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Gamification tools for learning Natural Sciences in the fourth year of Basic Education (Original)

Herramientas de gamificación para el aprendizaje de Ciencias Naturales en cuarto año de Educación Básica
(Original)

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Abstract

This research aimed to design gamification tools to strengthen the learning of Natural Sciences in fourth year students at "2 de Mayo" School in El Empalme, Ecuador. A mixed-methods approach was used, combining qualitative and quantitative techniques, with theoretical methods such as analysis-synthesis and inductive-deductive; empirical methods included surveys, interviews, document analysis, and systematic observation. Descriptive statistics and percentage analysis were used to interpret and represent the data obtained through tables and graphics. The pedagogical proposal was structured in four phases: discovery, introduction, support, and closure, integrating playful activities, educational narratives, collaborative challenges, and digital resources. The results showed a substantial improvement in the levels of motivation, participation, and understanding of scientific content, as well as an increase in knowledge about active learning methodologies. The intervention transformed classroom dynamics, promoting student engagement, teamwork, and environmental awareness. It is concluded that gamification, when applied pedagogically and contextualized within the school environment, is an effective



strategy for enhancing the learning of Natural Sciences, developing scientific competencies, and fostering responsible attitudes towards environmental care.

Keywords: Active teaching methods; Gamification; Learning; Natural Sciences

Resumen

La presente investigación tuvo como propósito diseñar herramientas de gamificación para fortalecer el aprendizaje de Ciencias Naturales en estudiantes de cuarto año de Educación Básica de la Escuela “2 de Mayo”, en El Empalme, Ecuador. Se empleó un enfoque metodológico mixto, combinando técnicas cualitativas y cuantitativas, con métodos teóricos como el análisis-síntesis y el inductivo-deductivo; entre los empíricos la encuesta, la entrevista, análisis documental y la observación sistemática. Además, se utilizó la estadística descriptiva y análisis porcentual para interpretar y representar mediante tablas y gráficos, los datos obtenidos. La propuesta pedagógica se estructuró en cuatro fases: descubrimiento, abordaje, acompañamiento y cierre, integrando dinámicas lúdicas, narrativas educativas, retos colaborativos y recursos digitales. Los resultados evidenciaron una mejora sustancial en los niveles de motivación, participación y comprensión de contenidos científicos, así como un incremento en el conocimiento sobre metodologías activas. La intervención permitió transformar la dinámica del aula, promoviendo el protagonismo estudiantil, el trabajo en equipo y el compromiso ambiental. Se concluye que la gamificación, aplicada con sentido pedagógico y contextualizada al entorno escolar, constituye una estrategia eficaz para potenciar el aprendizaje de las Ciencias Naturales, desarrollar competencias científicas y fomentar actitudes responsables frente al cuidado del ambiente.

Palabras claves: métodos activos de enseñanza; gamificación; aprendizaje; ciencias naturales

Introduction

The teaching of Natural Sciences in Basic Education faces the challenge of adapting to the demands of a constantly transforming society, marked by technological advancements, the environmental crisis, and the need to develop critical citizens committed to their environment. In this context, active learning methodologies have gained relevance as strategies that promote meaningful learning, especially in the early grades. Among these methodologies, gamification stands out for its ability to integrate games as a teaching resource, generating dynamic, participatory, and motivating learning environments.



The fourth year of Basic Education represents a key stage in students' cognitive development, as they begin to construct a more structured understanding of the natural world. At this level, the Natural Sciences curriculum aims for students to observe, describe, and explain phenomena related to living things, the environment, and their interactions. However, in many school settings, these goals are limited by the use of traditional approaches that fail to spark students' interest or active participation (Instituto Nacional de Evaluación Educativa [INEVAL], 2023). This situation highlights the need to incorporate methodologies that respond to students' characteristics and promote the construction of meaningful learning.

Several studies have demonstrated that gamification, understood as the incorporation of game elements into educational contexts, fosters student engagement, improves content retention, and stimulates critical thinking, according to Egas et al. (2023). This methodology allows for the creation of learning experiences in which students assume active roles, face challenges, receive immediate feedback, and collaborate with their peers. In the area of Natural Sciences, gamification facilitates the understanding of abstract concepts through simulations, narratives, and practical activities that connect theory with reality.

The application of gamified tools in the classroom not only transforms the pedagogical dynamic but also contributes to the development of key competencies such as autonomy, problem-solving, and environmental awareness. According to Sánchez & Lamedona (2021), games as an educational strategy allow students to explore, experiment, and reflect, generating deeper and more lasting learning. In this sense, gamification is presented as an effective alternative to address the educational needs of fourth-year students, promoting a more inclusive, contextualized, and meaningful education.

From the Ecuadorian constitutional perspective, nature is recognized as a subject of rights, which implies a direct responsibility of the education system in the formation of citizens who understand, respect, and protect their environment. This vision is aligned with the principles of the national curriculum, which promotes the development of scientific competencies, the use of educational technologies, and the formation of critical and responsible citizens, from the early levels of Basic General Education, geared towards understanding ecosystems, biodiversity, and the impacts of human activity on the environment (Ministerio de Educación, 2025).

The implementation of gamification tools in the classroom represents an opportunity to overcome these limitations. By incorporating game dynamics into the teaching-learning process,



active student participation is promoted, their curiosity is stimulated, and the construction of meaningful learning is fostered. According to Egas et al. (2023), gamification allows for the transformation of traditional teaching into an interactive experience, in which students become protagonists of their own learning, developing scientific skills and environmental values.

Environmental education should not be limited to the transmission of information; rather, it should promote pedagogical practices that enhance students' ecological behavior. These students, in turn, will pass on such behaviors to their family members and friends, as noted by Cabrera-Huayhua (2024). In the school context, this implies designing activities that allow students to explore their environment, identify environmental problems, and propose solutions from a critical and collaborative perspective.

Gamification, by incorporating elements such as challenges, rewards, levels, and narratives, facilitates the creation of educational scenarios in which students can experiment, investigate, and reflect on natural phenomena. This methodology not only improves motivation and academic performance but also strengthens students' ability to understand the complexity of ecosystems and act in favor of their conservation. As Martín et al. (2022) state, the use of gamified educational technologies allows for personalized learning, adapting it to students' interests and fostering autonomy in the learning process.

The Natural Sciences curriculum becomes a means of educating students about respect for life, sustainability, and environmental responsibility. Incorporating gamification tools in the fourth year of Basic Education allows for connecting curricular content with students' realities, promoting a deeper understanding of natural processes and an active attitude toward ecological challenges. This proposal responds to the need to educate citizens capable of analyzing, arguing, and making decisions about the use of natural resources and environmental protection.

To improve the teaching of Natural Sciences in the fourth year of Basic Education, it is necessary to draw upon solid theoretical foundations that guide pedagogical practice toward active and contextualized methodologies. In this sense, social constructivism presents itself as a relevant epistemological basis, since it conceives of learning as a process of collective knowledge construction, mediated by interaction among peers, the environment, and didactic resources. According to Caise et al. (2025), several studies have demonstrated the positive impact of gamification on the motivation and academic performance of students in lower secondary education.



The Ecuadorian curriculum is based on this paradigm, promoting a participatory, critical education oriented toward the development of competencies. In the area of Natural Sciences, constructivism favors the exploration, inquiry, and analysis of natural phenomena from an active perspective. Gamification tools, by incorporating game dynamics, challenges, and collaboration, align with this approach, as they stimulate participation, reflection, and the joint construction of knowledge. As Pazos & Aguila (2024) point out, active methodologies such as problem-based learning and gamification enhance critical thinking and autonomy in elementary school students.

In addition to constructivism, experiential learning is another fundamental pillar for designing effective pedagogical strategies. This approach highlights the importance of linking school content with the student's direct experience. In the fourth year of elementary school, children are in a stage of discovering the world, so practical activities, games, and simulations are especially effective for consolidating knowledge. Gamification allows for the creation of educational scenarios in which students experiment, solve problems, and reflect on their actions, fostering a deeper understanding of scientific content, as proposed by Estupiñan et al. (2024).

Problem-solving, for its part, is a key competency in scientific education. In the school context, this skill allows students to confront complex situations, analyze causes and consequences, and propose well-founded solutions. Gamification tools, structured around challenges, missions, and objectives, promote the development of this competency in a playful and meaningful way. According to Guamán & Espinoza (2022), problem- and project-based learning strengthens analytical skills, argumentation, and decision-making in elementary school students.

Within this theoretical framework, gamification is presented not only as a motivational strategy but also as a methodology that integrates sound pedagogical principles, fostering the holistic development of students. Its application in the fourth year of elementary school allows for addressing children's educational needs, respecting their learning styles, and promoting a more active, reflective, and contextualized education. This proposal responds to the need to transform traditional teaching practices by incorporating innovative resources that place the student at the center of the educational process.

From a didactic perspective, it is necessary to recognize the transformative potential of gamification as an educational strategy in the science classroom. This methodology allows for the incorporation of game elements such as missions, rewards, levels, and immediate feedback



into the design of activities that promote active learning. In the fourth year of primary education, students are at a developmental stage where play is not only a natural form of interaction but also an effective way to construct knowledge. According to Egas et al. (2023), gamification in primary education improves motivation, participation, and the understanding of scientific content by making learning a meaningful and enjoyable experience.

Students who participate in gamified activities develop skills such as observation, analysis, decision-making, and problem-solving. This allows them to develop skills for understanding natural phenomena and acting responsibly in the face of environmental challenges. By structuring gamification around educational narratives and collaborative challenges, it allows students to become emotionally and cognitively engaged in the learning process. Martín et al. (2022) point out that the use of gamified technologies fosters autonomy, creativity, and critical thinking—key elements for quality science education.

Learning about the environment through play sparks students' interest, motivates them to explore, and allows them to construct knowledge from experience. Gamification, by integrating playful dynamics with clear pedagogical objectives, facilitates the understanding of complex concepts such as natural cycles, ecological relationships, and the impacts of human activity on the environment. According to Sánchez & Lamonedá (2021), this methodology promotes autonomy, intrinsic motivation, and commitment to learning, which translates into improved academic performance and greater participation in practical activities.

The teacher's role in this model is transformed. They are no longer merely a transmitter of information, but rather a designer of learning experiences that connect curricular content with the student's reality. In the context of the "2 de Mayo" School, this means creating activities that respond to the group's characteristics, utilize accessible resources, and promote reflection on the natural environment. Gamification offers teachers tools to foster active participation, teamwork, and decision-making, strengthening the link between scientific knowledge and everyday life.

At this school, it has been identified that fourth-grade students have difficulty connecting Natural Science content with their environment, which limits their understanding and application of learning. This situation is exacerbated by the limited implementation of innovative teaching resources and the predominance of traditional approaches focused on memorization. Given this scenario, there is a need to transform pedagogical practices through the use of gamification tools that promote motivation, active participation, and the development of scientific skills.



The scientific problem guiding this research is: How to contribute to the learning of Natural Sciences in fourth-grade students at "2 de Mayo" Basic Education School? In response to this question, the general objective of the study is: To design gamification tools that promote the learning of Natural Sciences in fourth year students at the "2 de Mayo" Basic Education School.

Materials and methods

The research was conducted at the "2 de Mayo" Basic Education School, located in the El Empalme canton, Guayas province, Ecuador, during the 2025–2026 academic year. The study focused on fourth-grade students, who constitute the population. Given the interest in directly intervening with the entire group, a non-probabilistic, purposive sample of 30 students and 8 teachers from the Natural Sciences area was used.

The research employed a mixed-methods approach, combining qualitative and quantitative techniques to obtain a comprehensive view of the educational phenomenon under study. Theoretical methods such as analysis-synthesis and inductive-deductive reasoning were used to establish relationships between the pedagogical foundations of social constructivism and experiential learning, and their application in the design of gamified strategies. Regarding the empirical methods, surveys were administered to students and teachers to identify perceptions about the use of active methodologies in the classroom, as well as observation sheets during the implementation of gamified activities. In addition, a documentary analysis was conducted of the Ecuadorian national curriculum and recent research on gamification in Basic Education (INEVAL, 2023; Egas et al., 2023).

Mathematical and statistical methods were used in the data analysis. Descriptive statistics and percentage analysis allowed for the interpretation of the results obtained in the surveys and questionnaires. Levels of participation and academic performance were compared before and after the application of the gamified tools.

The methodological approach comprised three stages: initial diagnosis, design of the gamified proposal, and validation of the intervention. In the first stage, the main difficulties in learning Natural Sciences were identified through questionnaires and semi-structured interviews. In the second stage, gamified activities aligned with the curriculum content were developed, incorporating dynamics such as challenges, levels, rewards, and educational narratives. Finally, in the third stage, pre-tests and post-tests were administered to measure the intervention's impact on motivation, participation, and content comprehension.



Stage 1: Initial Diagnosis

Structured questionnaires were administered to students, and semi-structured interviews were conducted with teachers to identify the main difficulties in learning Natural Sciences. These instruments allowed for the collection of information on motivation, participation, content comprehension, and knowledge of active learning methodologies. The data obtained were tabulated and analyzed using descriptive statistics, which allowed for the establishment of key indicators justifying the need for an innovative pedagogical intervention.

Stage 2: Design of the Gamified Proposal

Based on the diagnostic results and the theoretical framework, a proposal of gamified activities was designed, aligned with the national curriculum and adapted to the context of the fourth year of Basic Education. The proposal included dynamics such as challenges, levels, rewards, and educational narratives, structured in phases that allowed for active student participation. Learning objectives, performance criteria, necessary didactic and technological resources, and application spaces were defined.

Stage 3: Validation of the Gamified Proposal

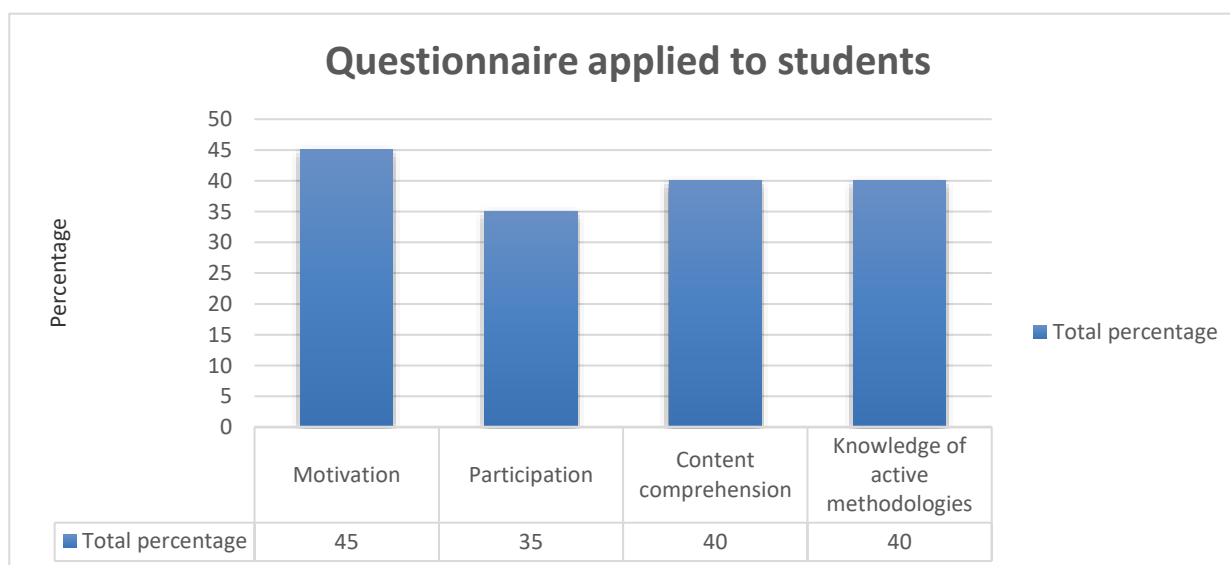
Once the gamified activities were implemented, pre-tests and post-tests were administered to measure their impact on motivation, participation, and content comprehension as key indicators. Systematic observations were conducted during the sessions, and teacher feedback on the effectiveness of the proposal was collected. The results were analyzed using descriptive statistical methods, allowing for a comparison of the initial and final indicators and an assessment of the relevance of gamification as a teaching strategy.

Analysis and discussion of the results

Stage 1: Initial Diagnosis

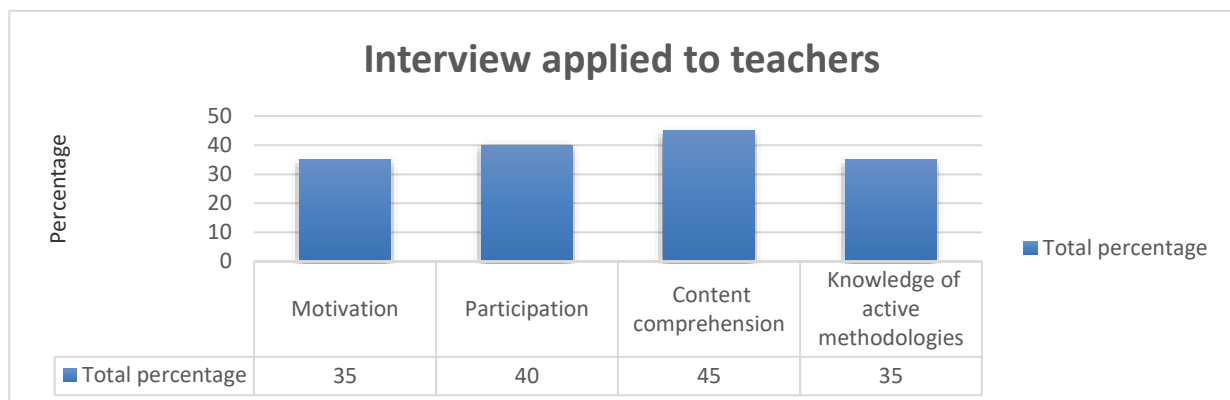
The results obtained through the questionnaire show that students exhibit low activity in class, reflecting a less than favorable attitude toward learning. Motivation is at intermediate levels, suggesting that students require additional stimuli to maintain interest in the subject. Furthermore, their knowledge of active learning methodologies is limited, indicating that they have not been systematically exposed to approaches such as gamification, project-based learning, or the flipped classroom. This deficiency presents an opportunity to introduce new dynamics that link play with learning, promoting the acquisition of Natural Science content from a playful and experiential perspective.



Figure 1. Results of the questionnaire applied to students

Source: Own elaboration.

The results show that teachers agree that students have difficulty connecting Natural Science content to their environment, which limits the applicability of knowledge. They reveal that predominant pedagogical practices focus on memorization and the use of traditional resources, which restricts the development of scientific skills. Furthermore, there is evidence of limited familiarity with active learning methodologies, resulting in poorly contextualized lessons with little student participation. This situation highlights the need to strengthen teacher training in the use of innovative strategies that promote critical thinking, problem-solving, and autonomous learning.

Figure 2. Results of the interview applied to teachers

Source: Own elaboration.



Stage 2: Design of the Gamified Proposal

The second stage focuses on the design of a gamified pedagogical proposal aimed at improving the learning of Natural Science content in fourth-grade students. This proposal arises as a direct response to the findings of the initial assessment, which revealed limitations in motivation, participation, content comprehension, and knowledge of active learning methodologies among both students and teachers.

The topic of water was chosen because it is an important resource that requires care and protection; furthermore, it is a learning topic that impacts individual, family, and community health. Its selection responds to the need to connect scientific content with students' immediate environment, facilitating the understanding of real-world problems such as water pollution. This approach allows for the integration of the curriculum with meaningful experiences, promoting environmental awareness from an early age.

The overall objective is to design and implement gamified activities that allow fourth-grade students to understand, apply, and reflect on Natural Science content related to water through meaningful educational experiences that integrate play as a teaching strategy.

Proposal Structure: The proposal includes: Title; Topic; Objective; and four phases for its development.

Proposal Title: Clean Water Mission: Guardians of the Vital Resource

Topic: Water Pollution in Ecuador's Rivers and Lakes

Learning Objective: To analyze the causes of water pollution in Ecuador's rivers and lakes, infer the consequences of this problem, and propose practical solutions to mitigate its impact, using gamification tools and collaborative work.

Phase 1: Discovery. Activity Topic: "The Call of the Rivers"

Phase Objective: To spark students' interest in the problem of water pollution, using an engaging narrative that motivates them to actively participate in the gamified project.

Detailed Activity: The teacher begins the class by showing a narrated video that simulates an environmental alert sent by Ecuador's rivers. The video shows real images of polluted rivers, testimonies from affected communities, and alarming data about the country's water quality. The following is a fictional story: students are recruited by an organization called "Water Guardians," which needs their help to save aquatic ecosystems.

Each student receives an explorer card containing key questions such as:



What do you know about the rivers in your community?

Have you seen pollution in nearby bodies of water?

Why is it important to take care of water?

They then access a digital platform such as Wordwall or Genially, where they must complete an interactive mission: identifying the main causes of water pollution through matching games, multiple-choice questions, and visual challenges.

Resources used: Projector and computer: to show the narrated video and introductory story. Printed cards: to guide individual reflection. Digital platform (Wordwall/Genially): to complete the interactive mission. Internet: to access the digital resources.

Game elements applied:

Narrative: Students are part of an environmental mission.

First mission unlocked: "Water Explorer."

Digital badge: Awarded upon completion of the activity on the platform.

Points: Awarded for each correct answer in the interactive game.

Phase 2: Approach. Activity theme: "Mission: Investigate and Act."

Phase objective: To familiarize students with the game rules, team roles, and learning objectives through a collaborative activity that promotes inquiry, critical analysis, and creativity.

Detailed activity: Once students have been introduced to the Water Guardians narrative, this phase represents the moment they receive their first major collaborative mission. The teacher divides the class into teams of four students, assigning each group a specific role within the fictional organization:

Team A – Cause Analysts: They must investigate the main causes of water pollution in rivers and lakes in Ecuador.

Team B – Consequence Detectors: They must identify and explain the ecological, social, and health consequences of water pollution.

Team C – Solution Providers: They must propose concrete and sustainable actions to mitigate the impact of water pollution.

Each team receives a Mission Sheet, which includes:

Clear instructions on what to investigate.

Suggested sources (videos, articles, interviews).

Guiding questions to organize the information.



Presentation criteria.

Students must search for information in reliable sources, such as educational platforms, environmental blogs, documentary videos, and scientific articles. The teacher provides access to computers, the internet, and printed materials, and supports the process with ongoing guidance. Once the information is gathered, each team must transform their findings into a creative presentation, choosing from:

A digital infographic (using Canva or Genially).

A physical poster with images and text.

A short explanatory video recorded with a cell phone or tablet.

The presentation must include:

- A catchy title.
- Relevant data organized visually.
- Final action plan or reflection.

Finally, each group presents its work to the class, answering questions from the teacher and their classmates. Dialogue, argumentation, and the exchange of ideas are encouraged.

Resources used:

Computers and internet access: for research and creating digital presentations.

Platforms such as Canva, Genially, or PowerPoint: for designing infographics or videos.

Cardboard, markers, magazines, scissors, glue: for those who choose to make physical posters.

Printed Mission Sheets: to guide each team's work.

Evaluation rubrics: to assess collaborative work and the quality of the content.

Game elements applied:

Specific challenges: each team has a mission with specific objectives.

Collaboration: students must work as a team to achieve results.

Rewards: Digital badges are awarded for creativity, clarity, and teamwork. Points are accumulated for active participation, mission completion, and presentation quality. Healthy competition: teams compete to be recognized as "Research Unit of the Month."

Constant feedback: the teacher guides, corrects, and motivates throughout the process.

Phase 3: Support. Activity Theme: "Knowledge Challenge"



Phase Objective: To maintain student motivation and engagement while they develop the gamified project, through interactive challenges, constant feedback, and game dynamics that reinforce the learned content.

Detailed Activity: In this phase, students have already researched, organized, and presented their findings on water pollution. Now, they must demonstrate their learning by facing a series of gamified challenges that will test their understanding, analytical skills, and teamwork.

The activity is organized as a team competition, in which each group participates in a series of stations or game levels. Each station represents a type of challenge:

Station 1 – Ecological Quiz: A platform such as Kahoot or Quizizz is used to present multiple-choice questions about the causes, consequences, and solutions to water pollution. Each team responds in real time from a tablet or cell phone. Correct answers earn points; incorrect answers receive immediate feedback from the teacher.

Station 2 – Visual Challenge: Images of polluted and healthy bodies of water are presented. Teams must identify the pollutants, explain the environmental impact, and propose a corrective action. This activity is done on paper or in a quick presentation.

Station 3 – Decision Simulation: A fictional scenario is presented: “A river near your community has been polluted by industrial waste. What would you do as a Water Guardian?” Teams must make decisions, justify their actions, and present a mini-intervention plan.

Each station has a time limit (10–15 minutes), and teams rotate until all stations are completed. The teacher acts as moderator, guide, and evaluator, providing constant feedback and motivating students to improve their answers.

Resources used:

Tablets or cell phones: for responding on digital platforms.

Platforms such as Kahoot, Quizizz, or Wordwall: for creating and managing the challenges.

Printed or projected images: for the visual challenge.

Scenario cards: for the decision simulation. Evaluation rubrics: to assess performance at each station.

Scoreboard: to record each team's progress.

Game elements used:

Difficulty levels: each station represents a level with progressive challenges.



Point system: each correct answer or well-reasoned action earns points.

Thematic badges: awarded for outstanding performance at each station (e.g., "Environmental Analyst," "Strategic Decision-Maker").

Healthy competition: teams compete for the title of "Water Rescue Unit."

Constant feedback: the teacher guides, corrects, and motivates at each station.

Phase 4: Final. Activity theme: "Commitment to Water"

Phase objective: To consolidate learning through personal reflection and concrete action that links acquired knowledge with environmental commitment, closing the gamified cycle with meaning and transformation. Detailed Activity: In this phase, students have completed all previous missions as part of the fictional organization Water Guardians. Now, they must demonstrate that they have not only learned but are ready to act as Clean Water Defenders.

The activity is divided into two parts:

Part 1: Personal Commitment. Each student writes an individual environmental commitment, answering questions such as:

What can I do at home or school to conserve water?

What habits should I change?

How can I influence my family or community?

The commitment should be clear, realistic, and personal. Examples:

"I will turn off the tap while brushing my teeth."

"I will teach my family not to throw trash in rivers."

"I will participate in community clean-up campaigns."

Then, each student designs a creative poster containing their commitment, decorated with drawings, motivational phrases, and ecological symbols. These posters are displayed on a collective bulletin board in the classroom or school hallway, titled "Our Pact with the Rivers."

Part 2: Community Action. To conclude the project, a practical activity is organized, which may include:

Cleaning the schoolyard or a nearby green space.

Planting seeds in recycled pots.

Creating digital posters for school social media.

Presenting the commitments to parents or teachers.



The teacher coordinates the activity, ensuring everyone actively participates and that the project's impact is visible.

Resources used:

Cardboard, markers, white paper, glue, magazine clippings: for creating the posters.

School space: for the bulletin board and the community activity.

Camera or cell phone: to document the day and share it on educational networks.

Reflection guide: with guiding questions for writing the commitment.

Game elements applied:

Final badge: “Defender of Clean Water,” awarded in a symbolic ceremony.

Public recognition: the posters are displayed as proof of achievement.

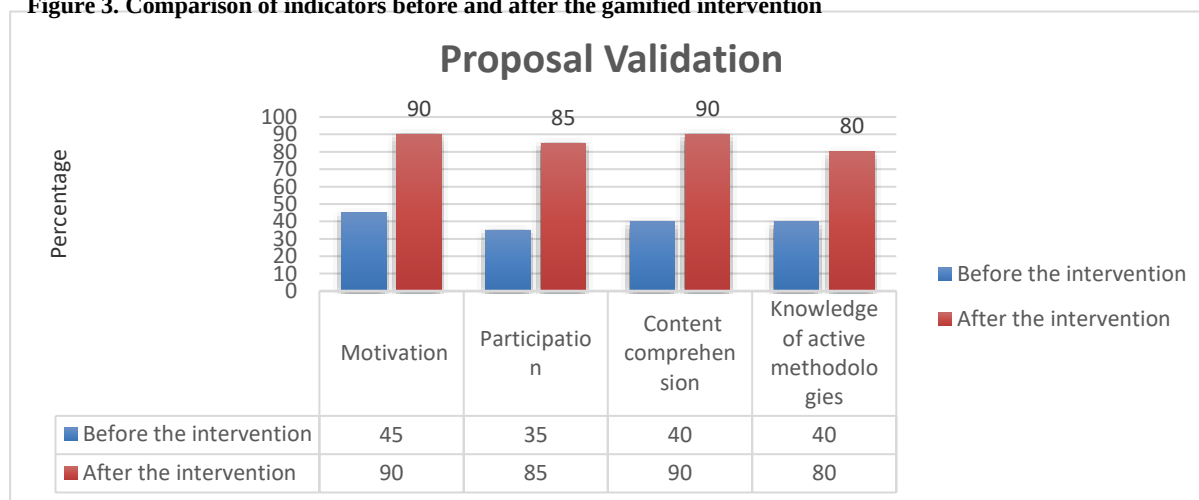
Narrative closure: the students complete their mission as Water Guardians.

Celebration of achievement: a symbolic diploma or ecological medal can be awarded.

Stage 3: Validation of the Gamified Proposal

The proposal was validated through the application of pre-tests and post-tests in each intervention, in addition to systematic observation in each section and teacher evaluation, thus strengthening the proposal's results.

Figure 3. Comparison of indicators before and after the gamified intervention



Source: Own elaboration.

The results obtained through systematic observations, pre- and post-tests, and teacher evaluations confirm that the gamified approach had a positive impact on the teaching and learning process. The improvement in the three key indicators validates the relevance, effectiveness, and applicability of gamification as a teaching strategy in the area of Natural Sciences.



The research conducted on the use of gamified tools for learning Natural Sciences in the fourth year of Basic Education demonstrated, through its three stages, the positive impact of this methodology on the educational process. The discussion of the results is structured according to each phase of the study, linking the findings to current theoretical and pedagogical frameworks.

The results obtained through the application of structured questionnaires to students and semi-structured interviews with teachers revealed a concerning situation: students showed low levels of motivation, participation, and understanding of the Natural Sciences content. Furthermore, both teachers and students demonstrated limited knowledge of active methodologies, especially gamification. This stage revealed that the traditional approach focused on memorization and content transmission did not meet the group's exigences.

The "Clean Water Mission: Guardians of the Vital Resource" proposal was designed based on the diagnostic results and principles of social constructivism and experiential learning. It was structured in four phases: discovery, approach, support, and conclusion, integrating game elements such as narrative, missions, badges, rewards, constant feedback, and digital resources. This structure allowed for personalized learning, fostered collaboration, and maintained student motivation. As Egas et al. (2023) affirm, gamification transforms the classroom into a space for meaningful interaction, where the student becomes the protagonist of their learning process.

The application of the pre-test and post-test during the intervention, along with systematic observations and teacher evaluations, allowed for measuring the impact of the proposal. The results showed a notable increase in the three key indicators: motivation (from 45% to 90%), participation (from 35% to 85%), and content comprehension (from 40% to 90%). Both individual commitment and community action improved significantly. Furthermore, the personal commitments written by the students demonstrated an ethical appropriation of knowledge, reinforcing the idea that learning should transcend the classroom and extend into everyday life, according to Cabrera-Huayhua (2024).

Conclusions

The findings obtained throughout this research allow us to conclude that the use of active methodologies, specifically gamification, represents a relevant and effective pedagogical alternative for improving the learning of Natural Sciences in fourth-grade students. The study showed that traditional approaches, focused on memorization and the transmission of content, do



not adequately meet current educational needs, especially in contexts where the link between scientific knowledge and the natural environment is weak.

The designed and implemented proposal transformed classroom dynamics, creating spaces for active participation, peer collaboration, critical reflection, and environmental commitment. The narrative structure, progressive challenges, use of digital resources, and game elements allowed for personalized learning, adapting it to students' interests and fostering intrinsic motivation. Furthermore, the intervention proved to be viable and replicable, reinforcing its value as a teaching strategy within the framework of the Ecuadorian national curriculum.

The validation of the proposal, using empirical techniques and descriptive statistical analysis, confirmed significant improvements in levels of motivation, participation, and content comprehension. These results not only support the effectiveness of gamification as a methodology but also demonstrate its potential to develop scientific competencies, social skills, and ethical values in students.

This research provides concrete evidence of the need to renew pedagogical practices in Basic Education, promoting methodologies that place the student at the center of the educational process, integrate play as a learning resource, and strengthen the link between school knowledge and environmental reality. Gamification, when designed with a pedagogical purpose and implemented with teacher support, becomes a transformative tool that contributes to a more active, meaningful, and environmentally engaged education.

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