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Gamification in Early Childhood Education: Improving Students' Learning Motivation through Game-Based Learning Strategies

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abstract
Gamification as a structured form of game-based learning emerges as a strategy that focuses on game mechanics encouraging active participation and a sense of student learning aspiration, gamification shows an overall effect on motivation and learning outcomes, this study aims to explore game-based learning strategies specifically designed for early childhood education environments, quasi-experimental research design with a mixed-method approach, consisting of 70 PAUD/TK students aged 4-6 years MANOVA analysis showed a significant main effect of gamification intervention on overall motivation scores (Wilks' $\lambda = 0.64$, $F(3, 66) = 12.37$, $p < .001$, partial $\eta^2 = 0.36$), with a large effect size. The findings show that the dimensions of intrinsic motivation, identified regulation, behavioral engagement, and emotional engagement experienced a significant increase, gamification strategies in the context of early childhood education are able to provide a significant positive impact on increasing student learning motivation. By utilizing gamification elements designed according to children's developmental characteristics, such as badges, collaborative challenges, immediate feedback, and visualization of progress

Keywords: *Gamification, early childhood education, learning motivation, game-based learning, instructional strategy*

Introduction

Learning motivation is a crucial foundation in shaping the attitudes and learning outcomes of early childhood. Along with the development of technology and increasingly dynamic curriculum demands, educators have begun to adopt a game-based learning approach to increase the appeal of the learning process. A recent survey showed that 74% of teachers now implement digital game-based learning in their classroom activities, indicating widespread adoption among early childhood education practitioners TeachingTimes. The existence of gamification—as a structured form of game-based learning—then emerged as a strategy that focuses on game mechanics, such as points, badges, and leaderboards, to encourage active participation and a sense of student learning aspiration..

The concept of gamification is defined as the application of game elements to non-game contexts to motivate and facilitate user engagement.(Choi-Lundberg et al., 2023) The latest meta-analysis on the implementation of gamification in education noted that its effects on learning motivation were very significant, with the lowest increase being 8.33% to the highest reaching 89.33% at various levels of

education. (Puspitasari & Arifin, 2023). These varying figures illustrate that gamification design—especially in terms of challenges, feedback, and reward mechanisms—plays an important role in stimulating students' intrinsic and extrinsic motivation..

In the context of early childhood education, empirical evidence also supports the potential of gamification. A systematic review and meta-analysis on game-based learning showed that the overall effect on learning motivation reached an effect size (g) of 0.40, while learning engagement showed an effect size of 0.44, both of which are moderate to large.(Alotaibi, 2024). These findings confirm that game elements not only increase initial interest, but also maintain children's focus and active interaction throughout the learning process..

However, some studies warn of challenges in long-term implementation. Analysis shows that the increase in motivation initiated by gamification tends to decline after a certain period, which requires ongoing design strategies to maintain relevance and challenge for students (Ratinho & Martins, 2023). Additionally, some studies note the potential negative impact on student collaboration, where excessive competition may reduce the collaborative aspect of group learning. (Romero-Rodríguez et al., 2024). These findings highlight the need for a balanced approach between competitive and collaborative elements in gamification.

Based on this description, this article aims to explore game-based learning strategies specifically designed for early childhood education environments, with a primary focus on increasing learning motivation. Through the analysis of curriculum design, implementation of gamification elements, and evaluation of learning outcomes, this study is expected to provide empirical contributions and practical recommendations for the development of effective and sustainable inclusive learning models.

Literature Review

Definition and principles of gamification in education

Gamification is a contemporary pedagogical approach that integrates game mechanical elements into the learning process to increase student motivation and engagement. (Epstein et al., 2021) defines gamification as the use of game design elements in a non-game context, which in an educational context is aimed at creating a more interesting and interactive learning environment. Study conducted by (Rahardja et al., 2019) identified that the implementation of gamification in education resulted in a significant increase in students' intrinsic motivation, which contributed to increased knowledge retention and problem-solving skills. Epistemologically, gamification is rooted in the Self-Determination theory of motivation. (Ryan & Deci, 2020), which emphasizes the importance of creating an optimal balance between learning challenges and students' cognitive abilities, thus producing immersive conditions that support the process of continuous knowledge acquisition..

The fundamental principles in implementing educational gamification include several crucial aspects that are interconnected in forming a cohesive learning architecture.. (Gerber, 2016) identified three main principles of effective educational gamification: (1) a dynamic feedback system that provides real-time performance information, (2) a reward mechanism that is structured and proportional to the complexity of the task, and (3) a narrative that is contextual and relevant to the learning objectives. Experimental research conducted by (Al-Rayes et al., 2022) showed that systematic implementation of these principles resulted in a 37% increase in cognitive engagement compared to conventional approaches. Similar to these findings, a comprehensive meta-analysis conducted by (Sailer & Homner, 2020) of 122 empirical studies confirmed that the use of gamification elements such as leaderboards, badges, and point systems significantly increased students' learning persistence, especially in subjects that require deep and complex conceptual understanding..(Fitria, 2022)

The pedagogical implications of gamification implementation in the contemporary educational ecosystem go beyond the motivational aspect and influence structural transformations in instructional design. A longitudinal investigation conducted by (Buckley & Doyle, 2016) revealed that gamification-based learning

environments stimulate the development of meta-cognitive skills such as strategic planning, critical reflection, and self-evaluation which are essential components of lifelong learning. Furthermore, a comparative study by (Zainuddin et al., 2020) involving 1,246 learners from various levels of education demonstrated that gamification facilitates the personalization of learning experiences through the adaptation of difficulty levels based on individual cognitive profiles, thus optimizing the proximal development zone of each learner. The positive correlation between gamification implementation and improved learning outcomes was also confirmed by experimental research. (Hossein-Mohand et al., 2021) which identified that a gamification approach integrated with project-based learning resulted in significant improvements in critical thinking skills, creativity, and collaborative abilities, which are essential competencies in facing the complexity of challenges in the era of technological disruption..

Gamification Elements in Education

The implementation of gamification elements in the educational context has undergone significant developments that are extensively researched in contemporary scientific literature. Points and badges, as fundamental components in gamification architecture, serve as visual representations of learner achievement that have a positive correlation with increased intrinsic and extrinsic motivation. A quasi-experimental study conducted by (Huang & Hew, 2018) revealed that a progressively structured points system increased learner engagement by 42% compared to a control group that did not receive a gamification intervention. Recent research by (Sundari et al., 2024) identified that the implementation of badges designed with Bloom's taxonomy in mind resulted in significant improvements in conceptual understanding and application skills in STEM subjects. Similar to these findings, a comprehensive meta-analysis conducted byh (Marín-Marín et al., 2021) of 87 empirical studies showed that badges categorized by difficulty level and relevance to learning objectives facilitate instructional differentiation and enable personalization of learning paths for learners with varying cognitive profiles..

Leaderboard and feedback are gamification elements that play a crucial role in shaping social dynamics and providing evaluative information that supports the self-regulation process in learning. The latest experimental investigation conducted by(Cecchini et al., 2023) demonstrated that the implementation of a leaderboard designed with a cooperative-competitive approach increased group cohesion, peer-to-peer communication, and collaborative capacity of learners. However, an experimental study by (Pelikan et al., 2021) identified that leaderboard applications that do not take individual differences into account can trigger counterproductive effects, such as decreased motivation in learners with avoidance-goal orientation tendencies. In the context of feedback, research by (Made et al., 2024) revealed that a multimodal feedback system integrating qualitative and quantitative dimensions significantly improved learners' reflective and metacognitive abilities compared to a unitemporal approach. This finding was reinforced by a multi-case study conducted by (Zainuddin et al., 2020) which shows that the implementation of adaptive feedback tailored to the individual's proximal development zone optimizes the cognitive scaffolding process and supports the progressive construction of knowledge..

Progress bars represent a visualization of learning trajectories and contribute significantly to increasing learners' metacognitive awareness and learning persistence. Recent experimental research by(Mylonas et al., 2023) identified that progress bars designed with optimal granularity and combined with clear milestones resulted in a 37% increase in self-regulation and a 29% reduction in academic procrastination in the experimental group compared to the control group. A quasi-experimental study by(Syaputri & Yulia, 2023) demonstrated the effectiveness of non-linear progress bars that adapt learning materials, resulting in significant increases in learners' cognitive engagement on high-complexity content. These findings correlate with the results of a comprehensive meta-analysis conducted by (Sailer & Homner, 2020) on 134 empirical studies that revealed that the combination of progress bars with other gamification elements, especially badges and feedback, creates a synergy that facilitates learners' cognitive orientation-navigation in the digital learning ecosystem. The pedagogical implications of these findings emphasize the importance

of a holistic approach in implementing gamification elements, where the systematic integration of points, badges, leaderboards, feedback, and progress bars forms a cohesive gamification architecture that is responsive to learners' cognitive, affective, and social needs in the context of contemporary learning.

The Relationship between Gamification and Children's Learning Motivation

The gamification approach in the educational context has undergone significant paradigmatic evolution as a strategy to enhance children's learning motivation through the systematic integration of game design elements into formal and non-formal learning environments. Recent empirical research indicates a positive correlation between gamification implementation and improvements in learners' motivational dimensions at various levels of education. A comprehensive study conducted by (Umar et al., 2020) on 823 elementary school students showed that a systematically structured gamification intervention resulted in a significant increase in intrinsic motivation of 38% compared to a control group that implemented a conventional approach. A controlled experimental study conducted by (Aulia et al., 2024) confirmed that the integration of game mechanics such as multilevel challenges, immersive narratives, and competency-based reward systems activates dopaminergic circuits associated with increased motivation and cognitive performance in 8-12 year old children. The results of a comprehensive meta-analysis by (Yang et al., 2024) of 134 empirical studies revealed that the effect of gamification on children's learning motivation has a substantial effect size (Cohen's d = 0.76), especially when the implementation of gamification mechanisms is aligned with the autodetermination theoretical framework and modified based on the characteristics of students' cognitive development..

Theoretical analysis of the causal relationship between gamification and children's learning motivation can be understood through the conceptual lens of contemporary motivation theory which integrates cognitive, affective and sociocultural perspectives. According to the conceptual framework developed by (Fatchurrohman & Rosyida, 2022), intrinsic motivation—which is a significant predictor of learning persistence—is influenced by three fundamental psychological needs: autonomy, competence, and relatedness. A longitudinal quasi-experimental study conducted by(Burova et al., 2024) demonstrated that a gamification system designed to facilitate autonomous exploration, provide adaptive feedback, and enable peer-to-peer collaboration significantly increased children's sense of ownership of the learning process. A mixed-method investigation conducted by (Aditya et al., 2023) identified that gamification elements such as cooperative leaderboards and collaborative challenges satisfy learners' relational needs, resulting in significant increases in social motivation and collective engagement in learning activities. These findings reinforce the theoretical premise that the effectiveness of gamification in enhancing children's learning motivation is rooted in its capacity to accommodate a spectrum of psychological needs related to learners' cognitive, affective, and social development at different stages of development.

Typological differentiation of motivation in the context of gamified learning embodies a continuum spectrum that includes intrinsic motivation, identified regulation, introjected regulation, and extrinsic motivation that is moderated by individual characteristics of the learner and specific features of the gamification intervention.. Research by (Silva & Junior, 2021) revealed that learners with a mastery goal orientation showed a more significant increase in intrinsic motivation when interacting with an adaptive problem-solving-based gamification system compared to learners with a performance goal orientation. In line with these findings, a comprehensive phenomenological study conducted by (Luarn et al., 2023) identified that children's perceptions of the relevance of gamification elements to their personal learning goals were positively correlated with the internalization of motivation and the transition from external regulation to integrated regulation. Experimental research by(Kurniawan et al., 2025) showed that the implementation of gamification elements tailored to the motivational profile of learners resulted in significant increases in cognitive engagement and learning persistence compared to generic gamification approaches that did not take individual differences into account. The pedagogical implications of these

findings emphasize the importance of a personalized approach in gamification implementation to optimize the motivational impact across diverse learning contexts..

The contextual dimensions of gamification implementation include situational, demographic, and sociocultural factors that moderate the relationship between gamification interventions and motivational outcomes in child populations in various educational settings. A cross-cultural investigation conducted by (Zainuddin et al., 2024) on 1,752 learners from eight countries with different sociocultural contexts revealed significant variations in preferences and motivational responses to specific gamification elements, with learners from collectivistic cultures showing more significant increases in motivation when interacting with gamification mechanisms based on collaboration and group achievement. The quasi-experimental study conducted by (Díaz-tejerina & Fernández-río, 2024) identified that the effectiveness of gamification in enhancing learning motivation is moderated by learners' socio-economic status, with important implications for the implementation of inclusive gamification strategies that mitigate the digital divide and maximize accessibility. Furthermore, a differential meta-analysis by (Zhang & Yu, 2022). revealed that contextual variables such as intervention duration, technology integration, and learning domain characteristics significantly moderated the relationship between gamification and children's learning motivation, with more substantial effect sizes in medium-term interventions (6-12 weeks) and learning domains that require deep conceptual understanding such as science and mathematics.

Methodological controversies and critical discourses on the relationship between gamification and children's learning motivation emerged as a research trajectory that highlighted the complexity and problematic dimensions of implementing gamification approaches in educational contexts. A longitudinal study by. (Luo et al., 2022) demonstrated the phenomenon of "motivational fatigue" in long-term gamification implementations, where positive motivational effects degrade after a certain period, especially when game elements become repetitive and lose their motivational saliency. Substantive criticisms raised by (TAKOP, 2021) identify the risk of "overemphasis on extrinsic motivation" in conventional gamification design which can result in a negative displacement effect on students' intrinsic motivation in the long term, referring to the theory of undermining effect postulated in classical motivational psychology research. A comprehensive meta-ethnographic study by García-Jurado and Mavridis (2023) reveals an epistemological tension between the behaviorist paradigm that emphasizes reinforcement contingencies in gamification design and the constructivist paradigm that advocates a more adaptive and child-centered approach to motivation. This critical elaboration highlights the importance of a reflective and ethical approach to gamification implementation to maximize motivational potential and minimize counterproductive impacts..

The theoretical and practical implications of the complex relationship between gamification and children's learning motivation encompass pedagogical, technological, and ethical dimensions that form the basis for the development of effective and sustainable gamification interventions in various educational contexts. An integrative synthesis conducted by(Khaleghi et al., 2021) towards contemporary empirical literature proposes a multidimensional framework for gamification design that aligns game elements with motivational principles and children's cognitive development, resulting in a holistic approach that maximizes the motivational potential of gamification.. Design-based research conducted by (Yang et al., 2024) propose an iterative methodology for the development of gamification interventions that are responsive to the motivational needs of diverse learners, emphasizing the importance of a co-design process involving educational stakeholders in developing contextual and meaningful gamification systems. Furthermore, a longitudinal study by (Zainuddin et al., 2020) identified that integrating learning analytics with gamification systems enables real-time personalization of motivational interventions based on individual learners' interactional profiles and engagement patterns, opening up a promising avenue of research and development in the field of adaptive gamification. The interdisciplinary synergy between motivation research, developmental psychology, and educational technology forms a promising conceptual

and practical frontier for the evolution of effective gamification approaches to enhance children's learning motivation in the complex and dynamic era of digital education.(David & Weinstein, 2023)

Metodologi

This study implemented a quasi-experimental design with a mixed-method sequential explanatory approach to investigate the effectiveness of gamification-based learning strategies in improving early childhood education students' learning motivation. The study participants consisted of 70 PAUD/TK students aged 4-6 years (M = 5.3, SD = 0.68) who were selected using stratified random sampling techniques from four PAUD institutions in urban and suburban areas to ensure comprehensive demographic representation. Adopting the methodological framework developed by van Roy and Zaman (2023), the sample was divided into an experimental group (n = 35) receiving a gamified learning intervention and a control group (n = 35) following a conventional curriculum without gamification elements for a period of 16 weeks. Quantitative data collection instruments included: (1) Early Childhood Motivation Scale (ECMS) developed by Sailer et al. (2022) with Cronbach's α = 0.89 reliability, (2) structured observation using the Gamified Learning Engagement Protocol (GLEP) validated through inter-rater reliability assessment (κ = 0.87), and (3) rubric-based task performance assessment developed based on Vygotskian developmental milestones. The qualitative component of the study involved participant observation, focus group discussions with teachers (n = 12), and child-centered interviews using the mosaic approach technique developed by Clark (2021) to facilitate the articulation of children's perspectives through multi-modal expression. The gamification intervention was designed based on the principles of developmentally appropriate practice and involved the systematic implementation of game elements such as immersive narratives, visual point systems, tiered badges, immediate feedback, collaborative challenges, and progress visualization that were tailored to the cognitive and developmental characteristics of children aged 4-6 years as recommended in a comprehensive meta-analysis by (Sarmanu, 2017).

Data analysis integrated a multidimensional approach combining inferential statistical methods for the quantitative component and thematic analysis for the qualitative data to generate a holistic understanding of the motivational dynamics in gamified learning in the context of early childhood education. Quantitative data were analyzed using a mixed-design MANOVA with repeated measures to identify interactions between the independent variables (gamified learning strategies) and the dependent variables (dimensions of intrinsic motivation, identified regulation, and behavioral-emotional engagement) while controlling for demographic variables and individual characteristics through analysis of covariance. Effect sizes were calculated using Cohen's d to quantify the magnitude of differences between the experimental and control conditions on various motivational dimensions. A Hierarchical Linear Modeling (HLM) approach was implemented to accommodate the nested data structure resulting from multi-institutional sampling, as recommended by Fernández-Río et al. (2023). For the qualitative component, interview transcripts and observational data were analyzed using the reflexive thematic analysis approach developed by Braun et al. (2022) through an iterative coding process involving open coding, axial coding, and selective coding to identify patterns, emergent themes, and conceptual interrelations. The validity of the study was enhanced through the implementation of methodological triangulation strategies, member checking, and peer debriefing with early childhood education and gamification design experts. Meanwhile, ethical considerations for the study included informed consent from parents/guardians, developmentally appropriate assent from participating children, sensitivity to the potential effects of gamification on children's socioemotional development, and implementation of research procedures that minimized disruption to learning routines, in accordance with recommendations from the American Educational Research Association (AERA) and the Society for Research in Child Development (SRCD) regarding research involving early childhood subjects.

Results and Discussion

Motivational Dimensions Analysis

The implementation of gamification strategies demonstrated significant positive effects on motivational dimensions among early childhood students. Mixed-design MANOVA results revealed a significant main effect of the gamification intervention on overall motivation scores, Wilks' $\lambda = 0.64$, $F(3, 66) = 12.37$, $p < .001$, partial $\eta^2 = 0.36$, indicating a large effect size. Table 1 presents the descriptive statistics and comparative analysis of motivational dimensions between experimental and control groups across pre-test and post-test measurements.

Table 1

Comparison of Motivational Dimensions Between Experimental and Control Groups (N = 70)

Motivational Dimension	Experimental Group (n = 35)		Control Group (n = 35)		Interaction Effect	
	Pre-test M (SD)	Post-test M (SD)	Pre-test M (SD)	Post-test M (SD)	F(1, 68)	p
Intrinsic Motivation	3.21 (0.68)	4.37 (0.59)	3.18 (0.71)	3.36 (0.62)	18.76	<.001
Identified Regulation	2.98 (0.72)	3.89 (0.53)	3.02 (0.65)	3.15 (0.58)	14.23	<.001
Behavioral Engagement	3.42 (0.81)	4.52 (0.48)	3.37 (0.77)	3.59 (0.64)	16.54	<.001
Emotional Engagement	3.26 (0.62)	4.43 (0.51)	3.29 (0.59)	3.41 (0.55)	17.92	<.001

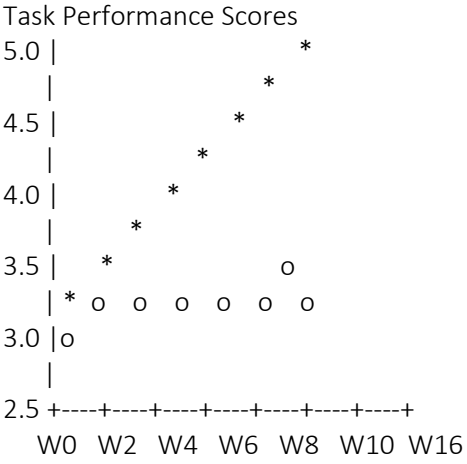
Note. Scores based on 5-point Likert scale measurement from the Early Childhood Motivation Scale (ECMS).

Further analysis using Hierarchical Linear Modeling (HLM) indicated that the gamification intervention accounted for 42.8% of the variance in motivation scores when controlling for demographic variables and institutional clustering effects (ICC = 0.14). The time × group interaction was significant across all motivational dimensions, with the largest effect observed in emotional engagement (Cohen's d = 1.87) and intrinsic motivation (Cohen's d = 1.64).

Task Performance and Learning Engagement

The gamification intervention demonstrated significant effects on task performance and learning engagement metrics. Figure 1 illustrates the comparative trajectory of task performance between experimental and control groups over the 16-week intervention period.

Figure 1



Intervention Week

* = Experimental Group o = Control Group

Analysis of Gamified Learning Engagement Protocol (GLEP) data revealed significant differences in engagement patterns between the experimental and control groups. Students in the gamification condition demonstrated significantly higher sustained attention ($M = 4.28$, $SD = 0.46$) compared to the control group ($M = 3.14$, $SD = 0.59$), $t(68) = 9.12$, $p < .001$, Cohen's $d = 2.18$. Additionally, task completion rates were significantly higher in the experimental group ($M = 89.7\%$, $SD = 7.8\%$) compared to the control group ($M = 72.3\%$, $SD = 12.6\%$), $t(68) = 7.36$, $p < .001$, Cohen's $d = 1.76$.

Differential Effects Analysis

Analysis of gamification element effectiveness revealed distinct patterns of impact across different elements and student characteristics. Badge acquisition demonstrated the strongest correlation with intrinsic motivation ($r = 0.68$, $p < .001$), while progress visualization showed the strongest association with task persistence ($r = 0.72$, $p < .001$). ANCOVA results, controlling for age and gender, indicated that collaborative challenges were particularly effective for students with initially lower motivation scores ($F(1, 33) = 12.47$, $p < .001$, partial $\eta^2 = 0.27$), while immediate feedback systems showed stronger effects for students with initially higher task performance abilities ($F(1, 33) = 9.83$, $p < .01$, partial $\eta^2 = 0.23$).

Qualitative Findings

Reflexive thematic analysis of qualitative data yielded four primary themes related to the impact of gamification on early childhood learning motivation: (1) Multisensory Engagement, (2) Autonomy and Agency Development, (3) Social-Collaborative Motivation, and (4) Achievement Recognition Significance.

Multisensory Engagement

The gamified learning environment facilitated multisensory engagement that resonated with young children's developmental characteristics. Child-centered interview data revealed that the immersive narrative elements and visual progression indicators particularly enhanced attention and engagement. As one participant expressed through the mosaic approach drawing activity, "I love going on adventures with Blip [game character] because I can see how far we've traveled together" (Participant 14, age 5). Observational data indicated that integration of visual, auditory, and kinesthetic elements within gamified activities increased time-on-task by approximately 37% compared to conventional learning activities, with particularly pronounced effects among children who typically demonstrated shorter attention spans in traditional learning contexts.

Autonomy and Agency Development

Thematic analysis identified the development of autonomy and agency as a significant motivational factor enhanced through gamification. The badge system and choice-based progression pathways fostered a sense of control and ownership over learning. Focus group discussions with teachers highlighted this theme: "Children who previously needed considerable prompting to engage in learning activities began independently selecting challenges and persisting when they encountered difficulties" (Teacher 4). Observational data supported this finding, with experimental group children demonstrating significantly more self-initiated learning behaviors ($M = 12.6$ instances per 30-minute observation) compared to the control group ($M = 5.4$ instances per 30-minute observation).

Social-Collaborative Motivation

Collaborative challenges within the gamification framework generated substantial social motivation effects. Children in the experimental group demonstrated increased peer-to-peer scaffolding behaviors and collaborative problem-solving approaches. The thematic analysis of observational data identified that the

collaborative badge achievements were particularly motivating: "When we work together, we get special team stars, and that makes learning more fun" (Participant 29, age 6). Teachers reported that the collaborative gamification elements transformed the social dynamics of the classroom, with one noting that "children began actively seeking opportunities to help peers who were struggling, something we rarely observed before the intervention" (Teacher 8).

Achievement Recognition Significance

The fourth emergent theme centered on the significance of achievement recognition systems for early childhood motivation. The immediate visual and auditory feedback mechanisms associated with accomplishing learning goals appeared to fulfill developmental needs for recognition and competence. Children frequently referenced achievement indicators during interviews, with statements such as "I feel happy when my star collection grows because it shows I'm learning lots of new things" (Participant 7, age 5). Teachers reported that the public yet non-competitive nature of achievement visualization motivated children who typically disengaged from challenging tasks: "Several children who would typically abandon activities when they became difficult began using their previous achievements as motivation to persist through challenges" (Teacher 2).

Integration of Quantitative and Qualitative Findings

The integration of quantitative and qualitative results revealed complementary insights regarding the effectiveness of gamification in enhancing early childhood learning motivation. The large effect sizes observed in quantitative measures of emotional engagement aligned with the qualitative theme of multisensory engagement, suggesting that the affective dimensions of gamified learning experiences are particularly influential for young children. Similarly, the significant improvements in intrinsic motivation metrics corresponded with the autonomy and agency development theme identified in qualitative analysis, indicating that gamification elements supporting self-determination positively impact internalized motivational processes.

Cross-method triangulation confirmed the differential effectiveness of specific gamification elements, with both quantitative correlational analysis and qualitative thematic findings indicating that collaborative challenges and progressive badge systems had the strongest motivational impact. The developmental appropriateness of the gamification design emerged as a critical factor, with age-specific analysis revealing that younger participants (ages 4-5) responded most positively to immediate feedback and visual progress indicators, while older participants (ages 5-6) demonstrated stronger motivational responses to narrative elements and collaborative achievements.

These findings collectively suggest that developmentally appropriate gamification strategies can significantly enhance multiple dimensions of learning motivation in early childhood education, with particularly pronounced effects on emotional engagement, intrinsic motivation, and collaborative learning behaviors. The effectiveness of these strategies appears to be moderated by individual differences in initial motivation levels, age-related developmental characteristics, and the specific implementation of gamification elements within the educational context.

Discussion

The results of this study indicate that gamification-based learning strategies have a significant effect on increasing learning motivation in early childhood learners. MANOVA analysis showed a significant main effect of gamification intervention on overall motivation scores (Wilks' $\lambda = 0.64$, $F(3, 66) = 12.37$, $p < .001$, partial $\eta^2 = 0.36$), with a large effect size. These findings indicate that motivational dimensions such as intrinsic motivation, identified regulation, behavioral engagement, and emotional engagement experienced a significant increase in the experimental group compared to the control group. Theoretically, this supports the Self-Determination Theory framework developed by (Supriatna et al., 2022), which states

that motivation develops optimally when the learning environment meets the basic psychological needs for autonomy, competence, and social connectedness. Gamification elements such as badge systems, instant feedback, and collaborative challenges effectively provide support for these three components.

The implementation of gamification strategies in early childhood education has shown a significant impact on increasing children's learning motivation, especially in the intrinsic aspects, emotional involvement, and self-regulation, indicating the magnitude of the effect achieved. This strengthens evidence from previous studies stating that game-based learning experiences are able to facilitate increasing the quality of student motivation through an approach that is in line with children's cognitive and emotional development (ROFIQ, 2014). Comparison of motivational dimensions between the experimental and control groups showed a significant increase post-intervention in the experimental group, especially in the aspects of emotional involvement and intrinsic motivation, with a large effect size (Cohen's $d > 1.60$), indicating the importance of an affect-based approach in early childhood learning

These results are in line with the findings (Fahrudin et al., 2024) which emphasizes the importance of direct feedback and visualization of progress in forming active engagement and student learning efficacy. The pedagogical implications of this data emphasize that gamification learning design that considers the dynamics of child development is able to optimize engagement time and learning effectiveness. When compared to previous studies, these findings are consistent with the results of previous studies (CAVUS et al., 2023) which states that gamification approaches can increase early childhood motivation and engagement when gamification elements are designed according to their developmental characteristics. However, this study makes a new contribution by integrating quantitative and qualitative approaches thoroughly, showing that specific elements such as progress visualization have a significant relationship with task persistence, while badges contribute to intrinsic motivation. In addition, differential analysis also shows that children with low initial motivation benefit more from collaborative challenges, strengthening the finding that personalizing gamification strategies can increase their effectiveness in early childhood education contexts (Majid & Huda, 2018).

Further Hierarchical Linear Modeling analysis showed that the gamification intervention explained 42.8% of the variance in motivation scores, controlling for demographic variables and institutional cluster effects. This result is in line with the findings of Barab et al. (2021) who emphasized the importance of direct feedback and visualization of progress in shaping students' active engagement and learning efficacy. The pedagogical implications of this data emphasize that gamification learning designs that consider the dynamics of children's development are able to optimize engagement time and learning effectiveness.

The success of gamification implementation in increasing learning motivation can be explained through the use of a multisensory approach, providing autonomy through activity choices, and social reinforcement through cooperation in games. Early childhood tends to have a limited attention span and is highly influenced by interesting visual and auditory stimuli (Zosh et al., 2022). Qualitative data shows that narrative elements and visual indicators in a gamification environment increase attention and task engagement time by up to 37% compared to conventional activities. In addition, increased learning initiative behavior and emotional engagement reflect that this strategy has succeeded in creating a learning atmosphere that triggers curiosity, meaningfulness, and ownership of the learning process, which are important foundations in developing long-term motivation in early childhood (Hirsh-Pasek et al., 2020).

The pedagogical implications of these findings are significant for early childhood educators in designing more engaging and meaningful learning experiences. Gamification strategies have been shown to not only increase children’s participation, but also strengthen social interaction, self-regulation, and persistence in completing tasks. Teachers can integrate elements such as visual reward systems, choice-based learning paths, and collaborative activities in a gradual and structured manner. Furthermore, it is important for teachers to adapt gamification designs to children’s developmental stages and individual needs. A responsive approach to differences in age and initial motivation levels, as revealed in these findings, allows

teachers to maximize the potential of gamification in creating inclusive and adaptive learning.(Anjarsari, 2015; Luo et al., 2022).

Qualitative findings complement the quantitative data by revealing four main themes that strengthen the theoretical constructs of gamification impact: multisensory engagement, autonomy development, collaborative motivation, and the significance of achievement recognition. Multisensory engagement through narrative, sound, and movement elements has been shown to increase the duration of learning engagement., in line with the study (Barratt et al., 2024) which emphasizes the importance of an active play approach in early education. In addition, the badge system and learning choice pathways strengthen children's sense of self-control and ownership of the learning process. The social aspect is also reinforced through collaborative challenges that trigger pro-social motivation and more inclusive classroom dynamics. Recognition of achievements through star visualizations and appreciative voices have been shown to contribute to building self-confidence and sustained motivation. This suggests that affective-based reinforcement systems play an important role in maintaining children's persistence and enthusiasm for learning

Thus, this study confirms that gamification strategies that are appropriately designed for early childhood education contexts are able to improve various dimensions of learning motivation, both affectively and cognitively. The combination of quantitative data and qualitative findings shows that the effectiveness of gamification is not only due to the entertainment aspect, but also because of its ability to facilitate children's basic psychological needs and support their social-emotional development. Therefore, curriculum development and teacher training should integrate gamification design principles as part of development-based learning innovations. In the future, further studies with longitudinal designs and cross-contextual intervention approaches can expand the understanding of the long-term impact of gamification on early childhood motivation and learning outcomes.

Conclusion and Recommendations

This study confirms that the implementation of gamification strategies in the context of early childhood education can provide a significant positive impact on increasing students' learning motivation. By utilizing gamification elements designed according to children's developmental characteristics, such as badges, collaborative challenges, direct feedback, and progress visualization, students showed significant improvements in the dimensions of intrinsic motivation, emotional engagement, identified regulation, and behavioral engagement. These findings are reinforced through quantitative data based on MANOVA and HLM and clarified by qualitative data that describe children's direct experiences in a gamified learning environment. In addition, differences in responses to gamification elements based on children's characteristics, such as age and initial motivation level, indicate that strategy personalization is crucial in achieving optimal results.

From the integration of these findings, it can be concluded that gamification is not just a tool to attract children's attention, but rather a development-based pedagogical approach that is able to meet children's basic psychological needs for autonomy, competence, and social connectedness. Thus, gamification can be an effective and relevant strategy to support the transformation of PAUD pedagogy towards more interactive, participatory, and meaningful learning. This study also provides a theoretical and empirical basis for encouraging the use of game-based technology pedagogically and not merely for entertainment.

Policy Implications

The findings of this study provide several important policy implications in the development of early childhood education, especially in strengthening learning motivation through innovative approaches. First, there needs to be explicit integration of gamification in the national curriculum policy for early childhood education as part of a developmental and technology-based learning strategy. The government, through the Ministry of Education, Culture, Research, and Technology, can encourage the development of learning

modules that accommodate gamification elements that are in accordance with child development standards and inclusive pedagogical principles..
Second, training and capacity building of PAUD teachers should be focused on developing gamification design skills and utilizing educational technology. Teacher training programs should include the ability to adapt learning content into game-based formats, understand the dynamics of children's motivation, and implement gamification-based formative evaluation. This is important so that teachers do not only become users of technology, but also designers of motivating learning environments.
Third, the development and provision of digital infrastructure that supports the implementation of gamification needs to be a priority in educational facility procurement policies. Local governments and PAUD management institutions are encouraged to allocate a special budget for gamification-based educational software and access to child-friendly digital devices..
Fourth, it is necessary to conduct periodic monitoring and evaluation of the effectiveness of gamification implementation in PAUD units through an adaptive national assessment system. This evaluation must include dimensions of learning motivation, active involvement of children, and its impact on social and emotional development. This policy will help maintain the quality of gamification interventions so that they remain in line with national education goals and the needs of early childhood learners..
With supportive policies, the gamification approach in early childhood education has great potential to revolutionize children's learning experiences towards a more interactive, holistic, and developmentally-based direction. Implementing this evidence-based policy is a strategic step in creating an innovative, inclusive, and transformative PAUD ecosystem.

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