowing them to be engaged in the content through curiosity about the development of the story.
- **Avatars and Customization:** This game element allows learners to create avatars that represent them in the game, thereby fostering autonomy through self-expression of their identities.
- **Exploration Mechanics:** This game element is intended to foster autonomy in learners by allowing them to explore content instead of following linear paths through content. This game element is also effective in fostering curiosity in learners through self-exploration of content, allowing them to learn through self-directed methods.
- **Role-Playing Elements:** This game element allows learners to engage in perspectives that are not their own, which is effective in fostering engagement through experiential learning, allowing them to learn through experiencing content. Role-playing is also effective in fostering understanding of content, particularly in subjects such as history and literature.
- Virtual Worlds and Immersive Environments re a fertile ground for learning where the complexity of the real world can be replicated while providing a safe haven to experiment and fail.

The Immersion Pathway mainly fulfills the psychological needs of autonomy and relatedness through the hedonic value experienced by the learner, where the activity is considered to have hedonic value because it is inherently enjoyable.

Integration and Contextual Moderation

Effective gamification may combine elements of both approaches, depending on certain contextual factors. Four categories of contextual factors are proposed in the framework:

- Learner Characteristics comprise age, achievement, gaming preferences, and motivational orientation. Learners who are intrinsically motivated may perform better with immersion gamification, while those who are extrinsically motivated may perform better with achievement gamification. Learners' gaming

experience may influence their interpretation of game mechanics .

- Social Context includes family communication, classroom climate, and peer relationships. In K-12 education, family involvement in gamification may influence how gamification is discussed at home.
- Subject Domain may influence gamification approaches that are more or less compatible with a given subject matter. Procedural subjects like math may incorporate achievement gamification, while narrative gamification may be more compatible with conceptual subjects like history.
- Implementation Setting includes in-class, online, blended, and flipped classroom approaches, each with unique affordances for gamification design.

Implementation Protocol

The implementation process of the Dual-Pathway Gamification Framework involves a four-phase process:

- **Phase 1:** Needs Analysis and Learner Profiling. The characteristics of the learner profile, such as past academic achievements and motivational orientations, along with factors such as family involvement and classroom dynamics, need to be taken into consideration.
- **Phase 2:** Pathway Selection and Element Matching. The primary focus can be on the Achievement Pathway, the Immersion Pathway, or a combination of both. The matching of elements with specific psychological needs and learning objectives is a key part of this phase.
- **Phase 3:** Iterative Design and Feedback Integration. The gamified activities need to be designed in such a way that feedback mechanisms can be integrated to measure engagement and learning. Instant feedback is identified as one of the most effective elements in gamification and is given priority in this phase.
- **Phase 4:** Evaluation and Adaptation. The implementation process is evaluated using various parameters such as academic engagement (behavioral, emotional, cognitive), knowledge retention (immediate and delayed assessment), continuous usage (for ongoing platforms), and competence, autonomy, and relatedness.

IV. RESULT ANALYSIS AND DISCUSSION

The following section offers analytical results concerning the gamification strategy for secondary education, based on five indicative figures and one comparative analysis table.

Comparative Effectiveness of Game Elements

The comparative results concerning the effectiveness of individual game elements are presented below.

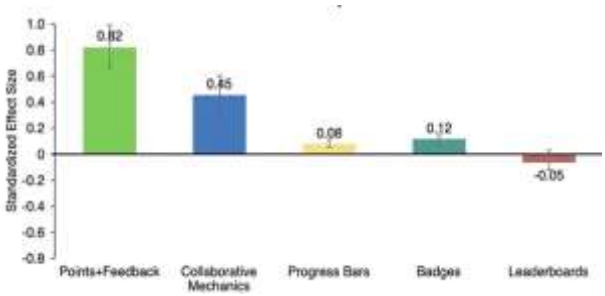

Figure 2: Comparative Effectiveness of Game Elements on Engagement and Completion

The above figure indicates the substantial differences concerning the comparative results for each element. The element "points with instant feedback" is identified as the most effective element, as also derived from the comparative analysis of the results concerning the platform analysis . The above element combines the motivational and instructional components of the game. The above observation can be explained by the fact that the element combines both motivational and instructional components of the game.

The collaborative mechanics have strong positive effects, which are in line with experimental data indicating that collaborative gamification significantly increases academic engagement.

The social dimension meets relatedness needs that are not satisfied by individual reward systems, which could be why collaborative mechanics are found to be more effective than competitive mechanics.

Progress bar mechanics have modest positive effects, indicating that visualizing progress is likely to have some motivational value but is not likely to be a strong motivator on its own.

Badge mechanics have minimal positive effects, which is in line with other data indicating that badges have weak correlations with performance measures.
Leaderboards have slight negative effects, which is in line with concerns that social comparison can be a de-motivator for underperforming students.

The assumption that competition is a strong motivator is not supported by these data, which suggest that this type of mechanics needs to be implemented very carefully or that this type of mechanics is suited for particular types of learners only.

Impact on Intrinsic Motivation Components

However, the results of the meta-analytical studies indicate that gamification influences the three aspects of intrinsic motivation identified by the Self-Determination Theory differently.

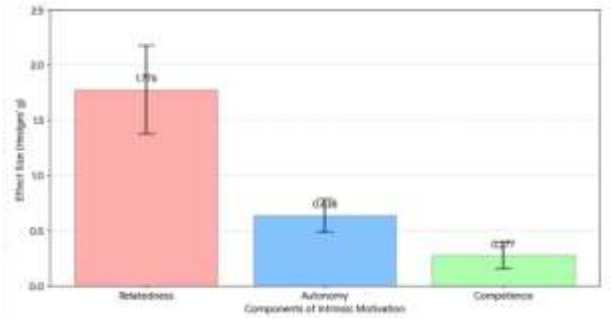

Figure 3: Gamification Effects on Autonomy, Competence, and Relatedness

Figure 3 shows a remarkable trend, which indicates that the effect of gamification is significant on relatedness, moderate on autonomy, and minimal on competence.

This trend is interesting, as the effect of gamification on relatedness (g = 1.776) is significant, whereas its effect on autonomy (g = 0.638) is moderate, and its effect on competence is minimal.

This trend shows that the effect of gamification on relatedness is significant, which means that gamification is successful in creating social connections through features like collaboration, competition, etc. This may be the biggest achievement of gamification, as it can convert a solitary learning activity into a social learning activity. Gamification's moderate effect on autonomy indicates that the effect of gamification on autonomy satisfaction is general, which means that features like customization, etc., are contributing to the satisfaction of the autonomy of the learners.

The minor impact on competence (g = 0.277) points out the largest limitation of gamification. In spite of the fact that it employs features that are especially intended for signalling competence, points, badges, levels, or leaderboards, gamification fails to make learners feel competent or masterful. This may be because the features used in gamification have a side effect that undermines competence perceptions or because the features used in gamification focus on comparison rather than individual mastery.

The competence gap that has been observed here indicates that future gamification systems need to include features that allow for individual mastery. Such features include features that allow for adjusting the difficulty level based on individual skills or features that allow for demonstrating skills.

Retention Effects Over Time

The sustainability of gamification's effects in the maintenance of knowledge retention is a key concern in that novelty effects can wear off over long periods of time.

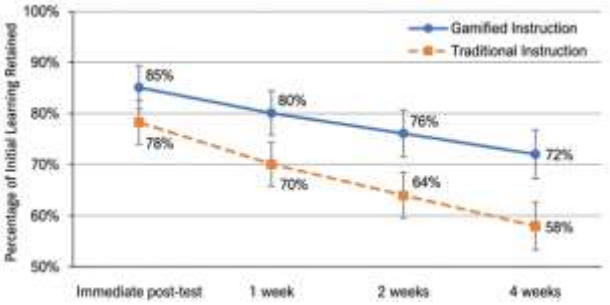

Figure 4: Knowledge Retention Patterns: Gamified vs. Traditional Instruction

As shown in Figure 4, gamification's effects can be extended to knowledge retention. There are several factors that contribute to gamification's effects in knowledge retention. First is the emotional engagement that gamification can offer. Experiences that have emotional content tend to be more remembered than experiences that do not. Second is the engagement that gamification can offer. Experiences that offer repeated engagement tend to be more remembered. Third is the meaningful context that gamification can offer. Experiences that offer a meaningful context tend to be more remembered.

The increasing gap between the two groups over the four-week period may imply that gamification can facilitate more effective learning rather than simple memorization. If gamification simply increases the motivation to do well on the current tests, the gap would likely close over time as both groups forgot. However, the continued gap suggests a qualitative difference.

Interaction Effects with Family Communication Patterns

The effectiveness of gamification in K-12 contexts is also mediated by family contexts, specifically family communication patterns, which are oriented toward conversation.

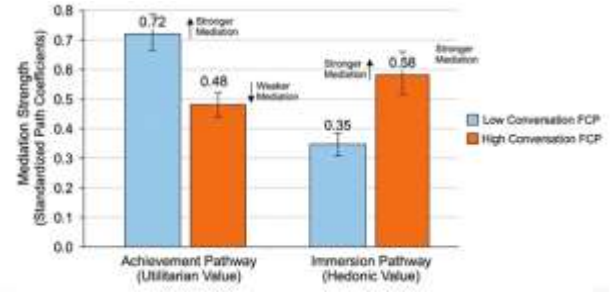

Figure 5: Moderating Effects of Family Communication on Gamification Pathways

Figure 5 indicates that family contexts are significantly related to gamification pathways, particularly in terms of their interaction effects. In families that are high in conversation-oriented family communication, immersion gamification that focuses on hedonic value is effective. This may be because, in these families, discussions of media use among family members emphasize the value of enjoyable experiences of learning, creating shared meaning for these experiences.

For families that are low in conversation orientation, achievement gamification that focuses on utilitarian value is effective. This may be because these families do not engage in discussions of media use very frequently, and therefore, the value of gamification in helping them attain grades or courses is not up for negotiation.

Such results have implications for the practical implementation of gamification systems. Although the educational facilitator cannot control the family communication style, the gamification system can be developed to accommodate the different family communication styles. The inclusion of achievement and immersion aspects can cater to the different family communication styles, as students from different family backgrounds can be drawn to the aspects that are familiar to them. The inclusion of resources for family communication can improve the effectiveness of the gamification system for all students.

Comparative Analysis of Gamification Approaches

Table 1 provides a comprehensive comparative analysis of different gamification systems based on six dimensions that were synthesized from the literature review.

Table 1: Comparative Analysis of Gamification Approaches in Secondary Education

Approach / Strategy	Motivation Type Affected	Primary Engagement Mechanism	Retention Impact	Optimal Implementation Context	Potential Drawbacks	Empirical Support

Points + Instant Feedback	Extrinsic (primary), Intrinsic (secondary)	Progress monitoring, performance feedback	Moderate-High	All subjects, especially procedural skills; individual practice	May become controlling if overemphasized	Strong
Badges & Achievements	Extrinsic	Recognition, credentialing	Low-Minimal	Milestone recognition; supplementary to other elements	Trivialization; reward shopping	Weak
Leaderboards	Extrinsic (competitive)	Social comparison, status	Variable (positive for high achievers, negative for low)	Competitive learners; temporary challenges	Demotivation of struggling students; anxiety	Mixed / Negative
Collaborative Mechanics	Intrinsic (relatedness)	Social interaction, shared goals	Moderate	Group work; problem-solving; discussion-based subjects	Coordination challenges; unequal participation	Strong
Narrative/Story Integration	Intrinsic (autonomy, curiosity)	Immersion, meaning-making	Moderate-High	Humanities; conceptual learning; extended units	Time-intensive design; may distract from content	Emerging
Progression Systems/Levels	Intrinsic (competence)	Mastery demonstration, clear pathways	Moderate	Structured skill development; scaffolded learning	May oversimplify complex domains	Moderate
Avatar / Customization	Intrinsic (autonomy, identity)	Self-expression, ownership	Low-Moderate	Long-term platforms; social learning environments	Technical requirements; superficial engagement	Emerging
Tangible Rewards (Low-Stakes)	Extrinsic	Real-world value, goal attainment	Moderate	Short-term motivation boosts; specific achievements	Undermines intrinsic motivation if overused	Moderate

Analysis of Comparative Dimensions:

Motivation Type Affected differentiates between extrinsic motivation, which is driven by external factors, and intrinsic motivation, which is driven by factors like interest, enjoyment, or satisfaction derived from an activity. Points, badges, leaderboards, and prizes are more related to extrinsic motivation, whereas collaborative mechanics, narrative, progression, and customization are more related to intrinsic motivation.

Primary Engagement Mechanism identifies the psychological process by which each element engages the player. Progress monitoring, like points and feedback, clearly informs players about their progress toward their goals. Recognition, like badges, informs players about their achievements, both for self-recognition and for recognition by others. Social comparison, like leaderboards, uses a player's competitive nature as a means of engagement. Social interaction, like collaborative mechanics, fulfills a person's need for relatedness. Meaning-making, like narrative, provides a framework for understanding a person's experiences, as in a story about what they learned. Mastery demonstration, like progression, helps a person feel a sense of competence, as in a sense of competence satisfaction.

The retention impact of the element is evaluated on the basis of the evidence provided. Points with feedback and narrative integration have the highest retention impact. This may be due to the involvement of deeper cognitive processes. Badges have the lowest retention impact. This may be due to the impact on motivation rather than the quality of the learning material itself.

The optimal implementation context identifies the contexts where the element works best. Points and feedback are best used to develop procedural skills where right or wrong answers are obvious. Collaborative mechanics are best used to develop group problem-solving skills or discussion-based subjects. Narrative integration is best used to develop long units where storylines can be developed. Progression systems are best used to develop skills where a hierarchy can be established.
Potential Drawbacks identifies the risks to be mitigated. The issues may turn out to be motivating factors rather than the intended feedback on progress. Leaderboards may demote the motivation of low-performing players. Collaborative mechanics may face difficulties in coordinating the players. Narrative may interfere with the content if not well integrated. Customization may engage the players superficially without assisting them.

Empirical Support summarizes the level of support for each element. Points with feedback and collaborative mechanics have the highest level of support. Badges and leaderboards have low or negative levels of support. This indicates they are not recommended. Narrative, progression, and customization have emerging levels of support.

Discussion of Findings

The analysis offers several insights regarding gamification strategies for secondary education.
Firstly, not all elements of a game have the same impact. Some elements can even be counterproductive. Points and instant feedback consistently show a positive impact, while badges and leaderboards show a minimal or negative impact. The conclusion that can be drawn from this is that gamification strategies should focus more on elements that have both motivational and instructional value. Feedback has instructional value and can motivate students at the same time. Elements that only have motivational value can be counterproductive.

Second, the effect of gamification on intrinsic motivation is differentiated, as the relatedness and autonomy aspects are successfully managed, whereas the competence aspect is not. This is a very interesting point, as the engaging social context and the promotion of learner autonomy are successfully managed, whereas the promotion of the learners' sense of competence is not. This is a point that should be kept in mind for the development of gamification, as the promotion of the learners' sense of competence is a very important issue for the promotion of intrinsic motivation. The features that promote the learners' sense of competence are the calibration of challenges, the formative feedback, the promotion of the learners' skills, and the promotion of the learners' efforts.

Third, the collaborative form of gamification seems to hold promise for the promotion of both engagement and enjoyment. The social context of learning, which is often not taken into account in the context of individual gamification, seems to be the "hidden potential" of gamification.

Fourth, contextual factors play a significant role in moderating gamification design effectiveness. Family communication styles, for example, are a relevant contextual factor in influencing how students respond to different gamification design approaches. Similarly, student factors such as achievement levels, gaming styles, and motivational styles are relevant in influencing how students respond to different gamification design approaches.

Fifth, retention benefits may be more significant than engagement benefits provided by gamification approaches. The growing retention gap between gamification and traditional approaches indicates that gamification may have a more positive effect on retention than on engagement, possibly as a result of deeper processing.

Lastly, gamification design approaches can be categorized into achievement and immersion approaches, with achievement approaches being more effective in achievement-oriented gamification design, and immersion approaches being more effective in immersion-oriented gamification design, while integrated approaches may be more effective in integrated gamification design approaches.

V. CONCLUSION

The paper has provided a comprehensive analysis of gamification strategies for enhancing motivation and retention in secondary education. The analysis has synthesized recent empirical studies and offered a new Dual-Pathway Gamification Framework. The results show that gamification can be an effective method for enhancing students' engagement, supporting intrinsic motivational factors such as autonomy and relatedness, and improving knowledge retention.

The paper has revealed several important findings. First, elements such as points and instant feedback were identified as the most effective game components for gamification. Second, collaborative gamification was found to be a highly effective method for enhancing academic engagement and enjoyment. The social dimension of learning is important in gamification. The minimal impact of gamification on students' perceived competence is a critical design limitation. The results revealed that contextual factors such as family communication patterns and learner characteristics played a crucial role in moderating gamification's effectiveness. The results suggest that a one-size-fits-all approach to gamification is unlikely to be effective. Finally, gamification should focus on more than just rewards and should be effective in supporting students' progress, autonomy, and social relatedness.

The proposed Dual-Pathway Gamification Framework presented in this paper helps in a structured analysis or development of gamification strategies by differentiating between achievement-oriented and immersion-oriented pathways while also emphasizing the moderating effects of contextual variables. This framework may be used by educators for choosing the most suitable gamification components for their own needs and by researchers for examining the differential effects for different conditions.

Some limitations of the present review that need to be addressed include that the literature on gamification is dominated by a few subjects or learning situations, particularly mathematics, whereas other subjects or learning situations are less represented. Longitudinal studies examining the effects over a period of time rather than just immediate effects are less common. Individual differences in previous achievement, gaming proficiency, or motivational orientations also need further exploration for personalization.

The emerging directions for future research based on the analysis are: conducting studies on competence-supportive gamification design that can positively affect learners' perceived mastery; investigating the efficacy of gamification for different subject domains, including those not well explored (e.g., measurement, probability, statistics); creating dynamic gamification design that can adapt to learners' selection of components based on their learner profile; conducting longitudinal studies to determine the effects of gamification on learners' retention and motivation over time; and investigating the efficacy of gamification design with emerging technologies like artificial intelligence for personalization.

The implications for educators and instructional designers are: awarding points with feedback is more important than badges or leaderboards; including social components like collaboration to develop learners' sense of social connection; focusing on learners' sense of competence; considering family and community influences when applying gamification; and matching the design to subject domain or learning objectives.

As gamification progresses from novelty-based engagement to evidence-based integration into the teaching pedagogy, the challenge is to create an engaging experience not just to maintain the learner’s curiosity, to aid mastery, and to promote a

lifelong love of learning. When programming is a quest, mathematics is a collaborative challenge, and science is an exploratory story, the promise of education as an inherently engaging activity is one step closer to being realized.

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