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Jogos e desenvolvimento do pensamento matemático na infância: estratégias lúdicas na Educação Infantil

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RESUMO
Este artigo resultou de uma pesquisa cujo objetivo central foi analisar a eficácia das brincadeiras infantis, com destaque para o jogo da Amarelinha, como ferramenta de aprendizagem ativa no ensino de Matemática na Educação Infantil. Buscamos analisar como se pode promover o desenvolvimento do pensamento lógico-matemático e estimular habilidades cognitivas, incluindo a resolução de problemas, atitude crítico-reflexiva e criatividade nas crianças. Trata-se de revisão bibliográfica e análise documental acerca dos condicionantes relativos à temática. Baseado no pensamento piagetiano, a pesquisa ressalta a importância de um ambiente educacional adaptado ao desenvolvimento da criança e enfatiza a relevância das atividades lúdicas. Os resultados indicam que as atividades lúdicas contribuem para a compreensão de conceitos matemáticos, estimulando habilidades cognitivas, como criatividade, socialização e resolução de problemas. O estudo conclui pela necessidade dos educadores valorizarem as atividades lúdicas, preparando as crianças para o pensar matemático, com vistas ao desenvolvimento intelectual.

PALAVRAS-CHAVE: Educação Infantil. Ensino da Matemática. Atividades lúdicas. Jogos.

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Games and development of mathematical thinking in childhood: playful strategies in Early Childhood Education

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ABSTRACT
This study investigates the effectiveness of children's games, particularly hopscotch (Amarelinha), as active learning tools for mathematics instruction in early childhood education. Through bibliographic review and documentary analysis grounded in Piagetian theory, we examine how playful activities can foster logical-mathematical thinking and enhance cognitive skills - including problem-solving, critical reflection, and creativity. The research underscores the importance of developmentally appropriate educational environments that incorporate play-based learning. Our findings demonstrate that ludic activities significantly contribute to children's understanding of mathematical concepts while simultaneously developing crucial cognitive and social skills. The study concludes by emphasizing the need for educators to intentionally integrate play activities into mathematics instruction to cultivate mathematical thinking and support intellectual development.

KEYWORDS: Early childhood education. Mathematics instruction. Play-based learning. Educational games.

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RESUMEN
Este artículo es el resultado de um proyecto de investigación cuyo objetivo principal fue analizar la eficacia de los juegos infantiles, especialmente el juego de la Amarelinha, como herramienta de aprendizaje activo en la enseñanza de las Matemáticas en la Educación Infantil. Se buscó analizar cómo puede promover el desarrollo del pensamiento lógico-matemático y estimular las habilidades cognitivas, incluyendo la resolución de problemas, la actitud crítico-reflexiva y la creatividad em los niños. Se trata de una encuesta bibliográfica y análisis documental de los factores relacionados com el tema. Basándose em el pensamiento piagetiano, la investigación destaca la importancia de un entorno educativo adaptado a la etapa de desarrollo del niño y subraya la importancia de las actividades lúdicas. Los resultados indican que las actividades lúdicas contribuyen a la comprensión de los conceptos matemáticos y estimulan habilidades cognitivas como la creatividad, la socialización y la resolución de problemas. El estudio concluye que los educadores deben valorar las actividades lúdicas, preparando a los niños para el pensamiento matemático, con miras al desarrollo intelectual.

PALABRAS CLAVE: Educación Infantil. Enseñanza de Matemáticas. Actividades lúdicas. Juegos.

Introduction

It is widely agreed that learning should be interactive and enjoyable. In the case of Mathematics, this premise necessitates a playful approach not only as a didactic assumption but also as an urgent need for engaging children in the pedagogical process.

More than just promoting joy in children, playful activities can trigger an articulated understanding of concepts throughout the process of schooling. Inspired by these ideas, this article aims to explore the theoretical roots of playfulness within the educational context, examining its effectiveness and relevance, from the early stages of child development to the mathematical challenges of the future.

Through this exploration, we seek not only to highlight the importance of the playful approach but also to analyze its role in the teaching of Mathematics, considering Early Childhood Education as a crucial stage of Basic Education a key dimension in the educational development of children, particularly regarding the consolidation of foundational learning and development.

Therefore, in this study, we will examine the possibility of incorporating playful activities in the teaching of Mathematics in Early Childhood Education, with a specific focus on children aged three to five who attend this level of education. We adopt a conceptual framework based on Piaget's (1964) observations regarding the preoperational stage, which show that children are actively developing logical notions. The inclusion of games and playful activities in this context is both aligned with the cognitive development stage of children and helps them engage more meaningfully in the learning process.

We followed the methodological stages of bibliographic research outlined by Gil (2002), which involve reading, analyzing, and interpreting various types of printed materials, such as books, mimeographed or photocopied documents, journals, images, manuscripts, maps, and other written resources.

For Gil (2002, p. 44), bibliographic research "[…] is developed based on previously prepared material, mainly consisting of books and scientific articles." This method requires a thorough investigation of already published sources, aimed at obtaining knowledge, contextualization, and theoretical support for the research in question. The primary goal of the bibliographic review is the enhancement and updating of knowledge, through a scientific examination of previously published works, such as scientific articles available in the Scientific Electronic Library Online (SciELO).

The keywords selected for this research were “Early Childhood Education,” “Mathematics Education,” “Piagetian trends,” “Neo-Piagetian trends,” “official guidelines for Early Childhood Education,” and “Developmental Education,” associated with Boolean descriptors, selected to guide the search for relevant articles in the SciELO database.

By applying the descriptor “Early Childhood Education” with all indexes, we obtained 1469 results, the vast majority of which were unrelated to mathematics education. Using the descriptor “Mathematics Education” with all indexes, we found 852 works, most of which did not align with our specific research interest. By refining the search and combining the descriptors “Early Childhood Education” AND “Mathematics Education,” we obtained 10 results, encompassing works that provided useful connections to our object of study. Consequently, we incorporated classical works from Piagetian thought, referenced at the end of the article. Although these works do not specifically address the exploration of mathematical ideas, they discuss the constitution of fundamental logical operations essential for acquiring and developing logical-mathematical thinking.

This choice was made in order to deepen the understanding of Mathematics education, exploring cognitive influences, normative guidelines, and perspectives on educational development. In this investigation, we aim to analyze the role of play as a specificity in Early Childhood Education, focusing on the potential of the game Hopscotch for teaching Mathematics.

To achieve our specific goals, we examined didactic-pedagogical approaches presented in the literature for teaching Mathematics through playful activities. Additionally, we investigated how legislation related to curricula and teaching programs addresses mathematical learning.

The integrated approach to these objectives aims to provide a critical and comprehensive analysis of the effectiveness of playful activities as pedagogical tools in Mathematics education, thereby contributing to the understanding of the knowledge development process in this educational field.

Thus, the central objective of this study is to analyze the effectiveness of children’s games, with a focus on Hopscotch, as a tool for active learning in Mathematics education in Early Childhood Education. We aim to verify how mathematical development can be promoted and cognitive skills stimulated, including problem-solving, critical thinking, and creativity in children.

Specifically, the research seeks to analyze how certain playful activities, such as the game Hopscotch, can enhance the process of developing activities in Mathematics teaching, contributing to active learning and social interaction, while realizing the principles of Piaget's (1964) socio-

interactionist theory. In Early Childhood Education, it is essential that children feel welcomed and perceive school as a space where learning is an enjoyable and interactive experience.

Therefore, we hypothesize that games and playful activities play a fundamental role by stimulating research and the construction of mathematical ideas, motivating children, and increasing interest and participation in lessons. According to Kishimoto (2009), games and playful activities are not just forms of entertainment but powerful tools for teaching and learning. In this theoretical context, they can promote healthy interaction among children, expanding their knowledge and transforming the school environment into a space of both learning and fun.

Development

Human beings undergo a series of significant transformations in the developmental process, from birth to adulthood. These changes are fundamental to development, playing a key role in learning and growth over time. These transformations shape physical, emotional, and cognitive aspects, having a profound impact on human development. According to Piaget (1999), this development is divided into four stages, and for these stages to occur, an interaction between them is essential, creating a balance that can also be referred to as adaptation. In the first stage, called Sensorimotor, the age range of children is from zero to two years. This phase is known as the period of actions and perceptions, practicing cognitive development even before language begins. During this stage, infants learn about themselves and their environment, as noted by Papalia, Olds, and Feldman (2019), referring to the constructivist theoretical framework.

The subsequent stage is called the Preoperational stage, with an age range of two to seven years. In this phase of early childhood, egocentrism is particularly pronounced, as children have difficulty perceiving the perspective of others. An important factor to be addressed at this stage is the concept of constructing logical ideas, which is a continuous process, allowing for the development of symbolic play:

> There will be “great expansion in the use of symbolic thinking,” which, from this, generates the mental constructions of the child directed towards problem-solving. However, despite the expansion of symbolic thinking, logic has not yet been fully attained” (Papalia, Olds, & Feldman, 2019, p. 8, quotation in the original).

The third stage, called the Concrete Operational stage, is characterized by the cycle of reversibility, in which the child develops the ability to think logically about concrete events and objects. In middle childhood, around seven years of age, children begin to develop clearer logical

thinking, although some limitations still exist, according to Piaget (1976). This stage occurs between the ages of seven and twelve, with an emphasis on intuitive discoveries, often achieved through the trial-and-error method.

The final stage, according to Piaget's framework, is called the Formal Operations stage, which begins when the child reaches twelve years of age. From this point on, reasoning becomes hypothetical, that is, deductive, emphasizing empirical and reflective actions. In this stage, children begin to formulate hypotheses and test them concretely, as they deal with "[...] a representation of a representation of possible actions" (Piaget, 1976, p. 62-64). Furthermore, they develop critical thinking skills, acting according to their potential and applying their ideas in practice (Piaget, 1976).

Adaptation, or equilibration, represents the period of transition between different stages of development. For this transition to occur, it is essential to have a stimulus capable of promoting a balance between assimilation (interpretation) and accommodation (a fundamental learning process). Only through this dynamic balance between incorporating new information (assimilation) and modifying existing mental schemas (accommodation) is it possible to effectively conclude the process of transition between cognitive development stages.

Therefore, the development of learning is related to the environment in which one is situated. Upon encountering new stimuli, the need for adaptation arises, generating a balance with what one is supposedly in contact with, articulating with new knowledge and prompting readaptation of learning (Piaget, 1976).

Kishimoto (2009) highlights the importance of playful activities in Early Childhood Education. The author emphasizes that play plays a crucial role in the cognitive and social development of children. She establishes that play activities provide opportunities for children to explore, experiment, and construct knowledge in an active manner.

Therefore, playful activities in Early Childhood Education can be seen as effective means to foster the development of children's mental structures, as suggested by Piaget (1976). Games allow children to understand new information, adjust their existing cognitive structures, and develop specific skills such as problem-solving, critical thinking, and creativity.

By incorporating playful activities, such as educational games and play, educators can create environments that stimulate the cognitive, emotional, and social development of children, in line with Piagetian principles.

These activities provide situations in which children can construct meanings, test hypotheses, and interact collaboratively, cooperating to develop thinking and creating mechanisms to connect the ideas explored.

Mathematics in Early Childhood Education

Mathematics is often met with aversion and criticism by students at various educational levels, being perceived as a highly challenging subject for many. However, it is a human construct and can be understood, particularly when taught through methods and didactic procedures aimed at effectively organizing learning. It is essential to recognize the importance of incorporating Mathematics education, not only in the school environment but also considering the practices developed in students' homes. This is justified by the fact that Mathematics is intrinsically linked to all daily activities, highlighting the relevance of incorporating mathematical situations from Early Childhood Education onward.

During the Early Childhood Education phase, children are immersed in a period of exploration and experimentation. Consequently, it is essential to adopt pedagogical approaches that include the teaching of Mathematics through games, play, and playful activities. These strategies can spark children’s interest, encouraging them to learn when complemented by effective pedagogical support guided by education specialists. This prepares them to formulate questions and face challenges that arise throughout their educational journey.

In the early years, Mathematics plays a crucial role in the development of children's logical thinking, according to Aranão (2011). Moreover, it serves as the foundation for learning in various other subjects. Thus, we observe, in attempts to establish curriculum frameworks, a concern with incorporating playful approaches in teaching, with the aim of effectively contributing to this development and creating a foundation for a more interactive and immersive knowledge construction.

Using their own resources and unconventional methods, children turn to counting and operations to solve everyday problems, such as checking stickers, keeping track of points in a game, sharing candies with friends, showing their age with fingers, handling money, and operating with it, etc. As they engage with their surroundings, they “[...] also observe and act in the space around them and, slowly, begin organizing their movements, discovering paths, establishing reference systems, identifying positions, and comparing distances “(Brasil, 1998, p. 207).

However, it is crucial to highlight that educators must possess pedagogical skills in order to implement these approaches effectively. The success of this methodological process depends on the teacher's ability to guide children toward the proposed educational objectives, thereby ensuring a solid foundation for future learning.

Fonseca (2017) explains:

> Among these proposals, I highlight the use of concrete materials, including logic blocks, building games, and various collections, which can be explored in different environments, such as, for example, a collection of colorful hula hoops in the yard; the participation of students in games and play, such as puzzles, which can be assembled in small groups or individually; and problem-solving activities, which allow the child to construct different hypotheses and compare them with those of other students (Fonseca, 2017, p. 20).

The development of lessons based on these didactic principles, with the teacher acting as a mediator, would greatly contribute to the development of children, as it would help avoid future difficulties and neutralize aversion to Mathematics. In this approach, the student would be enjoying themselves, learning, and feeling secure.

Playful Activity in Mathematics Education

Early Childhood Education marks the beginning of a child's schooling. Often, some children struggle with this process as they are very attached to their families. In such cases, the educator must be prepared to welcome these children into school and create a welcoming environment, guiding them on the rules and school norms, which may not always align with those from home, while demonstrating that, although it is a place for learning, it can also be a place for fun and activities aimed at their development as human beings. Through playful activities, it is possible to work on various dimensions in the child, particularly the intellectual, as they develop their thinking, and the social, where interaction with the teacher and other classmates takes place.

Moreover, as the child learns, they develop, a movement primarily sustained on the plane of interactions, in the exchange of experiences and lived moments. If the child’s main interest during childhood is marked by playfulness, it is a fact that, within the context of this field of activities, it is feasible to apply different teaching methods, making use of play and games.

It is important to highlight that, through play, children learn to live in society, and with the help of games, they can develop enhanced mental and motor coordination. In this line of thinking, it is

essential that educational institutions recognize the importance of play, even in the absence of an appropriate play space. It is crucial that the planning of playful activities be carefully designed to offer children meaningful socio-interactive learning. This aspect is emphasized by Kishimoto (1995), highlighting the need for a pedagogical approach that values play as an essential practice in the educational context:

> Each space created for play can be attributed to the recognition of the importance of promoting play, a specific way to develop imagination and the experience of social relationships through toys. However, it should be noted that play in school must be part of a pedagogical proposal, not just isolated spaces for play. The playroom should, within the school, be an integrated part of a pedagogical proposal that incorporates play as the central focus of childhood work (Kishimoto, 1995, p. 23).

The toy in the child's hands represents a treasure of possibilities; the toy, as an instrument of fun, takes on varied interpretations depending on its cultural meaning. According to Kishimoto (2009, p. 18), "[...] the toy transforms and photographs reality. It does not merely reproduce objects, but a social totality. Today, toys reproduce the technical and scientific world and the current way of life, with household appliances, spacecraft, dolls, and robots".

Thus, the toy can contribute to the child's ability to imagine, project, and establish relationships between things and ideas, creating the necessary conditions to progressively transcend the immediately perceptible, in order to, with the aid of tools and signs, put into practice a set of actions necessary to expand the scope of symbolic representation.

According to Kishimoto (2009), play plays the role of generating mental interpretations and reality, containing both visible and implicit rules for the participants. This process is grounded in the child's playful activity, providing pleasure and fun for the learners, as well as having an educational function, as it guides them to respect conventions and rules, thereby establishing relationships necessary for the appropriation of the knowledge at hand.

Kishimoto (1995) examines a category of traditional children's games those originating from popular culture which reflect the spiritual expression of a community at a particular historical moment. These games, as natural manifestations of popular culture, play a crucial role in preserving children's identity and promoting different forms of social interaction.

According to Cardoso's (2021) analysis, once students have become familiar with the game and have had the opportunity to manipulate it, the teacher assumes the role of mediator, encouraging them to build knowledge through problem-solving situations. However, it is important to clarify that mediation is not established solely through the teacher's speech but also reverberates through the

signs and meanings involved in the pedagogical process. This means that the teacher's speech is not always sufficient to establish communication with the students. This is why, at times, some children do not fully understand the way the teacher presents a given concept, but claim to have understood the way a peer explained it to them.

In the book *Children's Play in Mathematics Lessons*, Smole, Diniz, and Cândido (2000) highlight the importance of play, both inside and outside the classroom. According to the authors, such activities provide opportunities for students to explore mathematical skills, raise hypotheses, justify reasoning, and validate conclusions. These practices contribute to the construction of a social and intellectual community in the classroom, emphasizing the need to provide various opportunities for group work, whether in pairs, small groups, or even involving the entire class.

Lorenzato (2006) relies on Piaget's framework to assert that the concept of number holds great relevance in Early Childhood Education, and it is through seven basic mental processes (correspondence, comparison, classification, sequencing, seriation, inclusion, and conservation) that the child will understand the process of its formation.

In turn, Kamii (1983) emphasizes in her book that this principle implies that the child must relate various types of content or materials, such as objects, events, and actions, to construct the concept of number.

In this discussion, it is crucial to highlight the need to consider the influence of sociocultural factors in mathematical learning. Piaget (1964, 1976) did not disregard this influence; however, likely because his work did not specifically address an educational theory, he did not delve into these issues. From our perspective, the counterpoint for discussing this prerogative lies within the realm of historical-cultural theory, in its developmental education branch, a subject that goes beyond the scope of this text, and a task we aim to explore in future studies.

Example: Hopscotch as a Tool for Active Learning

The Statute of the Child and Adolescent (ECA), Law No. 8.069, dated October 13, 1990, in Article 16, guarantees children the right to freedom to learn, including playful activities such as playing, practicing sports, and having fun.

In turn, the *Curricular Guidelines for Early Childhood Education* (Brazil, 1998) emphasize children's right to engage in pleasurable experiences within educational institutions, promoting the integration of physical, emotional, affective, cognitive, and social aspects. Experimental activity is crucial for the appropriation of concepts, as different teaching materials and diverse activities can

provide students with new perspectives on learning, considering their sociocultural and individual differences:

> Through the opportunity to engage in imaginative play created by themselves, children can activate their thinking to solve problems that are important and meaningful to them. By providing play, for example, a space is created in which children can experience the world and internalize a particular understanding of people, feelings, and various forms of knowledge (Brasil, 1998, p. 28).

t is imperative that education professionals share a global and uniform concern regarding these rights, as well as the need to develop a deep understanding of the fundamental aspirations and needs of children. Without losing sight of the fact that child development is not linear, age range constitutes an essential factor to be considered, requiring educators to remain continually open to exploring new pedagogical approaches in order to meet the specific needs of each child. It is crucial to analyze playful activities, taking into account the physical, psychological, and psychosocial development of each individual child.

Technological advances and the growth of cities and populations have distanced children from traditional popular games that were once common in open spaces. This transforms the school environment, which now serves as a backyard for children to interact with toys from previous generations. The game of Hopscotch is one such traditional play that plays an important role in development, particularly in the field of Mathematics.

To achieve the objectives of the Hopscotch game, the activities involved require effort to recognize space, understand notions of distance, maintain balance, develop counting skills, perform basic calculations, and foster competitiveness, highlighting an essential area of children's motor development, which requires attention and enhancement.

Smole, Diniz, and Cândido (2000) emphasize:

> More specifically in mathematics, we can say that Hopscotch aids in the development of concepts related to numbers, measurements, and geometry. Counting, numerical sequence, recognition of digits, comparison of quantities, assessment of distance, assessment of force, spatial localization, spatial perception, and visual discrimination are some of the concepts and mathematical thinking skills involved in this game (Smole; Diniz; Cândido, 2000, p. 22).

To develop effective mathematical learning, children need to explore the things, objects, and situations in their daily lives, establishing relationships between them and with the environment in which they live, thus fostering the creation of a progressively internalized system of actions in

thought. The mental creation of this system of actions is the basic constitutive element of logical-mathematical knowledge.

For this reason, Kamii (1983) highlights Piaget's distinction between social knowledge, physical knowledge, and logical-mathematical knowledge, which is fundamental to this discussion. The first two encompass simple or empirical abstractions, recognizing characteristics and properties present in people or objects. Beyond this, logical-mathematical knowledge entails reflective abstractions and the creation of the aforementioned system of coordinated actions in thought.

The Base Nacional Comum Curricular (BNCC) (Brazil, 2018) defines the competencies and skills that students must develop at each stage of Basic Education in Brazil. In Early Childhood Education, the BNCC emphasizes the importance of Mathematics, aiming to promote the cognitive development of children through playful and contextualized activities. This includes exploring concepts of quantity, space, time, shape, and problem-solving, in an integrated manner with other areas of knowledge.

Hopscotch: Developing Critical Thinking, Creativity, and Problem-Solving Skills

Reinforcing fundamental mathematical skills, Hopscotch stimulates critical and creative thinking. Children should be introduced to the game initially for the sheer pleasure of playing, recognizing the characteristics of the activity.

Progressively, they can be encouraged to create their own versions of the game, modifying rules and numerical patterns. By doing so, they exercise their understanding of relevant mathematical concepts, in addition to developing skills of analysis and synthesis, which are essential for solving complex problems, based on Smole, Diniz, and Cândido (2000). This aspect of Hopscotch as a learning tool contributes to the development of students' autonomy, allowing them to become active creators of mathematical knowledge.

The very design of the board, that is, the layout on the ground for jumping over the squares, already involves, through its configuration, logical concepts of ordering, classification, seriation, hierarchical inclusion, space, and shape. This layout, in its usual form, can be represented by squares or rectangles arranged sequentially in straight lines, but it can also contain these shapes in a zigzag pattern, in order to explore with children the concepts of laterality, direction, and orientation.

Initially, without the concern for writing and numeral identification, some questions should be asked to help children recognize the space of the game: indicating which is the seventh square in the

sequence, how many squares one student (Student A) is ahead of another student (Student B), or vice versa; what is the total number of squares on the board, etc.

While all actions in the Hopscotch game are important for the development of logical reasoning, spatial recognition, and quantity understanding, one action emerges as central, as we begin to explore the concept of numbers and numerical symbolism: the notion of adding one unit, constituting another numeral. For example: 2 = 1 + 1; 3 = 1 + 1 + 1, but it also means 2 + 1. Likewise, 5 = 1 + 1 + 1 + 1 + 1, but it could also be 2 + 1 + 1 + 1, or 3 + 1 + 1, or 4 + 1, or even 2 + 2 + 1, or 3 + 2, among other mathematical possibilities to be explored. Note the richness of formulations of this kind in the exploration of such a common game in the imagination of children.

These actions of transforming ideas used in the formation of numerical thinking are not static; they are not formulated by mere repetition and recognition of symbols, but by establishing relationships and coordinating actions in thought. In fact, an essential distinction must be made here: the number is not, strictly speaking, the symbol used to represent it, but an idea of quantity. Its representation is shaped by the articulation of digits to form the numeral, that is, the symbolic representation of quantity.

Thus, as children progress in their schooling, it is essential to guide them to recognize that different cultures have different ways of representing the idea of number. In our culture, using Indo-Arabic numerals, we traditionally present the number 5 to children, but in Roman culture, it was represented by the letter V, symbolizing the five fingers of the hand. In this system, I, II, and III represented quantities of fingers less than five. To avoid repeating more than three symbols, the Romans developed certain rules, such as: placing I before a numeral means subtracting one unit, and placing I to the right means adding one unit. This is why four in Roman numerals is IV and six is VI. Similarly, following these rules, we have VII and VIII.

Children can recognize these numerical representations in book chapters, newspapers, the Bible, or on clock faces. These formulations, progressively explored in appropriate pedagogical moments, can contribute to guiding children towards the perception that Mathematics evolves and is a human construct.

Obviously, it is not about reconstructing the History of Mathematics with young children, but rather showing them that mathematical concepts and their representations have a historical evolution and vary from culture to culture. Similarly, it is worth noting that, when children do not know how to write Indo-Arabic numerals, they sometimes use notations such as a vertical line for one unit or a

small square for the numeral 4. These formulations can serve as the foundation for the development of algebraic thinking, which, in recent attempts at curriculum innovation, often causes concern for teachers due to the misunderstanding of the connections between the concepts of number, digit, and numeral, which are generally treated as synonyms but they are not.

Advancing further in exemplifying the role of playful activities in Mathematics education, without intending to exhaust the topic, the game of Hopscotch allows for the exploration of some mathematical situations, such as: how many squares did student A properly jump over more (or fewer) than student B? Or, by assigning points for the winner's path, how many points did they accumulate after a certain number of competitions? If the children cannot write, this is not a problem: they can represent the quantities by coloring the squares by unit, on a grid paper, expanding the forms of symbolic representation.

By integrating Piaget's Socio-Interactionist Learning (1976) and Pólya's Problem-Solving Methodology (1995), educators can create meaningful learning experiences, promoting not only mastery of mathematical concepts but also vital skills such as critical thinking, creativity, and problem-solving. The creative use of Hopscotch in Mathematics teaching, thus, represents a possibility to transform the classroom into a dynamic, interactive, and deeply educational environment.

Pólya's (1995) methodological perspective aims at the development of didactic actions designed to guide students in the problem-solving process. Pólya's writings have become a fundamental resource for educators dedicated to teaching Mathematics. For him, solving a problem is considered a kind of art, and he outlines four steps for solving any mathematical problem: understanding the problem, devising a solution plan, implementing the plan, and reviewing to verify the accuracy of the solution. These ways of acting and thinking are typical of the behaviors needed to succeed in the game.

According to Pólya (1995, p. 18-19), "[...] a great discovery solves a great problem, but there is always a touch of discovery in the resolution of any problem." It is this discovery that can spark children's interest in mental exercise, especially because, according to him, problems occupy a significant part of our conscious thought, and solving these problems plays a key role in human activity.

Pólya's (1995) problem-solving methodology emphasizes the importance of guiding students in developing strategies to face mathematical challenges. Hopscotch, as a game with rules, can be adapted to create problem-solving situations. For example, children can be challenged to find

different paths across the board, considering specific rules, such as jumping only on even numbers or reaching a certain sum during the course. These challenges promote the practical application of mathematical skills, encouraging children to develop creative strategies to overcome obstacles, thus consolidating their understanding of mathematical concepts:

> Mathematics is not a spectator sport; it cannot be enjoyed or learned without active participation. Therefore, the principle of active learning is particularly important for us, mathematics teachers, especially if we consider our main objective the first of our objectives to be teaching students how to think (Pólya, 1995, p. 10).

Smole (2003) discusses the importance of overcoming obstacles in problem-solving, emphasizing that solving a problem is not just about finding an answer quickly; the focus is on the decisions made when attempting to achieve a goal defined by the solver. The approach involves overcoming obstacles, providing enough resistance to move beyond instant solutions through known formulas.

It is about encouraging the solver to use their prior knowledge, mental representations, and questioning to develop new ideas and find approaches that solve the presented challenges. This process leads to new forms of learning and thinking, as described by Smole (2003). When considering the teaching and learning dynamics in schools, it is essential to incorporate Problem Solving as an integral part of this process. This implies recognizing the classroom as an environment conducive to the exploration of problems and issues (Smole, 2003):

> This strategy is centered on the idea of overcoming obstacles by the solver, and therefore, should not involve immediate resolution through the application of a known operation or formula, but rather offer enough resistance to lead the solver to mobilize their prior knowledge, as well as their representations and questioning, in order to develop new ideas and pathways aimed at solving the challenges presented by the problematizing situation, thus generating new learning and ways of thinking (Smole, 2003, p. 12).

The process of contextualizing, historicizing, and problematizing the mathematical ideas involved should prompt students to reflect and take initiative, making decisions about the best perspective for playing, creating a system of coordinated actions in thought and incorporating objects into it.

Play as a Means of Exploration and Knowledge Appropriation

The contributions of some authors, such as Brenelli (1996), Kishimoto (2009), and Smole, Diniz, and Cândido (2000), enrich the field of teaching and learning. Their research and innovative ideas have provided insights, shaping pedagogical practices and positively influencing how educators

approach the educational process. According to Kishimoto (2009), games are recognized as valuable tools in educational practices, playing a key role in teaching by creating conditions for children to learn and develop. Games provide children with the opportunity to explore concepts in a playful manner, fostering social interaction and encouraging the sharing of educational experiences:

> By allowing intentional action (affectivity), the construction of fundamental representations (cognition), the manipulation of objects and the performance of sensory-motor actions (physical), and exchanges in interactions (social), play encompasses various forms of representation of the child or their multiple intelligences, contributing to learning and child development. When playful situations are intentionally created by the adult to stimulate certain types of learning, the educational dimension emerges (Kishimoto, 2009, p. 45).

The act of playing offers children the opportunity to explore concepts in a playful manner, promoting social interaction and encouraging the sharing of educational experiences. This highlights that play plays a crucial role in the learning process of children, providing imaginary scenarios that drive cognitive development and facilitate interaction with others. These interactions significantly contribute to the expansion of children's knowledge (Kishimoto, 2009).

Engaged in games and playful activities, children not only interact with their peers, but also acquire relevant skills, such as attention, affectivity, the ability to maintain focus, and the development of perceptual and motor skills. These activities make the learning process more stimulating, encouraging the active and operative participation of children in the educational experience (Brenelli, 1996).

In the playful environment of Hopscotch, children can encounter fundamental mathematical concepts. Counting the numbers on the board, comparing spaces, identifying patterns, and making estimates are mathematical skills that can be intuitively absorbed during the game. The physical interaction with the game also stimulates motor coordination and agility, fostering holistic learning that goes beyond purely cognitive aspects:

> The proposed environment is a positive one, encouraging students to propose solutions, explore possibilities, raise hypotheses, justify their reasoning, and validate their own conclusions. In this way, in this environment, mistakes are part of the learning process (Smole; Diniz; Cândido, 2000, p. 11).

The responsibility of educators is to create a stimulating and inclusive educational environment. By introducing Hopscotch as a playful activity for learning Mathematics, they provide opportunities for children to build their own competencies autonomously. Children's curiosity should be encouraged by asking questions that challenge them to think, explore, and experiment. By offering

this space for questioning and discovery, mathematical skills are cultivated, as well as essential cognitive and emotional skills such as problem-solving, perseverance, and self-confidence.

In addition to addressing mathematical concepts, Hopscotch can be used in various ways to promote the child's holistic development. For example, by incorporating colors and geometric shapes into the Hopscotch spaces, it is possible to introduce concepts of art and aesthetics. By encouraging cooperation and communication among children during the game, we are developing important social and emotional skills. In this perspective, Hopscotch becomes an educational activity that plays a significant role in the perspective of transdisciplinarity, enriching both mathematical knowledge and the child's overall development.

Another key aspect highlighted by Brenelli (1996) is the importance of using games in educational contexts for children with learning difficulties:

> Using games in educational contexts with children who have learning difficulties could be effective in two ways: on one hand, it would guarantee their interest and motivation, as long sought by teachers, and on the other hand, it would act to enable them to build or enhance their cognitive tools and facilitate the learning of content. (Brenelli, 1996, p. 27).

The author emphasizes that the systematic application of games triggers processes of equilibration in individuals' cognitive structure. This happens because the introduction of problem-situations involving the game presents a challenge to thinking, encouraging the use of imagination to overcome obstacles. Therefore, this approach becomes an essential element in promoting cognitive development and overcoming the learning difficulties faced by these children in the educational environment.

Although not a primary aspect of this study, this approach provides valuable insights into the practical application of playful activities in the learning process of children facing educational challenges. Thus, this perspective may open new possibilities for further investigations, exploring the effectiveness of games as an educational strategy for children in similar situations, becoming a key aspect in the field of educational research.

By recognizing the value of play and playfulness in preschool learning and using Hopscotch as a creative approach to teaching Mathematics, educators will empower children to learn in a meaningful and engaging way. By creating an environment that values exploration, discovery, and enjoyment in the learning process, we are preparing children to become active, curious, and confident learners, essential for their success not only in Mathematics but in all aspects of their lives.

Final considerations

This study, based on a bibliographic and documentary review, observed that the contemporary conception of childhood significantly differs from that of the 17th century, due to continuous changes in social thought, customs, and culture. In the past, society did not recognize the importance of playful activities, such as play and games, in the context of children's learning, nor did it understand their role in motor, cognitive, imaginative, and creative development.

Currently, play is recognized as a crucial element for cognitive development, no longer seen as imposed activities, but as a potential means that stimulates the exploration of children's skills. Despite the recognition of the relevance of playful activities in Mathematics education, some educational institutions still persist in adopting early formal teaching practices, introducing complex mathematical concepts for which children are not fully prepared. These inadequate approaches can lead children to lose interest in Mathematics. Therefore, it is necessary to rethink teaching strategies in contemporary society, returning the protagonism to students in their own process of mathematical learning.

Educators should guide their pedagogical practices based on a solid ethical and pedagogical awareness, providing support to students in their authentic experiences with Mathematics. By doing so, we create an educational environment that both facilitates the understanding of mathematical concepts and promotes children's interest, creativity, and confidence in learning Mathematics.

To this end, it is important to integrate playful activities, such as games and play, effectively into the educational routine. By doing so, we provide meaningful and contextualized learning, also allowing children to explore their potential in all aspects of development, engaging in what is inherent to their growth: play.

Recognizing the importance of play, educational institutions can create more stimulating and child-centered environments, fostering solid intellectual and emotional growth in our society.

In this article, we explore the importance of playful activities, with a special focus on Hopscotch, in the context of Mathematics teaching in Early Childhood Education. We demonstrate that the playful approach makes the learning process more engaging while strengthening essential skills in children, promoting not only the understanding of complex mathematical concepts but also skills such as creativity, socialization, and problem-solving.

Additionally, our study established connections and relationships between official guidelines for Mathematics teaching, notably influenced by Piagetian and Neo-Piagetian trends. In subsequent

research, it is our intention to place this movement within the context of the Developmental Education perspective, identifying significant counterpoints, since, in our view, the influence of sociocultural factors on mathematical learning is still underexplored. Studying playful activities seems beneficial for this purpose.

By aligning our discussion with the Piagetian theoretical framework, we emphasize the need for an educational environment that adapts to the child's developmental stage, highlighting the importance of playful activities even during the preoperational stage. Furthermore, the analysis developed reinforced the effectiveness of playful activities, such as Hopscotch, in the educational context, showing not only the joy these activities provide but also the valuable tool they represent for the development of mathematical notions.

We also consider that situating mathematical education within the realm of social interactions leads us to undertake tasks that must take into account the influence of sociocultural factors on intellectual development, which exceeds the limits of this article but should be the subject of future studies.

This study highlights the imperative need to incorporate playful methods in Mathematics teaching, starting from Early Childhood Education. By doing so, we make learning more stimulating while ensuring a solid and lasting understanding of mathematical concepts. This requires transforming the culture of school Mathematics, which imposes on educators and educational institutions the recognition and appreciation of these playful approaches, thus preparing children for enjoyable relationships with mathematical thinking.

Investing in the educational potential of children through playful activities is not just a pedagogically relevant choice, but a significant step toward intellectual and emotional growth, in the perspective of transforming the school culture in our society. This culture still bears historical marks of learning through mechanical and repetitive procedures, despite the efforts that should be considered for such a necessary change.

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