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Gamification and Recyclable Materials as Mediators of Literacy Processes

Gamificación y materiales reciclables como mediadores de los procesos de lectoescritura

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Abstract

Literacy is a central pillar in the holistic education of students, as it enables access to knowledge, the development of critical thinking, and active participation in social and academic contexts. However, in educational contexts characterized by socioeconomic vulnerability, significant difficulties persist in reading comprehension and written production, associated with traditional teaching practices, low academic motivation, and limited access to innovative teaching resources. The objective of this study was to analyze the impact of gamification and the use of recyclable materials as teaching aids on strengthening literacy processes among fifth-grade students in elementary school. The research was conducted using a mixed-methods approach, with a case study design, at the 20 de Enero School in the municipality of Sincelejo, Sucre. Data collection techniques included initial and final diagnostic tests, direct observation recorded in field journals, and analysis of students' written work. The results showed significant improvements in reading comprehension levels—particularly in literal and inferential comprehension—as well as progress in textual coherence, cohesion, and organization in written work. Likewise, an increase in motivation, active participation, and collaborative work was observed. It is concluded that the integration of gamification and recyclable materials constitutes an innovative, relevant, and viable pedagogical strategy for strengthening literacy processes in vulnerable educational contexts, contributing relevant elements to the transformation of pedagogical practices in elementary education.

Keywords: Gamification; literacy; recyclable materials; pedagogical innovation; elementary education.

Resumen

La lectoescritura constituye un eje central en el proceso de formación integral de los estudiantes, en tanto posibilita el acceso al conocimiento, el desarrollo del pensamiento crítico y la participación activa en los contextos sociales y académicos. No obstante, en contextos educativos caracterizados por condiciones de vulnerabilidad socioeconómica, persisten dificultades significativas en la comprensión lectora y la producción escrita, asociadas a prácticas pedagógicas tradicionales, baja motivación escolar y limitaciones en el acceso a recursos didácticos innovadores. El objetivo de este estudio fue analizar el impacto de la gamificación y el uso de materiales reciclables como mediadores pedagógicos en el fortalecimiento de los procesos de lectoescritura en estudiantes de quinto grado de educación básica primaria. La investigación se desarrolló bajo un enfoque mixto, con un diseño de estudio de caso, en la Institución Educativa 20 de enero del municipio de Sincelejo, Sucre. Como técnicas de recolección de información se emplearon pruebas diagnósticas inicial y final, observación directa registrada mediante diarios de campo y análisis de las producciones escritas de los estudiantes. Los resultados evidenciaron mejoras significativas en los niveles de comprensión lectora, especialmente en los niveles literal e inferencial, así como avances en la coherencia, cohesión y organización textual en la producción escrita. Asimismo, se observó un aumento en la motivación, la participación activa y el trabajo colaborativo. Se concluye que la articulación entre gamificación y materiales reciclables constituye una estrategia pedagógica innovadora, pertinente y viable para el fortalecimiento de los procesos de lectoescritura en contextos educativos vulnerables, aportando elementos relevantes para la transformación de las prácticas pedagógicas en la educación básica primaria.

Palabras clave: Gamificación; lectoescritura; materiales reciclables; innovación pedagógica; educación primaria.

Introduction

Literacy is one of the fundamental pillars of the educational process, as it enables access to knowledge, the construction of meaningful learning, and the holistic development of the individual. Through reading and writing, students not only acquire information but also develop higher-order cognitive skills such as comprehension, analysis, interpretation, and reasoning—skills that are indispensable for their academic performance and active participation in social life. In this sense, literacy transcends the simple decoding of linguistic signs and is a sociocultural practice that allows individuals to interact with their environment and construct meaning from texts circulating in various contexts.

However, various studies have shown that, in educational contexts marked by social and economic vulnerability, reading and writing processes exhibit persistent weaknesses, reflected in low levels of reading comprehension, difficulties in organizing ideas, poor textual coherence, and limitations in written production. These issues are often associated with multiple factors, notably the prevalence of traditional methodologies focused on memorization, limited diversification of teaching strategies, a lack of motivation toward academic activities, and the sociocultural conditions of students' family and community contexts.

In the Colombian context, the results of large-scale external assessments have shown that a significant percentage of students in basic education perform inadequately in Spanish language arts, particularly in text comprehension and written expression. These difficulties not only impact immediate academic performance but also affect students' educational trajectories, increasing the risk of educational lag, grade repetition, and school dropout. Consequently, it is necessary to rethink teaching practices and promote innovative strategies that address students' real needs and the specific characteristics of the educational contexts in which they learn.

The 20 de Enero School, located in the municipality of Sincelejo, Sucre, is no exception to this reality. In this school setting, recurring difficulties have been identified in the literacy processes of elementary school students, manifested in low reading comprehension, poor reading fluency, difficulties in structuring written texts, and a marked lack of interest in activities related to reading and writing. These issues are exacerbated by the socioeconomic vulnerability of the student population, as well as by the limited availability of innovative teaching resources that foster meaningful learning.

Given this situation, there is a need to implement pedagogical strategies that transform classroom dynamics and promote more active and motivated student participation in their learning process. In this regard, gamification has established itself in recent years as an innovative pedagogical strategy that incorporates game elements—such as challenges, missions, symbolic rewards, levels, and playful dynamics—into formal educational contexts, with the aim of increasing students' motivation, engagement, and involvement in academic activities. Gamification is not limited to “playing in the classroom,” but rather involves intentional pedagogical planning aimed at achieving specific learning objectives.

Various studies have shown that gamification promotes meaningful learning, self-regulation, and the development of cognitive and socio-emotional skills by creating

more dynamic and participatory learning environments. In the specific case of literacy, the incorporation of playful activities has shown positive effects on reading comprehension, written production, and students' attitudes toward academic tasks by reducing anxiety associated with making mistakes and fostering a more positive relationship with learning.

Furthermore, the use of recyclable materials as teaching resources is a relevant strategy in educational contexts with limited resources, as it allows for the use of elements from the immediate environment to support learning, stimulate creativity, and promote values associated with environmental sustainability and social responsibility. Because recyclable materials are hands-on and accessible, they facilitate the construction of meaningful learning and encourage active student participation, especially in activities that require planning, organizing ideas, and writing.

The integration of gamification and the use of recyclable materials therefore represents an innovative pedagogical approach that addresses both students' academic needs and their contextual circumstances. This combination enables the design of meaningful, contextualized, and motivating learning experiences aimed at strengthening literacy processes from a holistic perspective that recognizes students as active agents in their own learning.

Within this framework, the present study aims to analyze the impact of gamification and the use of recyclable materials as pedagogical mediators in strengthening literacy processes among fifth-grade students at the "20 de Enero" Educational Institution in the municipality of Sincelejo, Sucre. Using a mixed-methods approach and a case study design, the research seeks to provide empirical evidence on the relevance and effectiveness of innovative pedagogical strategies in vulnerable educational contexts, thereby contributing to the reflection on and transformation of teaching practices in the area of Spanish language instruction.

Methodology

This research was conducted using a mixed-methods approach with a post-qualitative orientation, in that it integrated quantitative and qualitative procedures not as isolated elements, but as interrelated components that allowed for a broad and in-depth understanding of the educational phenomenon under study. From this

perspective, the numerical data obtained from diagnostic tests were integrated with qualitative records derived from observation, field notes, and the analysis of written work, acknowledging the complexity of literacy processes and the need to interpret them in relation to the sociocultural context in which they occur.

The methodological design was a case study, as the research focused on the detailed analysis of a specific pedagogical experience implemented at the 20 de Enero Educational Institution, located in the municipality of Sincelejo, department of Sucre. This type of design allowed for an in-depth examination of classroom dynamics, interactions between students and the teacher, and the effects of the pedagogical strategy in a real teaching-learning context. The case study was considered relevant because it facilitates a situated understanding of educational practices and the generation of contextualized knowledge, which is especially relevant in educational settings characterized by conditions of social and economic vulnerability.

The study population consisted of 95 students enrolled in the fifth grade of elementary school at the “20 de Enero” Educational Institution. From this population, a purposive sample of 30 students from class 5°A was selected, whose ages ranged from 9 to 11 years. The selection of the sample was based on pedagogical and academic criteria, including low initial performance in literacy processes, evident difficulties in reading comprehension and written production, as well as the willingness of the students and the homeroom teacher to actively participate in the pedagogical intervention.

The institutional context is characterized by serving a student population from socioeconomically disadvantaged backgrounds, which directly affects opportunities for access to educational resources and family support for school-related activities. These conditions justify the implementation of innovative pedagogical strategies that address the needs of the context and promote meaningful learning through the use of accessible and context-specific resources.

The pedagogical intervention was structured around a gamification strategy combined with the use of recyclable materials, designed specifically to strengthen the participating students’ reading comprehension and writing skills. The initiative was carried out over a specific academic period and included a series of planned activities that incorporated game-like elements—such as challenges, missions, levels, symbolic rewards, and collaborative work—all aimed at achieving clearly defined learning objectives.

The recyclable materials used—including cardboard, reused paper, plastic bottles, and bottle caps, among others—were selected not only for their availability but also for their educational potential to support writing planning, the organization of ideas, and text comprehension. In this way, the pedagogical strategy incorporated environmental education across the curriculum, fostering in students attitudes of environmental stewardship, material reuse, and social responsibility, which expanded the educational scope of the intervention beyond the strictly academic realm.

From the perspective of pedagogical innovation, the intervention was based on the design of active and meaningful learning experiences in which students took a leading role in constructing their own knowledge. The teacher acted as a mediator in the process, guiding activities, promoting reflection, and facilitating opportunities for ongoing feedback.

Various techniques and instruments were used to collect information, with the aim of ensuring data triangulation and strengthening the validity of the results obtained.

First, initial and final diagnostic tests were administered, designed to assess students' levels of reading comprehension and writing skills before and after the pedagogical intervention.

These tests made it possible to identify progress in areas such as identifying main ideas, making inferences, textual coherence and cohesion, and the use of basic spelling rules.

Second, direct observation of classroom activities was used, systematically recorded in field journals. These records documented behaviors, attitudes, levels of participation, student interactions, and collaborative work dynamics during the implementation of the gamified strategy. Observation was conceived as a key tool for understanding changes in students' attitudes toward reading and writing.

Finally, an analysis was conducted of the written work produced by the students throughout the intervention, based on previously established criteria related to textual structure, coherence, cohesion, lexical richness, and clarity in the expression of ideas. This analysis allowed for a qualitative assessment of progress in writing processes and complemented the results obtained from the diagnostic tests.

The research procedure unfolded in three key phases: initial assessment, implementation of the pedagogical intervention, and final evaluation. During the

assessment phase, the students' main difficulties in reading and writing were identified, which guided the design of the gamified activities. During the intervention phase, the planned activities were implemented progressively, promoting active participation and collaborative work. Finally, during the evaluation phase, the final diagnostic test was administered, and the students' written work was analyzed to identify the progress made.

The quantitative data were analyzed by comparing the results obtained on the initial and final tests, which allowed for the identification of trends toward improvement in reading and writing skills. Qualitative data, meanwhile, was analyzed through processes of categorization, coding, and triangulation, drawing on observation records, field journals, and written work. This methodological approach enabled the construction of a comprehensive interpretation of the results, consistent with the mixed-methods and post-qualitative research design.

Results

The results presented below are based on the analysis of data obtained from the initial and final diagnostic tests, direct observations recorded in field journals, and the analysis of written work produced by the students during the implementation of the pedagogical strategy based on gamification and the use of recyclable materials. The presentation of the findings is organized according to the processes of reading comprehension and written production, taking into account the identified performance levels and the changes observed throughout the intervention.

The results obtained demonstrate significant progress in the participating students' reading comprehension levels, especially when comparing initial performance with the results achieved at the end of the pedagogical intervention. This progress manifested itself differently at the literal, inferential, and critical levels, allowing for the identification of progressive changes in the way students engage with texts.

At the literal level—which involves the explicit identification of information present in the text—the initial results showed that a significant proportion of students had difficulty recognizing main ideas, characters, sequences of events, and explicit details. During the initial diagnostic test, it was observed that students tended to respond in a fragmented manner, with incomplete or imprecise answers, indicating a superficial reading of the texts.

Following the implementation of the gamified strategy, the final test results showed a notable improvement at this level. Students were able to identify main and supporting ideas more accurately, as well as establish basic relationships among the elements of the text. This progress was reflected in more complete and structured responses, indicating greater attention to and comprehension of the content they read.

At the inferential level—related to the ability to deduce implicit information and establish relationships between different parts of the text—the initial results revealed greater difficulties. During the diagnostic phase, students showed limitations in anticipating events, inferring meanings from context, and drawing simple conclusions, which resulted in ambiguous answers or responses disconnected from the textual content.

The results following the intervention showed significant progress at this level. Students were able to formulate more coherent inferences, justify their answers based on elements of the text, and establish causal relationships between the events described. This progress was evident in their increased use of explanatory connectors and their ability to provide basic reasoning for their interpretations, which represents a significant step forward in the development of reading comprehension.

At the critical level—associated with evaluating, reflecting on, and forming judgments about the text—the initial results showed limited performance. On the initial diagnostic test, most students had difficulty expressing well-founded personal opinions, relating the text's content to their own reality, or adopting a critical stance toward what they had read.

Although this level continued to pose a challenge for some students, the final results showed steady progress. By the end of the intervention, several students were able to express clearer personal opinions, establish connections between the text and their immediate context, and begin to justify their points of view. These advances, though modest, reflect a gradual strengthening of critical reading skills as a result of the participatory and reflective dynamics fostered during the gamified strategy.

With regard to written production, the results showed significant changes in the way students plan, organize, and express their ideas in writing. An analysis of the writing samples produced before and after the intervention revealed improvements in the structural, discursive, and formal aspects of the texts.

In the initial writing samples, it was observed that students had difficulty organizing their ideas logically, which manifested in fragmented texts with disjointed ideas and limited use of connectors. Additionally, word repetition and the absence of a clear sequence in the text's development were common.

After the intervention, the written pieces showed greater coherence and cohesion. The students were able to organize their ideas into more structured paragraphs, use basic connectors to provide continuity to the text, and maintain a logical sequence in presenting the content. These advances demonstrate an improvement in writing planning and in the understanding of textual structure.

Another significant finding relates to the structure of the texts produced. In the initial phase, many students wrote without a clear introduction, a well-defined body, or a coherent conclusion. By the end of the intervention, there was greater recognition of the basic structure of texts, especially in narratives and descriptive texts, which allowed for a more organized presentation of ideas.

This progress was reflected in pieces such as the following, written by a student:

"First we played the game, and then we wrote the story using the cards. My story is about taking care of the planet because we used recycled materials and learned through play."

The implementation of gamified activities using recyclable materials also fostered creativity and written expression. Students showed a greater willingness to write, use varied vocabulary, and express ideas related to their environment and personal experiences. Compared to their initial work, the final texts demonstrated greater length, clarity, and expressive richness.

An example of this can be seen in the following excerpt:

"When we used bottles and cardboard to play, it was easier to think of what to write. I liked making up a story because I felt like I could say what I was thinking."

Although the study's primary focus was on literacy processes, the results of direct observation revealed significant changes in students' attitudes toward reading and writing. During the intervention, there was an increase in active participation, collaborative work, and a willingness to take on academic challenges presented in the play-based activities.

Field notes documented greater interaction among students, as well as a more positive attitude toward reading and writing activities, which was reflected in a decrease in initial resistance and an increase in voluntary participation. These attitudinal changes constitute a relevant outcome of the intervention, as they create favorable conditions for learning and the strengthening of literacy skills.

A discussion of the results obtained in this study supports the conclusion that gamification, combined with the use of recyclable materials, constitutes an effective pedagogical strategy for strengthening reading and writing processes among elementary school students, particularly in educational contexts characterized by social and economic vulnerability. The findings show that the implementation of active and contextualized methodologies promotes not only the development of reading and writing skills but also a shift in students' attitudes toward learning.

With regard to reading comprehension, the progress observed at both the literal and inferential levels aligns with theoretical frameworks that emphasize the importance of creating meaningful and motivating learning experiences to promote deeper and more reflective reading. Various studies have indicated that gamification, by incorporating game-like dynamics into the classroom, increases intrinsic motivation and promotes sustained attention—fundamental aspects for text comprehension. In this regard, the results of this study reinforce the idea that motivation is not a secondary element of learning, but rather a central factor that directly influences academic performance.

The progress observed at the inferential level is particularly relevant, given that this level of comprehension often poses a significant challenge for elementary school students. The ability to make inferences, anticipate information, and establish causal relationships requires not only cognitive skills but also a pedagogical environment that promotes reflection, dialogue, and the collective construction of meaning. The gamified activities implemented in the study fostered opportunities for interaction and feedback that supported the development of these skills, which aligns with constructivist and sociocultural approaches to learning.

Although progress at the critical level was more moderate, the results show an incipient progression toward reflective and evaluative reading. This finding is consistent with research indicating that the development of critical reading requires systematic and sustained processes over time, as well as intentional pedagogical mediation. In this regard, the study's results suggest that gamification can serve as a starting point for the strengthening of critical reading, provided it is integrated with

strategies that promote analysis, argumentation, and the formation of positions regarding the texts.

Regarding written production, the improvements observed in coherence, cohesion, and textual organization demonstrate that the pedagogical strategy implemented fostered writing planning and the expression of ideas in a more structured manner. The use of recyclable materials as teaching resources allowed students to organize their ideas visually and physically before putting them into writing, which facilitated the creation of clearer and more coherent texts. This result supports the arguments that highlight the importance of hands-on and visual resources in the writing process, especially in the early stages of learning.

From the perspective of pedagogical innovation, the integration of gamification and recyclable materials represents a significant contribution to the field of education, as it offers a viable and context-specific alternative for institutions with limited resources. Unlike other strategies that rely on high-cost digital technologies, the approach developed in this study is based on utilizing resources available in the immediate environment, which facilitates its replicability and sustainability in similar contexts. Furthermore, the incorporation of environmental education as a cross-cutting theme broadens the educational scope of the strategy, fostering in students a critical awareness of environmental stewardship and the responsible use of resources.

Another relevant aspect of the discussion concerns the strategy's impact on the socio-emotional dimension of learning. The results showed an increase in active participation, collaborative work, and students' willingness to tackle academic challenges, suggesting that gamification not only influences the development of cognitive skills but also fosters a more positive relationship with learning. This finding is particularly significant in vulnerable educational contexts, where demotivation and disinterest often constitute barriers to academic learning.

However, it is important to acknowledge the study's limitations. First, the case study design and sample size limit the ability to generalize the results to other educational contexts. Second, the duration of the intervention did not allow for an assessment of the long-term sustainability of learning or its impact on academic performance in external assessments. These limitations do not invalidate the findings, but they do call for interpreting them in context and considering the need for complementary research.

Based on the above, several avenues for future research open up, aimed at delving deeper into the impact of gamification and recyclable materials in other grades of basic education and in different subject areas. Likewise, it is relevant to conduct longitudinal studies that allow for an analysis of the durability of learning and the impact of these strategies on the development of reading and writing skills in the medium and long term. Similarly, future research could explore the integration of gamification with low-cost digital tools, thereby expanding the range of pedagogical possibilities in underserved educational contexts. Therefore, a discussion of the results confirms that the pedagogical strategy implemented not only contributed to strengthening literacy processes but also generated significant changes in classroom dynamics and in students' relationship with learning. These findings provide relevant empirical evidence for the field of education and reinforce the need to promote innovative, contextualized, and socially relevant pedagogical practices in elementary education.

Conclusions

The conclusions of this study derive directly from the general objective and the specific objectives set forth, as well as from a comprehensive analysis of the results obtained through the implementation of a pedagogical strategy based on gamification and the use of recyclable materials as mediators of literacy processes among fifth-grade students in elementary school. From a pedagogical and research perspective, the findings provide relevant insights for reflecting on teaching practices in educational contexts characterized by social and economic vulnerability.

With regard to the general objective, it is concluded that the integration of gamification and recyclable materials contributed significantly to strengthening the participating students' reading comprehension and writing skills. The progress observed in the literal and inferential levels of reading comprehension, as well as improvements in the coherence, cohesion, and organization of written texts, support the conclusion that the pedagogical strategy " " (Gamified Recycling) implemented fostered the development of reading and writing competencies essential for students' academic performance and holistic development.

From a pedagogical perspective, the study's results confirm that incorporating active and playful methodologies into the classroom is an effective way to redefine the teaching and learning processes of reading and writing. Gamification, by intentionally and systematically integrating game-based activities, fostered students' motivation, active participation, and engagement with academic activities, which positively

influenced their willingness to read and write. This finding is particularly relevant in vulnerable educational contexts, where demotivation and disinterest often constitute recurring barriers to learning.

Furthermore, the use of recyclable materials as teaching resources made it possible to contextualize learning and link literacy processes to the students' immediate environment. This strategy facilitated writing planning, the organization of ideas, and creative expression, while also promoting values associated with environmental education, sustainability, and social responsibility. In this regard, the research demonstrates that it is possible to develop innovative pedagogical approaches with a high educational impact without relying exclusively on costly technological resources, thereby expanding the possibilities for intervention in institutions with budgetary constraints.

From a research perspective, the study provides empirical evidence supporting the relevance of mixed-methods and post-qualitative approaches for analyzing complex educational phenomena such as literacy. The integration of quantitative and qualitative data allowed for an understanding not only of progress in terms of academic performance but also of changes in attitudes, interactions, and classroom dynamics—aspects that are fundamental to a comprehensive interpretation of the effects of the implemented pedagogical strategies.

Based on the findings, a derived hypothesis is proposed: the systematic incorporation of gamified strategies mediated by contextualized instructional resources can generate sustained improvements in literacy processes, provided that these strategies are designed in a manner consistent with learning objectives and the characteristics of the educational context. This hypothesis opens up new research possibilities aimed at further exploring the impact of gamification at different educational levels and in various subject areas.

However, it is important to acknowledge the study's limitations. The case study design and sample size limit the generalizability of the results to other educational contexts. Furthermore, the duration of the intervention did not allow for an assessment of the long-term retention of learning. These limitations do not invalidate the findings, but they do call for interpreting them within their specific context and considering the need for complementary research to broaden the scope of the results.

Finally, the study's conclusions support the assertion that gamification and the use of recyclable materials constitute a viable, relevant, and innovative pedagogical strategy

for strengthening literacy processes in elementary education. Their implementation contributes not only to the development of academic skills but also to the formation of students who are more motivated, engaged, and aware of their environment, which represents a significant contribution to improving educational quality in vulnerable contexts.

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