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Traditional Games as Playful Methodological Strategies for the Teaching-Learning Process of Mathematics

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Abstract

This research analyzed how traditional games can be used as playful methodological strategies in mathematics learning to enhance numerical thinking in elementary school students at the "10 de Julio" Educational Unit in Chapuli, Manabí, Ecuador. The results of the research, obtained through observation, are presented as a way to project the level of complexity students encounter in this subject and the need to analyze how traditional games represent a valuable educational resource. The challenges students face in learning mathematics include various difficulties that lead to errors in basic operations, hindering their progress in the development of numerical thinking. A classification of topics on the potential of traditional games was carried out within the theoretical framework. The importance of numerical thinking for improving learning and applying it in daily life was also highlighted. The objective was to determine the level of complexity that students in Basic General Education experience in the teaching and learning process of Mathematics regarding the implementation of traditional games as playful methodological strategies in the institution under investigation. The study employed a mixed-methods approach, combining qualitative and quantitative methods, as well as inductive and heuristic analysis. Observation was the primary technique used to analyze and interpret the results, focusing on the students' perceptions of the subject matter. The results demonstrated a high level of complexity (41.67%) in mathematics learning, highlighting the need to reinforce learning with playful methodological strategies (traditional games) to improve comprehension, teachers' pedagogical practice, and strengthen students' numerical thinking.

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1 Introduction

This research focused on analyzing how traditional games can be used as playful methodological strategies in the teaching-learning process of mathematics to enhance numerical thinking in students of Basic General Education. The "July 10th" Educational Unit, located in the Chapuli site, belonging to the Membrillo parish of the Bolívar canton, Manabí province-Ecuador, during the period 2022-2023.

In the field of mathematics, there are various learning difficulties. Most students struggle to understand the diverse subject matter. According to Tenesaca et al. (2022), this problem was exacerbated during the COVID-19 pandemic due to various learning factors. Therefore, teachers must seek strategies that motivate and engage students, because mathematics plays a vital role in people's lives, helping them solve everyday problems.

Globally, Peñaranda et al. (2019), argue that games are key strategies for the learning process because they can be adapted to any content, boosting and strengthening students' attention, helping them understand concepts, and developing skills. Currently, students' failure to acquire mathematical skills is attributed to educators, who continue to use traditional strategies that do not allow for meaningful learning (Cáceres et al., 2020).

Currently, not all students learn to perform mathematical operations correctly through traditional strategies; some simply memorize but then forget, or they simply don't want to learn because, from their perspective, they see the learning process in this subject as monotonous. Therefore, to overcome these difficulties, as Ávila (2021) suggests, it is necessary to apply playful methodological strategies that contribute to and capture students' interest, such as traditional games, which, in addition to preserving cultural identity, allow for the development of mental agility, helping students learn about themselves.

The United Nations Educational, Scientific and Cultural Organization (UNESCO, 1991), in its book, states that play in education is a key factor, which conditions a harmonious development of the body, affectivity, and intelligence. It also states that a child who does not play makes his body, mind, and spirit sick.

Studies conducted by the Program for International Student Assessment (PISA-D, 2018) show that in Ecuador, 70.8% of students in 2018 did not reach the second level in mathematics, reflecting low performance in this area. Furthermore, a rote learning approach does not help students develop logical problem-solving skills. In this regard, UNESCO (2017), through its fact sheet, stated that 56% of students in Ecuador did not achieve a good level of proficiency in mathematics.

The National Institute for Educational Evaluation (2020) reported that in the province of Azuay, Ecuador, 1,818 students assessed during the 2019-2020 period obtained a final grade of 7.37 in mathematics, highlighting an educational crisis in this area. From this perspective, it is necessary to research to identify the contribution of traditional games to student development.

With the intention of addressing these research problems, the objective was setTo determine the level of complexity that students in Basic General Education have in the teaching and learning process of Mathematics for the implementation of traditional games as playful methodological strategies in the "July 10th" Educational Unit, for the improvement of the pedagogical practice of the teachers and numerical strengthening of the students investigated (Chai et al., 2014).

The difficulties in the teaching and learning process of Mathematics are due to a lack of appreciation for its importance, due to factors such as the transmission of inadequate content from a traditional school, which is currently considered rigid and unsuitable for teaching this subject, so significant changes must be promoted in this area (Condori et al., 2023).

The Ministry of Education of Ecuador (2016), in its new approach, considers that play is essential, especially in the vertical teaching practice in the didactics of mathematics training that fosters repetition and school dropout, with hostile environments, rote learning, rigid, monotonous, and mechanical teaching where the student loses interest and chooses not to attend classes or definitively abandons their studies, a reality that is observed in educational institutions.

In agreement with Cáceres et al. (2020), teaching mathematics should be a more dynamic, engaging, and fun process, but above all, an efficient one. Therefore, this research seeks to contribute a methodology that incorporates traditional games into the teaching and learning process of mathematics, where students feel confident, motivated, and understand that this subject is present and used in all aspects of life. Thus, the following research question is posed: How can traditional games be used as playful methodological strategies in the teaching and learning process of mathematics to enhance students' numerical thinking?

2 Materials and Methods

The methodology employed employs a mixed-methods approach, which, according to Hernández & Mendoza (2018), "represents a set of systematic, empirical, and critical research processes and involves the collection and analysis of both quantitative and qualitative data" (p. 612). The qualitative component facilitated the exploration, analysis, and understanding of information from various scientific bibliographic sources. Meanwhile, the quantitative component aided in the collection, examination, and representation of data from the observation guide, utilizing statistical techniques and descriptive statistics.

Furthermore, it is classified as explanatory and cross-sectional because it was directed at evidencing, demonstrating, and verifying the hypothesis. According to Hernández-Sampieri (2018), the explanatory level "generates a sense of understanding of the phenomena and problems they examine" (p. 141), and the cross-sectional factor allows for "the collection of data at a specific moment" (p. 212).

To characterize and analyze the phenomenon under study, validate the findings, and design the playful methodological strategies, the heuristic method was applied. According to Gualdrón et al. (2020), this method allows one to "understand, interpret, and solve a problem to conceive and execute a plan" (p. 108). Furthermore, the inductive method facilitated the processing of information and the introduction of new concepts to perceive and discuss the results. According to Guerrero (2019), the inductive method is based on observation to achieve generalization.

In his studies, Cruz (2021) indicates that the researcher views the setting and the people from a holistic perspective, considering traditional games as an opportunity to explore and develop new relationships between individuals, generating diverse learning possibilities. Furthermore, the documentary method allows information to be described, detailed, ordered, and systematized. (Illescas et al., 2020)

The study population consisted of the 36 students of Basic General Education belonging to the high school, elementary and middle school levels of the "July 10th" Educational Unit located in Chapuli, Membrillo parish, Bolívar canton, Manabí province, Ecuador. Observation was used as the research technique, using an observation guide as a tool, which was carried out over several days on the entire selected population.

3 Results and Discussions

Traditional games as playful methodological strategies

There are various relationships between mathematics and games, which are closely linked to primary education. According to Baste (1998, as cited in Soto 2020), strategies are embedded in games, where the player discovers and applies steps that help them solve a problem in the best way. These strategies are focused on a mathematical perspective. There are several benefits to playing traditional games, such as those mentioned by Cáceres et al. (2020):

- It improves coexistence.
- Develops students' intelligence.
- Promotes participation.
- It helps with motor coordination.
- It strengthens social interaction.
- Promotes collaboration.

Mathematics is a fundamental subject in the lives of students because it helps them develop logical thinking through its phases of observation, classification, and comparison. However, for some students, it is a complex subject. Cáceres et al. (2020) assert that it is not easy for everyone to understand, making it essential for educators to use engaging and precise tools that motivate students to acquire the necessary skills and abilities. Consequently, traditional games in the teaching and learning process of mathematics allow students to develop intellectual, emotional, and social competencies.

In this regard, Coloma et al. (2019) indicate that the main potential of traditional games for students is that they construct and create meaningful learning, which is applicable to everyday life. Games allow them to "explore their domain and expand it to generate new results" (p. 15). Play is a behavior that guides an activity; it is composed of playful forms corresponding to the structures of the stages of intellectual development in children (Piaget, 1946, as

cited in Azúa and Parrales, 2019). According to the literature by López & García (2020), the main potential benefits are highlighted as follows:

- Activator of human behavior, Caballero (2021) explains that play is vital for the development of people, developing mental, motor, social, affective, and cognitive skills.
- It produces pleasure and gratification; it is a playful action. Córdova (2022) states that it is an activity that provides joy and can be practiced at any age.
- It stimulates creativity and imagination; for Alonso (2021), it is a motivating, spontaneous action that stimulates the imagination.
- It is motivating because it produces intrinsic drive and satisfaction in those who do it.
- It promotes the development of skills and abilities; Ormazábal et al. (2023) assert that, framed within a didactic activity or strategies, play serves as a communicative, affective, and cognitive enhancer.

Therefore, play-based learning in education, particularly in mathematics, fosters the holistic development of students and positively influences their affective, social, motor, cognitive, and intellectual development. Almeida & Cerezo (2020) describe how games strengthen numerical or logical-mathematical thinking and reasoning. Vygotsky (1982) argues that play promotes mental development because it provides cognitive support, leading to higher-level mental processes.

Mathematics teaching and learning process

In recent years, mathematics teaching has incorporated challenges, tests, contests, puzzles, and games, as well as various playful strategies. "Games are a teaching strategy that develops numerical thinking in the four basic mathematical operations" (Colorado & Gutiérrez, 2016, as cited in Guerrero, 2022, p. 12). These strategies motivate students to use numerical thinking.

Experts Navarro & Rodríguez (2020) define numerical thinking as mathematical thinking that helps those who develop it to configure and substantiate conceptual structures in symbolic systems and numerical domains. Its use occurs in school and scientific contexts, in groups, individually, and in everyday life in general. "It encompasses the use and meaning of numbers, operations, relationships, and calculation and estimation techniques" (Barrera, 2021).

Therefore, it is established that numerical thinking allows the development and mastery of mathematical skills, which help to solve problems, through the processes of reasoning and argumentation, generating in individuals the ability to solve situations autonomously (Sanabria & Jaimes, 2021).

According to Shiguay et al. (2022), the current educational system needs people with analytical, reflective, and critical abilities, competencies that are developed through numerical thinking. To this end, their calculation skills must be increased, mainly in the four basic operations of Mathematics. An individual with a high intellect can express, argue, demonstrate, pose, and solve problems. Consequently, it is important that students acquire numerical sense, and games are one of the best strategies because they stimulate intelligence, creativity, and imagination (Zou et al., 2013).

The more meaningful the students' use of numbers, the stronger their numerical thinking will be. Therefore, teachers should guide the teaching-learning process with manipulatives as a positive strategy, in this case, games. The concepts of Winter and Ziegler (1983, as cited in Condor, 2019) present a schematic representation of the relationship between games and numerical thinking. As can be seen in Table 1, the relationship between games and numerical thinking is detailed.

Table 1
The effects of using games in mathematics education

Games	Numerical thinking
Rules of the game	Construction rules, logical rules, instructions, operations.
Initial situations	Axioms, definitions, and what is given.
Plays	Constructions, deductions.
Play figures	Media, expressions, terms.
Game strategy	Skillful use of rules, reduction of known exercises to formulas.
Resulting situations	New theorems, new knowledge.

Source: Data obtained from (Gairín, 1990, cited by Condor, 2019, p. 29).

The relationship between games and numerical thinking is detailed. Specifically, through the first point regarding the rules of the game, students learn the rules and logical constructions of mathematical operations. In the initial stages of the games, students create definitions of the topics studied (Zhang et al., 2022). While playing, they practice deductions. Through the game's figures, they create a means of expression using mathematical terms. Through game strategies, they make use of the rules, deductions, and formulas they have studied. Finally, new knowledge is obtained as a result. Therefore, it is considered that using games with students of various ages is the best way to make mathematics an interesting subject. The opinions of the leading expert on this topic, Gardner (1975, as cited in Condor, 2019), maintain that games are the best way to engage students, keeping them alert and motivated.

The development of numerical thinking is a fundamental pillar for achieving mathematical intelligence, contributing to the well-being and development of students. This is because this type of intelligence is more than just numbers; it is the ability to understand concepts, logical relationships, techniques, and schemas, as established by Salvador et al. (2022). That is, it helps to organize reasoning and allows it to be expressed appropriately.

The results described here are the data and information obtained from the observation guide used to determine the level of complexity experienced by students in Basic General Education in the teaching and learning process of Mathematics, as well as their perception of this subject and traditional games at the “10 de Julio” Educational Unit. The structure of the observation guide considered four aspects established by Vinueza (2022).

a) Level of complexity of the subject Mathematics.
b) Mathematical operations with greater difficulty.
c) Activities applied by the teacher for the teaching of Mathematics.
d) Playful methodological strategies (traditional games).

The results obtained for each concept assessed in the observation guide are detailed in Table 2.

Table 2
Level of complexity

What is your level of difficulty in the subject of Mathematics?		
Alternatives	Frequencies	Percentages (%)
Very high	4	11,11
High	15	41,67
Regular	8	22,22
Low	9	25,00

Source: Data obtained from the application of the observation guide.

Table 2 details that, from the students' perspectives, the level of complexity in mathematics was very high for 11.11%, high for 41.67%, average for 22.22%, and low for 25%. Therefore, it was found that the majority of students at the "10 de Julio" school find mathematics to be highly complex. This is because teachers continue to use traditional methods, employing concrete materials such as books, Cuisenaire rods, beads, abacuses, and other similar materials, which makes the teaching and learning process inflexible and rigid. Table 3 shows that the operations pose the greatest difficulty for the students.

Table 3
Basic Mathematical Operations

Which of the following mathematical operations do you find most difficult?		
Alternatives	Frequencies	Percentages (%)
Addition	4	11,11
Subtraction	8	22,22
Multiplication	13	36,11
Division	11	30,56

Source: Data obtained from the application of the observation guide.

The students evaluated are multiplication (36.11%) and division (30.56%). These are followed by subtraction (22.22%) and addition (11.11%). According to the students, this generates negative emotions such as frustration, stress, and in

some cases, sadness, because they struggle to understand and solve problems related to these four basic mathematical operations. In Table 4, the activities teachers use to teach mathematics are detailed.

According to 38.89% of students, they use concrete materials such as books, Cuisenaire rods, beads, and abacuses. 30.56% stated that teachers use group activities. Additionally, 22.22% indicated that they use interactive activities, and 8.33% used traditional games. As can be seen, teachers follow a pedagogy focused more on traditional methods, because they use few playful strategies such as interactive activities and games, which are more motivating for students and foster creativity and imagination, thus promoting numerical thinking.

Table 5
Playful methodological strategies (Traditional games)

Would you like to learn mathematics through traditional games?		
Alternatives	Frequencies	Percentages (%)
And	25	69,44
Maybe	11	30,56

Source: Data obtained from the application of the observation guide.

Finally, it was observed that students would like to learn mathematics through traditional games; 69.44% stated yes, and 30.56% said maybe. As can be seen, the students are willing to learn this subject using a new methodology, one structured around playful strategies, with traditional games that help them strengthen their weaknesses in this area. Therefore, educators should restructure their curriculum and incorporate strategies using these games, which can be recreational, riddles, sequencing, and memory games.

The observation guide applied to the 36 students of Basic General Education at the "July 10th" Educational Unit demonstrated that the majority of them have a high level of difficulty in mathematics (41.67%), especially in multiplication and division. This indicates that the student population needs the implementation of innovative strategies to address their weaknesses and develop mathematical thinking, which is crucial not only academically and professionally, but also in everyday life. Mathematical thinking is present in all aspects of life, enabling individuals to be analytical, reflective, and capable of solving problems (Toala-Bailón & Ávila-Rosales, 2022).

Through the instrument applied to the students, it was observed that teachers do not use traditional games in the mathematics teaching and learning process. As established by Cáceres et al. (2020), learning environments should be created where students enjoy their education by incorporating games designed to develop skills and abilities that contribute to meaningful learning. The practice of these games improves social interaction, promotes participation, strengthens social skills, develops students' intelligence, fosters collaboration, and aids in motor coordination.

Traditional games as playful methodological strategies have great potential for students because they build meaningful learning that is applied to the everyday reality of society, according to the literature cited by López & García (2020). Among the most relevant potentialities are: activating human behavior, stimulating imagination and creativity, promoting the development of skills and abilities, and the playful action produces gratification and motivates.

In summary, it is established that traditional games, as playful methodological strategies in mathematics, strengthen the holistic development of students and also positively impact their motor, social, cognitive, and intellectual development. According to Salvador et al. (2022), mathematical intelligence contributes to students' well-being because this type of intelligence is more than just numbers; it encompasses the ability to analyze and understand definitions, schematic relationships, techniques, logic, and critical thinking.

4 Conclusion

This research determined that 41.67% of students at the "10 de Julio" Basic General Education Unit have a high level of difficulty in mathematics, primarily in multiplication and division exercises. This data establishes that it is essential to reinforce student learning, as the four basic operations will be useful in their daily lives. This subject is present in all environments and will help them assimilate new experiences and face their realities. Therefore, playful methodological strategies will promote intellectual development, reflective thinking, and a critical attitude among students.

Through a theoretical review, it was established that traditional games are an excellent pedagogical tool for strengthening the development of numerical thinking. Therefore, it is viable to implement playful strategies to reinforce mathematical skills with basic operations that encompass mental calculation and the application of skills in solving mathematical problems, thus building and strengthening their knowledge while they play.

In general, the results described demonstrate the need to analyze, redesign, and implement playful methodological strategies based on traditional games to improve the teaching-learning process of the subject Mathematics, considering as a starting point the basic knowledge and skills already existing in the students.

Conflict of interest statement

The authors declared that they have no competing interests.

Statement of authorship

The authors have a responsibility for the conception and design of the study. The authors have approved the final article.

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