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Investigative Activities as a Way of Promoting Scientific Initiation in Early Childhood Education

Atividades Investigativas como Possibilidade de Promover Iniciação Científica na Educação Infantil

Las Actividades de Investigación como Forma de Promover la Iniciación Científica en la Educación Infantil

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Abstract

Learning about Science and natural phenomena is important from the beginning of Basic Education. With this in mind, this study aims to analyze the implementation of investigative activities to promote scientific initiation in an Early Childhood Education class. This is a qualitative study, of the research-application type, developed from a research project on Science initiation for young children, carried out at a federal public university. It addresses the theme "air and wind," a suitable topic for working with Inquiry-Based Science Education with children. For this, playful activities were carried out with recyclable materials, taking into account the children's previous knowledge, and meeting the learning objectives proposed by the Brazilian National Common Curriculum Base for Early Childhood Education. The results indicate that the ways in which the activities were designed and implemented contributed to the development of scientific initiation through investigative activities. The children's natural curiosity and their ability to reason, investigate, and argue were further stimulated. More studies on Scientific Literacy in Early Childhood Education must be developed to improve teaching methods and techniques that help children appropriate their culture, life context, and understanding of the natural phenomena to which they are exposed.

Keywords: scientific initiation, early childhood education, inquiry-based science education

Resumo

A aprendizagem sobre Ciências e os fenômenos da natureza é importante desde o início da Educação Básica. Nesse sentido, esta pesquisa tem o objetivo de analisar a realização de atividades investigativas na promoção da iniciação científica em uma turma de Educação Infantil. Trata-se de um estudo de abordagem qualitativa, do tipo pesquisa-aplicação, desenvolvida a partir de um projeto de pesquisa sobre a iniciação às Ciências para crianças pequenas, realizado em uma Universidade Pública Federal. Aborda a temática "ar e vento", tema adequado para trabalhar o Ensino de Ciências por Investigação com as crianças. Para isso, foram realizadas atividades lúdicas, com materiais recicláveis, que levaram em conta os conhecimentos prévios das crianças, atendendo aos objetivos de aprendizagem propostos pela Base Nacional Comum Curricular para a Educação Infantil. Como resultados, entendeu-se que as formas como as atividades foram concebidas e executadas contribuíram para o desenvolvimento da iniciação científica por meio das atividades investigativas. Foi despertada, ainda mais, a curiosidade natural das crianças e a capacidade de raciocinar, investigar e argumentar. É necessário que estudos sobre a Alfabetização Científica na Educação Infantil sejam desenvolvidos, para que se aperfeiçoem métodos e técnicas de ensino que facilitem às crianças a apropriação da sua cultura, do seu contexto de vida e da compreensão dos fenômenos da natureza aos quais estão expostas.

Palavras-chave: iniciação científica, educação infantil, ensino de ciências por investigação

Resumen

El aprendizaje de las ciencias y los fenómenos naturales es importante desde el inicio de la educación primaria. Teniendo esto en cuenta, esta investigación tiene como objetivo analizar la implementación de actividades de investigación para promover la iniciación científica en una clase de Educación Infantil. Se trata de un estudio cualitativo de investigación-aplicación, desarrollado a partir de un proyecto de investigación sobre iniciación científica para niños pequeños en una Universidad Pública Federal. Trata del tema aire y viento, que es un tópico adecuado para trabajar con niños en la Enseñanza de las Ciencias por Investigación. Para ello, se realizaron actividades lúdicas con materiales reciclables que tuvieron en cuenta los conocimientos previos de los niños, atendiendo a los objetivos de aprendizaje propuestos por el Currículo Nacional Común para la Educación Infantil. Los resultados mostraron que el diseño e implementación de las actividades contribuyó al desarrollo de la iniciación científica mediante actividades investigativas. Esto despertó aún más la curiosidad natural de los niños y su capacidad de razonar, investigar y argumentar. Es necesario desarrollar estudios sobre la Alfabetización Científica en la Educación Infantil con el fin de mejorar los métodos y técnicas de enseñanza para facilitar la apropiación por parte de los niños de su cultura, su contexto de vida y los fenómenos de la naturaleza a los que están expuestos.

Palabras clave: iniciación científica, educación infantil, educación científica basada en la investigación

Introduction

Science Teaching in Basic Education is a challenging field, often associated with the exclusive work of research centers and scientists (Duarte et al., 2024). This made it something distant from the students' daily lives. Currently, however, new paradigms have advanced in Science Teaching, leading to scientific initiation from the early years of schooling.

In this sense, promoting Scientific Literacy in children is essential for their development as citizens. The child is a historical subject with rights, who develops through interactions, relationships, and daily practices, constructing meanings and producing culture (Ministério da Educação, 2010). Childhood is a propitious period for this, as children have a natural curiosity to explore the world around them.

The concept of Scientific Literacy by Lorenzetti and Delizoicov (2001) is adopted here, being "the process through which the language of the Natural Sciences acquires meanings, constituting a means for the individual to expand their universe of knowledge" (p. 52). The aim of Science Teaching beginning in Early Childhood Education also considers the "construction of hypotheses to address existing doubts and in the future enabling students to develop a point of view or opinion that escapes the empirical and common sense" (Ximendes & Pessano, 2023, p. 8).

Therefore, it is necessary to understand what Brito and Fireman (2018) state about Science Teaching by Inquiry, especially with young children, when they highlight that it does not mean the teaching of ready-made scientific concepts, but that "this teaching

perspective allows the student to learn Science as a culture to read, think, speak, perceive and feel the world" (p. 468), placing them in front of authentic problems, in which investigation becomes an essential condition to solve them (Sasseron & Carvalho, 2008).

Ximendes and Pessano (2023) also point out that, in Early Childhood Education, scientific terms will not be emphasized, but exposed for knowledge.

In Early Childhood Education, with children in the age group of 0 to 5 years old, Science Teaching needs to involve, in its pedagogical proposals, "observation, experimentation, questioning, formulation of hypotheses, construction of knowledge that involves the sciences and their contextualization with other areas of knowledge" (Ximendes & Pessano, 2023, p. 2). Therefore, "in this educational context, there is not a curricular division by disciplines, but an integrative approach that encompasses topics from different areas of knowledge, including the Natural Sciences" (Quidigno et al., 2024, p. 2).

In this context, the following research question arose: Is it possible to promote Scientific Literacy in Early Childhood Education through investigative activities? To try to answer this question, this research aims to analyze the implementation of investigative activities in the promotion of scientific initiation in an Early Childhood Education class.

In the following sections, aspects of Early Childhood Education, Scientific Literacy in this school phase, as well as investigative activities in Science Teaching, will be addressed. The methodology of the research, its results and discussions, and, finally, the considerations on the theme will be described. It is expected that the research will foster new studies on Inquiry-Based Science Education, especially in an educational stage as peculiar and important as Early Childhood Education.

Aspects of Early Childhood Education

Early Childhood Education is an excellent field of work for teachers, from the perspective of employing playfulness and care. Here, the central focus is not the content itself, but the integral development of the child as a unique individual and a holder of rights. In this sense, the planning of activities to be developed with children must take these aspects into account. Also, "in a pedagogical action in the classroom, both teachers and students have the opportunity to learn something about Science" (Ximendes & Pessano, 2023, p. 9).

With regard to Science Teaching, Marques and Marandino (2018, p. 1) defend the reconfiguration of the role of science education, so that it favors the emergence of Scientific Literacy as a formative objective. The authors summarized this understanding:

> It is a process that occurs inside and outside the school and that implies i) the promotion of dialogues and approximations with scientific culture; ii) the appropriation of knowledge related to scientific terms and concepts, to the nature of science, to the relations between science, technology and society; iii) the promotion of the necessary conditions for critical readings of reality, participation in public debate, responsible decision-making, social intervention in an emancipatory perspective and social inclusion.

In view of this panorama, the planning of the activities developed with the children took into account the documents that guide Early Childhood Education, such as the National Curriculum Guidelines for Early Childhood Education (DCNEI) (Ministério da Educação, 2010, p. 12), which seek to "articulate children's experiences and knowledge with the knowledge that is part of the cultural, artistic, environmental, scientific and technological heritage".

Another relevant document is the Brazilian National Common Curriculum Base (BNCC) (Ministério da Educação, 2017), with its fields of experiences for Early Childhood Education: the self, the other, and us; Body, gestures and movements; Traces, sounds, colors and shapes; Listening, speaking, thinking and imagination; and Spaces, times, quantities, relations and transformations, described in Figure 1.

Figure 1

BNCC's fields of experience and their characteristics

Field of experience	**Characteristics**
The self, the other, and us	Social interaction and self-awareness, developing autonomy, one's own way of acting, feeling, and thinking.
Body, gestures, and movements	Exploration of the world and awareness of one's own body through movement and different languages, such as music, dance, theater, and pretend play.
Traces, sounds, colors, and shapes	Interaction with different artistic, cultural, and scientific expressions. Perception of the environment through the senses and expression through various languages, creating their own artistic or cultural productions, and exercising authorship (collective and individual).
Listening, speaking, thinking and imagination	It is important to promote experiences in which children can speak and listen, enhancing their participation in oral culture and in the constitution of language and human thought.
Spaces, times, quantities, relationships, and transformations	To stimulate a more critical and creative look at the world, with more meaningful learning, in a world made up of natural and sociocultural phenomena.

Source: Ministério da Educação (2017).

Oliveira (2024) starts from the understanding that "the fields of experiences, described in the BNCC include pedagogical principles and proposals that are consistent with the promotion of Scientific Literacy in Early Childhood Education" (p. 43). In this sense, the author emphasizes, in her analysis, that the BNCC's fields of experiences "highlight the multiple possibilities for the development of Scientific Literacy in schools, based on the promotion of pedagogical activities that relate scientific knowledge to the experiences lived by children in their daily lives" (Oliveira, 2024, p. 47).

To work with children, it is necessary to take into account these fields of experience proposed for Early Childhood Education and their objectives, which address important aspects of the development of this age group, relating them to the actions developed with them, as specified here. The process is multiple and, in this sense, the importance of the teacher in the possibilities (or not) of students' learning is a fundamental fact in the educational context, especially in Early Childhood Education, since learning relationships are effective in social, cognitive, and affective relationships (Ximendes & Pessano, 2023).

Figure 2

BNCC's fields of experience explored in the activities

Fields	Skills	Characteristics
The self, the other, and us	EI03EO01	To demonstrate empathy for others, realizing that people have different feelings, needs, and ways of thinking and acting.
	EI03EO02	To act independently, with confidence in their abilities, recognizing their achievements and limitations.
	EI03EO03	To expand interpersonal relationships, developing attitudes of participation and cooperation.
	EI03EO04	To communicate ideas and feelings to diverse people and groups.
	EI03EO07	To use strategies based on mutual respect to deal with conflicts in interactions with children and adults.
Body, gestures and movements	EI03CG01	To create with the body diversified forms of expression of feelings, sensations, and emotions, both in everyday situations and in games, dance, theater, and music.
	EI03CG02	To demonstrate control and adequacy of the use of their body in play and games, listening and retelling stories, in artistic activities, among other possibilities.
	EI03CG03	To create movements, gestures, looks and mimics in games, plays, and artistic activities, such as dance, theater, and music.
	EI03CG05	To coordinate their manual skills in the appropriate service to their interests and needs in different situations.
Traces, sounds, colors, and shapes	EI03TS02	To express themselves freely through drawing, painting, collage, folding, and sculpture, creating two-dimensional and three-dimensional productions.
Listening, speaking, thinking, and imagination	EI03EF01	To express ideas, desires, and feelings about their experiences, through oral and written language (spontaneous writing), photos, drawings and other forms of expression.

Figure 2

BNCC's fields of experience explored in the activities (continuation)

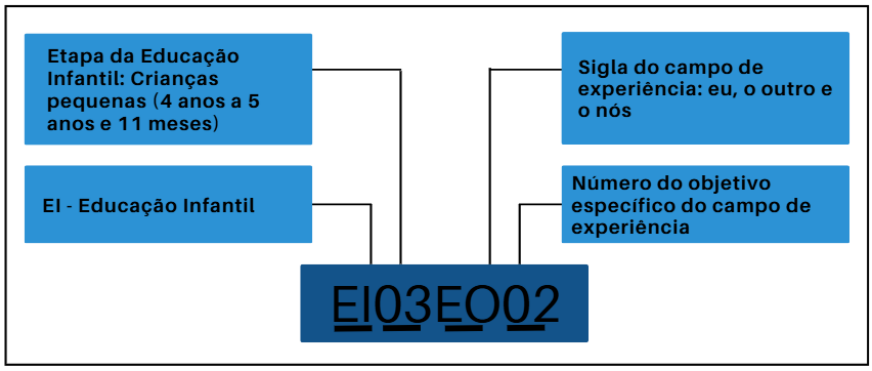
Fields	Skills	Characteristics
Spaces, times, quantities, relationships, and transformations	EI03ET01	To establish comparison relationships between objects, observing their properties.
	EI03ET02	To observe and describe changes in different materials, resulting from actions on them, in experiments involving natural and artificial phenomena.
	EI03ET03	To identify and select sources of information, to answer questions about nature, its phenomena, and its conservation.
	EI03ET04	To register observations, manipulations, and measurements, using multiple languages (drawing, registration by numbers, or spontaneous writing), on different supports.
	EI03ET05	To classify objects and figures according to their similarities and differences.

Source: Ministério da Educação (2017).

As for skills, they are recorded using their own codes, according to the field of experience and the objective developed, as exemplified in Figure 3.

Figure 3

Explanation of the BNCC skills code



Source: Ministério da Educação (2017).

It is necessary for the teacher to consider these important aspects of Early Childhood Education in order to design activities appropriate to children's development. Rodrigues and Amorim (2024) understand that the teacher's role is fundamental in the search for the desired Scientific Literacy, and it is the teacher's responsibility to plan, design, prepare, and organize teaching activities and strategies that stimulate students' interest, contemplating different spaces and resources to achieve the learning objectives.

Scientific Literacy in Early Childhood Education

Over the years, Early Childhood Education has expanded more and more, thus allowing the inclusion of several proposals for activities that can help the teacher in this teaching process for the individual. Scientific Literacy provides a range of conceptions, from which we can develop ideas that can be applied to children, allowing them to work in an interconnected way with other areas of knowledge.

Each type of idea needs to be thought of by the mediator so that the child assumes an active and central role in their educational development, so that fundamental skills are acquired for their intellectual and emotional growth. The tasks and activities experienced at school "are associated with cognitive processes, namely with the capacity for attention, concentration, information processing, reasoning, and problem solving" (Lourenço & Paiva, 2010, p. 113).

When introduced healthily to Scientific Literacy, children tend to show more positive and lasting results, which will endure throughout their lives, recognizing science as something present in their daily lives. "It enables the improvement of students' reasoning and cognitive skills, as well as cooperation among them, in addition to enabling them to understand the nature of scientific work" (Zômpero & Laburú, 2011, p. 68).

The teachings transmitted from an early age allow activities that were previously trivialized to be developed in a natural and conscious way by the children themselves.

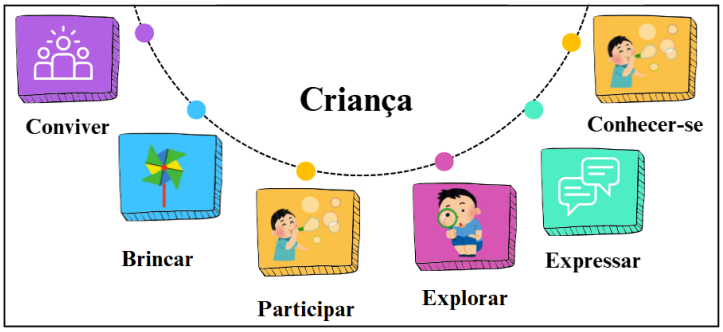
In traditional education, the contents focused on Science are often presented in isolation, not allowing one to understand how Science is interconnected to other areas of knowledge. In this article, later on, we will show how we integrate children's literature and the arts in the proposals constructed, using other areas of knowledge to expand the process of Scientific Literacy through paintings and approximation with written language.

Lorenzetti and Delizoicov (2001) emphasize that the objective is not only the training of future scientists, as was the case before, but the preparation of citizens capable of carrying out daily tasks in a conscious, critical, and efficient way.

When the child is included in the investigative process from the moment he or she enters school, the conscious observation of the world becomes part of his or her learning routine, favoring the understanding of scientific topics and guaranteeing the learning rights of all children (Figure 4).

Figure 4

Early Childhood Education Learning Rights



Source: Ministério da Educação (2017).

The six learning rights proposed by BNCC (Ministério da Educação, 2017) allow children to develop through various activities proposed in their daily lives. By emphasizing, specifically, the rights to explore, express, and play, it is understood that the process of scientific literacy in Early Childhood Education consists of exploring the environment, seeking to question and understand what is observed, in addition to enabling the expression of ideas and doubts, and sharing them with peers. This whole process happens through play, one of the main ways in which children acquire and produce knowledge.

Thus, the National Curriculum Reference for Early Childhood Education (Ministério da Educação e do Desporto, 1998, p. 23) points out:

> Playing is, therefore, an internal activity of children, based on the development of imagination and the interpretation of reality, without being an illusion or a lie. They also become authors of their roles, choosing, elaborating, and putting into practice their fantasies and knowledge, without the direct intervention of the adult, being able to think and solve problems free from the situational pressures of the immediate reality.

It is understood that, in Early Childhood Education, playing is an essential activity. However, its role goes beyond simple distraction. In this process, several aspects need to be present for play to have pedagogical intentionality. It is about understanding play as a natural form of learning, through which the child communicates and expresses their emotions.

Investigative Activities in Science Teaching

Understanding scientific issues requires taking into account the fact that knowledge is constantly changing, and it is necessary to maintain a permanent search for the construction of knowledge about the natural sciences and how they impact our lives (Sasseron, 2015).

Investigative activities, such as observation, exploration of materials, technological resources, and the environment, are strategies that contribute to the investigative process. Regarding Science Teaching by Inquiry, Carvalho (2013) points out that this approach promotes the application of theoretical knowledge through practical experiences of everyday life, especially through problem solving.

From this perspective, the proposal of Science Teaching by Inquiry conceives scientific knowledge as a human construction situated in a historical context (Morais & Bego, 2024).

Thus, the inclusion of activities that lead children to understand topics related to Science is interesting for the construction of meaningful learning, which stimulates questioning and experimentation. Oliveira (2024) reinforces this thought by stating that "Science Teaching, at this stage, should enable the development of skills such as observation, questioning and experimentation, in addition to stimulating a cooperative attitude and children's ability to express themselves" (p. 52).

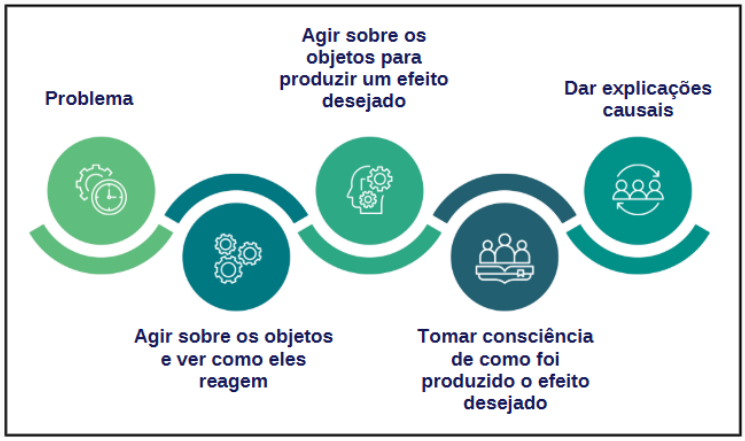
In this sense, Sasseron (2015) understands scientific work as a "[...] set of actions and behaviors involved in the research activity [...]" (p. 55). As evidenced in Figure 5, Brito and Fireman (2018) define the starting point of an investigative activity as the proposition of a problem. By presenting a problem to the students, it stimulates thinking and the search for explanations, which are points to be worked on throughout the investigative process.

As a didactic approach, Carvalho (2013) and Sasseron (2015) state that teaching by inquiry seeks to help students solve the problems presented, promoting interaction among peers, material resources, and systematized knowledge.

From this perspective, Morais and Bego (2024) highlight that the investigation of scientific problems in the classroom constitutes the central axis of Science Teaching by Inquiry.

Figure 5

Investigative activities



Source: Adapted from Brito and Fireman (2018).

After the presentation of the problem, the investigative activity follows a path. The interaction of students with the objects of study, the manipulation of these elements and the observation of the effects generated are fundamental stages of the investigative process. The final phase, corresponding to explanation, plays an essential role in the systematization of knowledge.

This moment enables the evaluation of the research process, allowing the analysis of the perspectives and conclusions elaborated by the students. In addition, it is configured as a relevant source of data for research.

In this argumentative context, it occurs what Sasseron (2020, p. 6) defines as "discursive interactions", and the author highlights that:

> Discursive interactions do not have a simple purpose. Since their functions are multiple, they can range from the establishment of an environment for the presentation of information, the creation of space for discussions and the construction of understandings, to the obtainment, by the teacher, of information that allows the evaluation of the involvement and learning of their students on the topics in question.

According to Driver et al. (1999), "the role of the teacher is to provide physical experiences and encourage reflection. Children's conceptions are considered and questioned respectfully" (p. 33). In this sense, analyzing the discursive interactions is crucial for the continuity of the investigative process, so that, from this perspective, the teacher can observe the different approaches that children use to learn, identifying how such factors influence the construction of knowledge.

Methodological Procedures

This research is characterized by a qualitative approach, in which the researcher explores and evaluates the research object in detail, observing subjective aspects of its nature (Gil, 2022). For its development, research-application was adopted, which Nonato and Matta (2018) report to be the type of research that "seeks to design, develop and apply interventions on the floor of educational spaces" (p. 14).

The study was developed based on research project aimed at the initiation to science for young children, linked to a federal public university. This is the second application of activities of the project[1], conducted under the coordination of a professor with a PhD in Physics, responsible for the line of research that investigates processes of initiation to science in childhood.

In this stage, investigative activities were developed with themes from the children's daily context. The present research addressed the theme "air and wind", considered pertinent to the teaching of Science in Early Childhood Education, as it favors the understanding of the dynamics of air in the environment and its relevance for the maintenance of life and human survival.

1 The research project on initiation to science for young children was carried out in the second half of 2024, after approval by the Research Ethics Committee. Two applications of sequences of investigative activities were executed, lasting three days each. This study refers to the first day of the second application of activities.

Two undergraduate students from the Pedagogy course and one doctoral student in Teaching, with a degree in Pedagogy, all members of the project, and identified as "Teachers P1, P2, and P3" participated in the study. The research was developed in a first-period class of a public Early Childhood Education school, composed of 12 children, aged between 4 years and 5 years and 11 months, identified as "Children C1 to C12".

The project was planned considering the children's previous knowledge, in order to favor the construction of new learning.

The proposed activities involved the use of recyclable materials, storytelling, and playfulness as central elements of the investigative process (Figure 6).

Figure 6

Organization of activities on air and wind

Organization of activities	
Objective	To explore activities using air and wind, with the child's breath as the main resource, observing the effect in different contexts and, from there, understanding the relationship with our breathing.
Resources	Story book, straw, basin with water, balloons, plastic bottle and ribbon, colored ink, A4 sheet of paper.
Steps	Storytelling The Three Little Pigs, conversation circle, questions; Demonstration of the human lung, conversation circle, questions; Boat to blow in the water, conversation circle, questions; Blow painting with ink, conversation circle, questions; Systematization of knowledge; Presentation of the children's drawings.

As data collection instruments, audio and video recordings, notes in a field diary, as well as photographic records and children's productions were made. The research was submitted to and approved by the Research Ethics Committee, opinion number: 7.060.732, CAAE: 82266324.8.0000.5013, and all ethical standards were met.

Results and Discussions

Based on BNCC's fields of experience, the activities presented in Figure 6 were developed with the children. The process began with a conversation circle, when the theme was presented and investigative activities were introduced, based on the telling of the story "The Three Little Pigs" (Figure 7). At this time, several skills were worked on, including the EI03CG02 skill, emphasizing the retelling of stories.

The objective of this strategy was to bring children closer to the concept of air and wind. According to Silva et al. (2024), "the teacher can make use of the most varied resources, including the reading of texts that discuss scientific themes" (p. 3).

Figure 7

Reading the story of the three little pigs

Source: Authors' collection.

Being a classic of children's literature, the story was already familiar to most children, which contributed to enhancing the discussion and directing the questions to the theme of the activities. As in the field study by Rodrigues and Amorim (2024), "some children already had some knowledge and the teachers took the opportunity to encourage them to share what they already knew, promoting a healthy discussion about what they expected to happen during the activity" (p. 13).

Through these dialogues and the reflections raised by the storytelling, it was possible to analyze the children's previous knowledge on the subject, as well as their interpretations and perspectives in relation to the book and the phenomenon studied.

When questioning how the wolf knocked down the houses, there was the following dialogue:

Q2: *How did the wolf knock down the house?*

Children: *Blowing.*

Q2: *And why did the wolf's breath knock down the houses?*

Children: *Because he is strong.*

Q3: *Let's all blow like the wolf to see if we can bring down the house.* [pointing to the wall of the room].

Children: [blow towards the wall].

Q2: *You don't have a strong breath like the wolf's, do you?*

C1: *I have. Everyone together has it!*

Q2: *And when the wind is strong, what do we call it?*

C1: *Whirlwind... Then it sucks people in.*

A relevant example of this interaction was the association made by C1, who compared the strong breath of the wolf to a whirlwind, a natural phenomenon that involves the movement of air. This relationship evidences the children's ability to establish connections between elements of literature and scientific concepts, favoring the development of investigative thinking and the construction of knowledge in a meaningful way.

These interactions contribute to the integral development of children, promoting an interdisciplinary or transdisciplinary view of learning (Quidigno et al., 2024).

Thus, this observation can be related to an indicator of Scientific Literacy, defined by Pizarro (2014) as "articulating ideas", a moment in which the student can establish relationships between the knowledge that is being addressed and the reality or environment in which he or she is inserted, expressing them orally or in writing.

In line with the BNCC, this activity provided the ability EI03ET03, which is characterized by the identification of information and the elaboration of responses that involve nature and its phenomena (Ministério da Educação, 2017). Oliveira (2024, p. 45) reinforces this thought:

> From the documentary analysis of the BNCC, it is considered that the Teaching of Science in Early Childhood Education can be built based on educational processes that awaken children's natural curiosity for the elements and phenomena of nature, mobilizing observation, investigation, and experimentation in the search for other looks, questions, and understandings about the world around them.

With this, the possibility of interdisciplinarity in the development of activities is demonstrated, allowing for the integration of various fields, such as science, reading, Portuguese Language, and text interpretation, among others. Science Teaching in Early Childhood Education is presented "in a globalized way with the other areas of knowledge, providing children with a wealth of possibilities to explore the environment around them" (Ximendes & Pessano, 2023, p. 2).

To continue the sequence of activities, the children were presented with a representation of the lung, made with recyclable materials, which served as a starting point to demonstrate how air enters the lungs. A model made of plastic bottles and blowing balloons was used, connected to a straw that, when blown, inflated the balloons, simulating the movement of the lungs during breathing, as shown in Figure 8.

Figure 8

Plastic bottle lung activity

Source: Authors' collection.

This proposal was designed as a playful and experimental approach, allowing them to understand the function of the lungs and the importance of breathing for our health. Among the skills, EI03CG03 and EI03ET02 were worked on, referring to movements, mimics, and changes in materials resulting from actions on them.

A dialogue was initiated with the children to explore concepts related to the respiratory system, building on their prior knowledge and association with the activities developed, thereby promoting body awareness — "bodies that own their own path in their processes of discovery and learning" (Souza et al., 2022, p. 7).

From this execution, some observations were made by the children:

Q2: (Shows lung) *Does anyone know what this is?*

C4: *Bottle.*

Q2: *In here, what do you think it is?*

Children: *Balloons!!*

C5: *You'll blow the straw, and the wind will enter the balloon, and the balloon will grow.*

Q3: *Let's find out?*

Q2: *This is the representation of our lungs when we breathe. Let's put our hand on our chest and take a deep breath. What happens to our chest? When we breathe, when we catch air, our lungs fill, and when we release the air, it empties.* (Demonstrates).

P2: *I want to know if you see the air entering me* (Take a deep breath) *Did anyone see?*

Children: *No!*

C1: *The air is transparent.*

Q2: *Can you catch the air coming out of you?*

C1: *I can feel it.*

Q2: *When you blow, how can you feel it?*

C1: *Hot.*

C2: *Cold.*

C3: *Iced.*

C4: *The air is hot.*

Q2: *We don't see the air, we can't catch the air; can we store it?* (Demonstrates with a balloon) *But if I release it, what happens?*

C1: *The air comes out.*

Q3: *What happened to the air in the balloon?*

C1: *It left.*

C2: *It flew.*

From this conversation, it is recognized that children have different interpretations about air and that, in the face of the same subject, different perceptions may arise. An example of this is the comment of C1, who mentions that the air is hot; however, for C3, that same air can be cold. This does not mean that children are wrong in their ways of recognizing natural phenomena, but that their experiences influence their perceptions of the natural world.

It can be seen, then, that Science Teaching is important to stimulate the child's capacity for investigation, interest, and curiosity. Children in Early Childhood Education are discovering the world around them and, by nature, are curious, showing interest in various facts that happen in their natural and social environment.

In this context, "Science Teaching can be rich, as it enables children to investigate, research, and raise hypotheses to solve their curiosities and interests" (Ximendes & Pessano, 2023, p. 11).

Continuing the sequence of activities, a paper boat was produced with the children in order to explain the action of the wind, responsible for the locomotion of boats and other objects in general. An A4 sheet of paper was used to make an origami boat, which was then placed in a basin of water. A plastic straw was used so that the children could blow and move the boat, with greater or lesser intensity, depending on the strenth of their breaths, as shown in Figure 9.

Figure 9

Boat blow activity on the water

Source: Authors' collection.

The skill that was most emphasized was EI03CG03, creating movements, discussing with the children the relationship between blowing and the movement of the boat. The children contributed with some interesting ideas:

Q2: *When we are at the beach, when we see the boat sailing, what do you think makes the boat move?*

C1: *The wind.*

C2: *When the wind goes on the sailing boat, the boat goes and moves.*

Q3: *Can we produce wind?*

C1: *Yes, like that* (makes a blowing gesture).

Q3: *Do you remember how the wolf knocked down the piglet's house?*

Children: *He blew.*

Q3: *Let us now call each of you, and see if you blow as hard as the wolf. You can't let the boat sink, you have to make it move.* (Children do the activity, one by one).

C2: *Look, my breath is very strong.*

C3: *It's moving.*

This was an interesting moment of awareness, that it is possible to move the boat with the force of the breath. The children were able to make references to the previous activities, to the wolf's blowing and to the concrete experience, establishing a connection between a natural phenomenon, which is the wind, and their own "wind" produced by blowing. For Sasseron (2015) "it is necessary to build an understanding of natural phenomena and their impacts on our lives" (p. 4).

When starting an activity with children, it is essential to bring the previous knowledge they have about certain topics. In this way, the teacher can relate the information to the existing knowledge of the individuals, as it is from there that new knowledge will be acquired, allowing learning to occur in a more meaningful way for the child, not just being mere information. According to the "Reading in Sciences" indicator

of Scientific Literacy, proposed by Pizarro (2014), "it is about reading texts, images and other supports recognizing typical characteristics of the scientific genre and articulating these readings with previous and new knowledge, built in the classroom and outside it" (p. 92).

The paper boat activity brings meaningful experiences to children, allowing their imagination to be explored. In this experience, they can relate the movements that were made by the boat from their breath with experiences already lived before, helping to establish a connection between the real and imaginary worlds, stimulating their curiosity and scientific thinking.

Finally, the activity of drawing with paint blowing was carried out, contemplating the skills EI03TS02, EI03TS02, and EI03EF01, which emphasize free expression through drawings, paintings, and other artistic forms. This activity, exemplified in Figure 10, provided the children with the opportunity to express themselves artistically, using breath as a tool for creation, establishing a direct connection with the concepts addressed in the previous activities.

Figure 10

Children's drawings with ink blowing

Source: Authors' collection.

By relating the blowing used in the painting activity to elements previously explored, such as the wolf's blowing in the story and the awareness about the functioning of the lungs, the activity strengthened the children's understanding of the topic. This connection became evident in the initial and final dialogues of the activity, in which the children demonstrated recognition and appropriation of the concepts explored:

Q3: *Did you enjoy the activity?*

Children: *Yes!!*

Q3: *How did you feel about this technique of blowing paint?*

C1: *Cool!*

Q3: *What do we use for blowing?*

C3: *Our lungs.*

C4: *I did it all by blowing, I blew a lot!*

When C3 demonstrates the acquisition of knowledge through the activities carried out, the success of the pedagogical intentionality underlying the developed proposals is evidenced. The understanding of air as an essential element for human life was valued and recognized by the children, which reflects an advance in the process of Scientific Literacy. In addition, by understanding that the lung is one of the organs of the respiratory system, children begin a process of building fundamental scientific concepts. These pedagogical strategies favor the active participation of children in the formulation of hypotheses, moments in which assumptions are raised on the theme (Sasseron & Carvalho, 2008), as well as the construction of knowledge, promoting meaningful and contextualized learning.

The use of activities that involve painting plays a fundamental role in children's creative development, promoting expression and motor coordination. The sharing of the final art among peers favors interaction, stimulating the development of social skills and enabling the observation of the various forms of artistic creation provided by the activity.

In this way, painting goes beyond simple fun, becoming an essential tool for child development in multiple aspects, making the child an explorer, creative, and creator of meanings, emphasizing their autonomy and expressiveness (Curtolo, 2025).

It is understood that the activities were able to further stimulate the children's natural curiosity and their ability to reason, investigate, and argue, which supported a scientific initiation of the children through the investigative activities carried out. The exploration of scientific concepts through playful situations allows children to be actively involved in the learning process, associating scientific knowledge with fun and imagination (Rodrigues & Amorim, 2024).

As for the skills and learning objectives shown above in Figure 5, all were developed to a greater or lesser degree, corroborating the BNCC when it states that "in Early Childhood Education, essential learning comprises both behaviors, skills, and knowledge as well as experiences that promote learning and development in the various fields of experiences" (Ministério da Educação, 2017).

In this way, the problematization and use of various cultural tools are fundamental for the development of scientific knowledge, skills, and values, the objective of the proposal of Science Teaching by Inquiry (Morais & Bego, 2024). In this sense, studies on Scientific Literacy in Early Childhood Education must be developed, so that teaching methods and techniques can be improved to facilitate the children's appropriation of their culture, their life context, and the phenomena of nature to which they are exposed.

Considerations

This study aimed to analyze the performance of investigative activities in the promotion of scientific initiation in an Early Childhood Education class. This is a relevant theme to further develop the investigative sense and curiosity, important characteristics of young children, in order to reinforce a Scientific Literacy focused on the Teaching of Science by Inquiry.

As argued in the research, it is not a matter of working on concepts with children, but of introducing them to a more critical and inquisitive reasoning of the phenomena of nature that surround them in their daily lives. For this purpose, the activities were guided by the theme "air and wind", seeking to favor a more structured and scientific understanding of the world, natural phenomena, and of themselves. Recyclable materials, familiar to the children, were used, and their previous knowledge was explored in the questions posed.

The guiding documents of Early Childhood Education were taken into account, such as the National Common Curriculum Base (BNCC) for Early Childhood Education, as well as the National Curriculum Guidelines for Early Childhood Education (DNCEI), focusing on the objectives and skills to be developed in each activity. Playfulness, games, and respect for the learning rights of Early Childhood Education, such as interacting, playing, participating, exploring, expressing, and becoming self-aware, were also respected so that the children's development could be truly experienced.

The results found that the ways in which the activities were conceived and executed by the students of Pedagogy and the doctoral student contributed to the development of the scientific initiation of children through the investigative activities carried out, evidenced in the effective participation in the activities, in the questioning carried out by them, and in the systematization of knowledge from the productions built. Therefore, it is possible for young children to be able to think and act in a more organized way from pedagogical activities aimed at Investigative Science Teaching.

Author's Contribution

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Data Availability Statement

The data will be provided upon request.

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