TOWARDS THE DESIGN OF A DIDACTIC FRAMEWORK FOR SCIENCE EDUCATION IN PRESCHOOL IN THE COLOMBIAN CONTEXT

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DEDICATORIA

I dedicate this work to Mia and Nathan, the two children who accompanied me in this process and helped me find the passion to transform our society by understanding the unique experiences of childhood.

To my entire family, I am grateful for their efforts and support in helping me turn my dream of creating change through education into a reality.

Este trabajo lo dedico a Mía y a Nathan, los dos niños que me acompañaron en este proceso y me hicieron encontrar la pasión en transformar nuestra sociedad desde cada una de las realidades de la infancia.

A toda mi familia por sus esfuerzos y apoyos para hacer realidad este sueño de hacer un cambio desde la educación a la sociedad

Julián Arias

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ABSTRACT

The topic of scientific education in early childhood has been a subject of ongoing debate, particularly regarding children's ability to comprehend and form direct connections with scientific theories, phenomena, or situations. This has created a gap in the teaching processes of natural sciences and the promotion of child development, particularly in effectively integrating the educational needs of both areas. This gap has had repercussions on scientific literacy and the abilities of the population in higher grades, as evidenced by the PISA and Saber 11 tests. In response to this, there is a need to propose interventions that effectively integrate the processes of both educational dimensions.

This research aims to design a didactic proposal that enables the development of scientific thinking skills among preschool children in the Colombian education system. It also involves implementing and validating experiences structured according to the elements of the proposal. The “Natural Explorers” proposal has emerged as a result, with a focus on exploring natural phenomena and systems through experiential activities. This approach allows children to create mental representations and understand the functioning and causality of various natural phenomena, as well as their implications in their lives. Additionally, the "A World of Trash" experience demonstrated the potential of Guiding Activities as a means of understanding situations analyzed from a scientific perspective.

Key Words: Preschool, science education, pedagogy, childhood development.

RESUMEN

La educación científica en la primera infancia ha sido un tema de constante debate frente a la capacidad existente o no de los niños para comprender y establecer relaciones directas con teorías, fenómenos o situaciones de tipo científico. Esto ha generado un vacío en los procesos de enseñanza de las ciencias naturales y la potenciación del desarrollo infantil, especialmente en la integración efectiva entre las necesidades educativas de ambas líneas, y con repercusiones en la alfabetización científica y capacidades de la población en grados superiores tal como lo muestran las pruebas Piza y Saber 11. Ante esto surge la necesidad de proponer mediaciones que integren de forma efectiva los procesos de ambas dimensiones educativas. Esta investigación tiene como objetivo el diseño de una propuesta didáctica que permita el desarrollo de las habilidades de pensamiento científico con las realidades y dinámicas propias de los niños en la etapa preescolar del sistema de educación colombiano, junto a la implementación y validación de experiencias estructuradas bajo los elementos de la propuesta.

Como resultado, surge la propuesta “Natural Explorers”, centrada en la exploración de fenómenos y sistemas naturales, mediados por experiencias permeadas por las actividades rectoras, donde los niños puedan hacer representaciones y construcciones mentales frente al funcionamiento y causalidad de diferentes fenómenos naturales y las implicaciones en sus vidas. Además de la experiencia “A World of Trash” (Un mundo de basura) donde se evidenció el potencial de las actividades rectoras como medios para la compresión de situaciones analizadas desde una perspectiva científica.

Palabras Clave: : Preescolar, educación científica, pedagogía, pensamiento del niño.

1. Introduction.

In contemporary times, there exists an ongoing imperative to incorporate the natural sciences into the realities of every citizen, encompassing the scientific developments achieved in the past fifty years, for the improvement of society and the global reality in which we live (UNESCO, 1999). Aligning with Meinardi's (2010) assertion, individuals are encouraged to not only fulfill their civic responsibilities, but also exploit their potential through scientific literacy citizenship, promoting the understanding, interaction and intervention with natural phenomena that directly impact their daily lives.

The issue of children's access to science has been an ongoing topic of debate. This debate encompasses various aspects, including children's understanding of scientific concepts and their ability to express these ideas and concepts to others. Some theories consider that children often face challenges in comprehending scientific theories or phenomena. In fact, as Johnson (1999) cited by Wilson (2002) points out "science is perceived and presented as too formal, too abstract, and too theoretical" (p. 19), where science education has not traditionally been considered a significant component of early childhood programs.

Nonetheless, research has shown that it is not only relevant but also important to develop scientific skills at an early age (Gopnik, 2012), promoting cognitive development in children's daily lives. Indeed, the scientific potential of children is undeniable, as they naturally observe, inquire about, and explore their environment (Sánchez Ortega, 2020) where they actively seek and generate explanations for the phenomena that occur in their reality (Salguero, 2011). In fact, as mentioned by Ravanis (2022), early childhood scientific education has emerged as a research field in the study of children's development, looking to understand the importance of scientific thinking skills during this stage, as well as the complexity of the phenomena from various perspectives, such as neuropsychology, teaching strategies, learning processes, and didactic materials.

Research demonstrates that it is necessary to address children's scientific potential, as there is a general perception that efforts have not been enough to achieve this goal (O'Connor, Fragkiadaki, Fleer & Prabhat, 2021). It is necessary to establish new objectives in both research and practices to promote children's scientific development, contributing to their

participation as active citizens who can comprehend society from a scientific perspective (Meinardi, 2010). In this way, children get to know the world, developing cognitive processes that integrate representation, classification, association, and understanding of the natural phenomena in their environment (Borja, Galeano and Pinzón, 2018). They explore in diverse ways, mediated by their physical, social, emotional, communicative, and cognitive development, which is reflected in the interventions and transformations they generate in their daily life situations within the communities they coexist in.

In this way, there is a current necessity to harness children's development potential through specific approaches and didactic proposals for children to comprehend and engage with real science in their own realities from a very young age, particularly before they enter formal education.

2. Problem Statement.

Early childhood education has been a topic of discussion over the years. As Amar (1997) proposes, children's development is crucial for the economic and social development of the whole society due to the impact that generational renovation will have in the long term. The author mentions that “For every dollar that is not invested in childhood, between 3 to 5 must be spent when they are adults" (p. 16). Indeed, Gardner (2011) has established a close relationship between childhood learning and students' performance in later grades. Deficient processes during initial education experiences could lead to difficulties across all areas, particularly in language, mathematics, and scientific thinking.

This scenario could explain the low performance on national and international exams in natural sciences over the past few years. According to the PISA report (OECD, 2018), around 50% of the students assessed have the ability to comprehend phenomena and offer fundamental scientific explanations. Colombia is ranked as one of the worst countries around the world, scoring 76 points below the OECD average. In the national context, scores in natural sciences evaluated by “Pruebas Saber 11” have shown a decreasing trend in recent years. A larger number of students now demonstrate a below-basic ability to understand natural phenomena from a scientific perspective (ICFES, 2021). Therefore, it is imperative to promote educational reforms aimed at enhancing students' scientific thinking skills in the nation. There is an opportunity to achieve that objective throughout the intervention in early years, which could contribute to improving the results in upper grades (Gutierrez & Duarte, 2018).

Unfortunately, results for evaluations such as “Pruebas Saber 5º”, a test that assesses the progress children have made in mathematics, communication, and scientific thinking by the end of primary school (Ministerio de Educación Nacional, 2014), are not available due to the exclusion of the natural science component in the last applications in the department of Cundinamarca (ICFES, 2016) (ICFES, 2017), as this edition only focused on mathematics and language. It is necessary to explore areas of innovation where science education could be integrated into preschool educational systems seeking to improve cognitive skills development related to the scientific thinking in upper grades (Salas, 2004).

2.1. Research Question.

How to promote children's scientific development in preschool education based on Colombian curricula?

2.2. Research Objectives.

General: To design a didactic proposal for the development of scientific thinking processes in preschool education.

Specific:

- To establish a theoretical framework of scientific thinking in preschool education.
- To plan and implement scientific learning experiences based on the didactic proposal.
- To determine the characteristics and competencies required by the teacher for the development of the proposal in preschool contexts.

3. Justification.

As mentioned previously, UNESCO (1999) emphasized, in the Declaration on Science and the Use of Scientific Knowledge and the Science Agenda: Framework for Action, the importance of incorporating scientific discoveries and innovations into public knowledge. This is to enable citizens to participate in decisions, actions and processes through scientific approaches. Complementing the previous ideas, Sustainable Development Goal number four, "Quality Education" establishes the importance of providing universal access to national educational systems for the entire community (United Nations, 2022). Particularly, focusing on target 4.7 that refers to promoting the knowledge and skills necessary for implementing sustainable development practices in every person's life. This would certainly imply the need to emphasize scientific education.

Therefore, it would seem necessary, to introduce educational process throughout the Colombian system in order to promote a scientific culture in the country. In addition to this, Duran, Artene, Gogan & Duran (2015) mention that this goal contributes to the welfare of society. The improvement of science literacy in every citizen (Meinardi, 2010) allows people to make informed life decisions from a scientific perspective and act responsibly. Additionally, interventions in preschool scientific education would complement the improvement of the quality of education, as stated in the “Plan departamental de desarrollo 2020-2024: Cundinamarca ¡Región que progresa!” (“State Development Plan 2020-2024: Cundinamarca, a Region in Progress!” (Gobernación de Cundinamarca, 2020).

Finally, this proposal aims to address the poor results obtained in national and international exams that evaluate the quality of education and student scores in tests such ICFES and PISA. It seeks to improve skills in young students before they enter formal education (Unicef, 2015).

4. State of the art.

As mentioned by Guevara Patiño (2016), the state of the art is a resource that enables researchers to establish the theoretical background in their thematic area of study and identify potential areas to deepen through upcoming studies. In other words, it acknowledges the research carried out on the topic of interest. This section presents information on recent developments in preschool science education.

For this study, the researcher ran a search in the Scopus database, with the search terms “Preschool”AND(“Science Education”OR”Scientific thinking”) to select research focused on preschool science education in the classroom (as this is mandatory in most countries across the world). To gain a wider perspective of the phenomena the search terms were used again, including articles regarding teachers' perspectives about the processes.

Initial results showed a total of 230 documents. That information was classified by selection criteria based on the topics used and the context where it was implemented, to determine the most relevant and coherent results for this project, these criteria include:

- Articles published between 2018 and 2022.
- Articles that focus on documentation and analyses of educational experiences in school contexts.
- Literature reviews that evaluate science education in early years.
- Research that evaluates teachers' perspectives in science education during either preschool or early childhood.

A second search was conducted, including articles available in the Dialnet Repository, using the same search terms translated into Spanish. This search identified research conducted in the Latin American region, applying the previously mentioned selection criteria.

After classification, there were a total of 55 articles related to educational experiences and 14 research projects about teachers' perspectives. This data was processed using the

Scival platform, which established statistical trends for the studies conducted up until the time of evaluation.

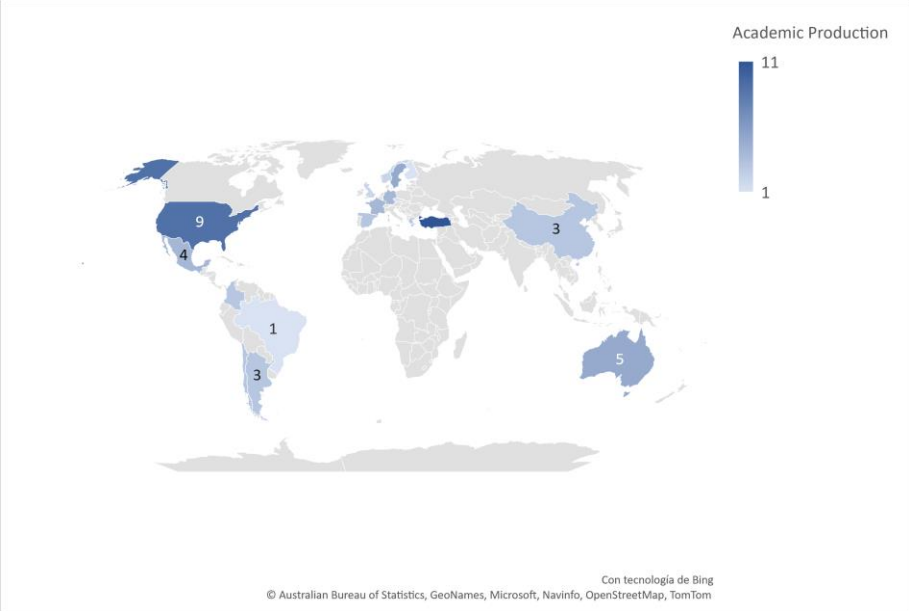

Figure 1. Global production related to preschool science education. Source: prepared by the author.

As presented in Figure 1, the majority of production came from Europe, Asia, and North America, specially from Turkey, the United States, Australia, and Sweden. Latin America is the region with the least research related to the topic. The information found is exclusively related to practice in classrooms, as seen in Table 1.

Table 1. Academic production classified by topic and country. Source: prepared by author.

Country	Thematic Dropout		
	Preschool Science Education Practices Research	Teachers' perspective about preschool science education Research	Total Production
Turkey	9	2	11
United States	8	1	9
Australia	4	1	5
Sweden	4	1	5
France	4	0	4
Mexico	4	0	4
Argentina	3	0	3
Chile	3	0	3
China	2	1	3
Greece	2	1	3
Norway	2	0	2
United Kingdom	2	0	2
Colombia	2	1	3
Finland	1	0	1
Czech Republic	1	0	1
Germany	1	3	4
Israel	1	0	1
Spain	1	2	3
Brasil	1	0	1
Cyprus	0	1	1

In fact, statistical information supports the idea that there is a lack of knowledge production and active investigations related to this topic in Colombia, with only three studies presented within the established period. Indeed, the findings presented by Pino & Perdomo (2021) are more focused on the socioemotional aspects of preschool rather than on approaches to scientific education. Even though the proposal by Rojas (2020) shows an

opportunity to promote the development of scientific behavior through the stimulation of scientific cognitive skills. Analyses from institutions like Maloka have identified teacher difficulties in fostering scientific knowledge at early stages (Quevedo & Franco, 2022). Therefore, it is important to study preschool science education and explore innovations to enhance education in this area.

It is important to mention that due to the lack of coverage in indexed journals or searchable databases, local experiences may not have been included. This does not mean that there are no local programs or experiences related to science education in the early stages.

In terms of the principal findings of other researchers, there is a focus on inquiry-based processes. In fact, Raven & Wenner (2022) established a direct relationship between cognitive development through inquiry and children's capacity to represent the world they perceive.

Below are the main findings based on theoretical trends that were identified throughout the analysis. It is important to mention that those trends were inferred after the review and were not predetermined.

4.1. Scientific thinking in early years.

The main thinking skills identified are prediction, observation, and explanation, which enable children to represent their perceptions. This offers an opportunity to introduce new concepts and models of natural phenomena (Zudaire, Buil, Uriz & Napal, 2022). Particularly, Vartiainen & Kumpulainen (2020) identified four key moments in the inquiry process of children. These moments include the creation of an imaginary scientific situation, followed by the assignment of new meanings to scientific objects and processes, the integration of reasoning to solve problems in the imaginary situation, and the engagement of scientific analysis in those imaginary situations.

4.2. Learning experience structure.

The exploration of the environment and interaction with natural elements has shown improvement in children's ability to ask questions related to factual characteristics and make predictions about outcomes (Skalstad & Munkebye, 2021). This could be related to the findings of Calderón, Gallegos & Flores (2019), who stated that children are able to develop their own mental representations about the phenomena or objects through their perceptions, questions, and actions.

Interactive material is considered the most suitable resource to implement with children, as highlighted by the findings of Åkerblom & Thorshag (2021) and Fragkiadaki, et al. (2021). Cognitive improvement is achieved through the use of materials and toys that enable children to recreate both physical phenomena and mental representations. Now, regarding resources and activities, there is a clear tendency to use games for play-based approaches (Guarella, van Driel & Cohrssen, 2022), especially as an initial opportunity to engage children into the "do science" approach[1], recreating natural phenomena in their games (Miller & Saenz, 2021). Moreover, Sliogeris & Almeida (2019) mention the necessity of teacher-guided play to introduce science content, which has a direct effect on child-guided play, where children integrate these elements on their own.

4.3. Use of language.

The use of language is interesting to evaluate because specific vocabulary and expressions allow children to interpret the world from a theoretical perspective. Indeed, Rumper et al. (2021) link the use of formal scientific language and home-promoted language to a deeper understanding of the world. Also, children tend to assimilate the use and meanings of scientific vocabulary better through permanent interaction with adults who use it correctly (Jančaříková, 2021).

4.4. Teachers' Perspectives.

In terms of teachers' perspectives, Mazzas & Bravo Torija (2018) identify that teachers are interested in introducing science to children and understanding the importance of these

processes. However, they also declare that they lack the necessary resources and knowledge to carry them out correctly. Indeed, Barenthien & Dunekacke (2021) found that there is a significant fear among teachers when it comes to delivering science classes without sufficient disciplinary and pedagogical knowledge in this field.

5. Theoretical framework.

The theoretical framework, as mentioned by Daros (2002), establishes the necessity of defining specific theories to interpret the phenomena of interest for the researcher. This includes the legal, theoretical, and educational background related to scientific education in preschool. This includes Colombian regulatory orientations, early childhood development, and science-specific didactics.

5.1. Colombian Legal Framework.

Colombia has distinguished itself from other countries by creating legislation for early childhood development based on the Declaration of Children's Rights (Morales Forero, 2023). This legislation, known as Law 1804 of 2016 “De cero a siempre," mandates the Ministries of Education, Health, Culture, and Housing to contribute to a high standard of quality of life for every child. In terms of education, the law emphasizes the importance of providing opportunities for access to early education, preschool, and formal education. Moreover, according to the General Law of Education 115 of 1994, preschool is when compulsory education starts for all Colombian students. Particularly, during the only official grade of preschool, known as the "transition" period, the main objective is to promote the multidimensional development of children in biological, cognitive, psychomotor, socio-affective, and spiritual aspects in order to attain the abilities needed for formal education. Now, focusing on scientific skills, the law proposes that children in this phase should acquire different skills. These skills include (Law 115 of 1994):

> “The development of creativity, age-related skills and abilities, as well as their ability to learn; the sense of space and time, and the exercise of memory [...] The stimulation of curiosity to observe and explore the natural, family, and social environments” (pp. 5)

Furthermore, Colombia has implemented curricular guidelines that prioritize preschool and formal education. These guidelines include the Basic Competence Standards (Ministerio de Educación Nacional, 2006) which outline the specific skills that students need to develop in each grade, and the Basic Learning Rights (Ministerio de Educación Nacional, 2016),

which identify the key thematic areas to be addressed in each grade. These guidelines provide teachers with the necessary framework to plan their lessons (Ortiz & Cervantes, 2015).

At the preschool level, the National Ministry of Education (MEN from its acronym in Spanish) has established a curriculum based on experiential learning. The focus is to enable children to develop their own perceptions, ideas, and methods to interact with the world (Ministerio de Educación Nacional, 2017). This curriculum emphasizes "Actividades Rectoras" (Guiding Activities), which encompass games, literature, environmental exploration, and arts, aiming to enhance child development through interactions between children, adults, and the environment (Caballero de la Espriella, Felipe & Pérez, 2022). Through the Guiding Activities, children are able to "develop their own the ideas of how their culture represents reality, discover social norms and agreements, approach the physical world and what it means, contrasting all these things with their emotions, sensations, thoughts and interpretations." (Ministerio de Educación Nacional, 2017, p. 39). Furthermore, some of these activities could be conducted in scientific educational settings, such as the exploration of the environment, representation-building processes, and students' recognition of themselves as natural researchers in context.

5.2. Preschool Education and Child Development.

Yoshikawa, Weiland & Brooks (2016) state that preschool is a crucial stage in the development of children (and human life overall). Additionally, these authors argue that during this stage, children are able to solidify the majority of their fundamental cognitive abilities, which will be utilized in subsequent stages of development. According to Escobar (2006), preschool is a critical stage for the development of students' cognitive, emotional, physical, and social skills. Indeed, this stage is seen as an opportunity where the children's main objective is being and becoming social agents (Alasuutari & Markström, 2011), interacting with and transforming the world they perceive.

Perception and interaction processes are more complex during the preschool stage. At this point, children are expected to interact with their surroundings using their senses and create representations that mimic the characteristics of what they perceive (Zaporozhets, 1965). As Gardner (2011) acknowledges, during this stage, children begin to interpret events,

objects, and phenomena using symbolic representations. They can mentally recreate an idea of the phenomenon, organism, or event even without direct physical interaction.

In terms of expressive and communicative skills, the formalization and schematization of writing and reading processes are still in the early stages across neural networks (Jimenez Rodríguez, 2010). On the other hand, speaking abilities tend to be more developed and manifest through the use of "wh" questions to comprehend their surroundings (Shaffer, 2000), as well as coherent initial conversations where a wide vocabulary is used to express their ideas. Drawing allows children to express ideas graphically through pre-schematic representations, even without formal writing. Geometric figures, proportions, and relationships among elements integrate ideas about their conceptions (Rojas, 2012), thus allowing for alternative means of representing their understanding, which can be complemented by verbal explanations (Forero Quiroz, 2018).

5.3. Scientific thinking in Preschool Education.

Rohita, et al. (2018) propose a focus on scientific thinking skills during preschool, emphasizing inquiry processes with two levels of cognitive development: low-level that includes observation, question making, and hypothesis construction¸ and high-level skills refer to information collection, reasoning and representation of phenomena, and communication of their ideas.

Ramanathan, Carter & Wenner (2021) provide a practical framework for the promotion of inquiry in young learners; this includes:

- Use of topics based on children's interests: Create situations and experiences that are attractive for them.
- Open-ended material: The resources used inside the classroom can be transformed during children's play; they can be adapted and can be used to represent different situations.
- Small-Group time: Projects where children interact with each other in small groups promotes communication and reasoning with others.

- Asking Open-Ended Questions: where students have opportunities to bring up multiple ideas.

As Gopnik (2012) explains, children have the ability to create mental models that reflect their understanding of reality. They create mental processes by connecting the causes and effects of various phenomena, allowing them to generate explanations and predictions (Akerson, Avsar & Elcan, 2019). Cognitive development occurs through the consolidation of model thinking during this stage. Valderrama & Pedraza (2021) emphasize the significance of developing models that represent reality during childhood. The authors suggest that constant interaction with these perceptions of the world allows young learners to develop scientific argumentative and critical thinking skills. Cruz & Martínez (2021) discovered that using models helps students comprehend the dynamics of unfamiliar phenomena in other organisms, extrapolating their initial perceptions into new schemas; for example, through the explanation of the digestive systems of different groups of animals.

Additionally, Kornelaki & Plakitsi (2020) acknowledge the importance of connecting students' perceptions of reality to experimental and theoretical inputs to promote moments of confrontation and reflection in the construction of their own models. Martínez (2018) argues that direct interaction with natural environments and phenomena enhances children's understanding and their ability to represent them. The ongoing reconstruction of young children's understanding of the world enables them to generate various explanations and comprehend the different types of interactions that take place between organisms and their environments (Carretón, García & García, 2021).

6. Methodology.

6.1. Research type and design.

The research was conducted using a qualitative approach to comprehend and propose explanations about educational phenomena (Fetterman, 1988) in preschool scientific education. The chosen research scope was descriptive, as defined by Hernández Sampieri, Fernández Collado, and Baptista, Lucio (2014). This scope focuses on the analysis and characterization of specific phenomena. Moreover, it presents the opportunity to analyze the current reality of a process to identify opportunities for improvement (Ramos Galarza, 2020).

Furthermore, the methodological design was structured as an action research study, where the main intention is "to improve the practice of education by studying issues or problems they face. Educators reflect about these problems, collect, and analyze data, and implement changes based on their findings" (Creswell, 2012, p. 577); in this case, it was projected with an emancipatory vision, providing possible solutions along with an awareness of the social need of the research in this topic (Hernández Sampieri, Fernández Collado & Baptista Lucio, 2014).

6.2. Evaluation criteria of analysis.

A total of three criteria were designed to analyze and evaluate the didactic proposal, based on the literature review about the topic and the necessity to integrate both Science Education and Preschool Education. These are:

6.2.1. Curricular relevance in Colombian Contexts: The proposal is meaningful and is related to cultural, social, and academic realities around the country, ensuring high quality education for all students (Ministerio de Educación Nacional, 2006).

6.2.3.1. Relevance: Practical pertinence of the proposal according to the country's necessities in terms of science education.

6.2.3.2. Coherence: Adequate relationship and connection between the elements of the proposal along with the curricular needs for science and early childhood education.

6.2.3.3. Adaptability: Capacity and facility to design specific variations on the proposal to make it applicable in different educational contexts.

6.2.2. Use of natural sciences didactics: Integrates the specific methods, epistemological perspectives, and techniques to teach and develop natural sciences contents and thinking skills in educational contexts (Badmus & Jita, 2022) (Moreno & Ussa, 2018).

6.2.3. Childhood Development grounding: "Intentional processes that seek to propose experiences for children's development and learning, taking into account what happens in their daily lives" (Ministerio de Educación Nacional, 2017).

6.2.3.1. Communicative skills: The children are constantly expressing and communicating their ideas, feelings, and perspectives about their reality.

6.2.3.2. Connection with the world: The strategies and experiences designed for children allow the interaction with the environment, and the construction of their own ideas and feelings regarding the phenomena they perceived.

6.3. Design of the proposal.

Based on the theoretical review, the didactic proposal was designed considering the elements of its structure based on the ideas of Chevallard (1991), Artigue (2018) and Addine, Recarey, Fuxá, & Fernández (2020). Those components were used to define the specific contents of the proposal; each one is described in the following sections.

6.3.1. Objective of the proposal: Define the main objectives to achieve through the proposal, including the objectives related to the social impact of the proposal and the objectives focused on improvement in children's learning,

6.3.2. Methodological aspects: Corresponds to the specific methods, techniques, and ways to approach the thematical content and stimulate the development of children's scientific thinking skills.

6.3.3. Content: Recognizes the specific thematic content that could be used to integrate the methodological aspects for the achievement of the learning goals of the proposal.

6.3.4. Teacher and students' roles: Defines the specific processes and actions carried out by each one to achieve learning during the implementation of the approach.

6.3.5. Evaluation process: Identifies sources, techniques, and criteria to evaluate the children's progression regarding scientific thinking.

6.4. Theoretical evaluation of the proposal.

In order to improve the quality of the initial proposal, it was evaluated by three experts in both Science Education and Early Childhood Education, analyzing the potential, effectiveness and viability of each element of the proposal, using the rubric presented in table 2[1] including the respective justification in each element. Based on the respective feedback, a reflective improvement of the proposal was carried out.

Table 2. Evaluation rubric for the initial proposal.

Criteria	Not fulfilled	In development	Partially fulfilled	Fulfilled
Coherence	The proposal lacks internal coherence among its elements, with the objectives and theoretical elements being disconnected from	The coherence of the proposal is limited, and improvements are needed to establish a clear relationship	At this level, the proposal shows adequate coherence in general and effectively relates theoretical	The coherence of the proposal is exceptional and is perfectly in line with the objectives set out in the proposal.

[1] The rubric provided to the experts was a translated version of the one presented in the document, due to language limitations.

	the practical methods. Lack of alignment makes it difficult to understand how the components of the proposal relate to each other and to the goals, leading to confusion and clutter.	between theoretical elements and practical methods. Although some connections are apparent, not all elements relate effectively, resulting in a proposal that needs further structuring.	elements and practical methods. Most of the elements of the proposal are properly aligned with the topic and objectives to be developed.	All the theoretical elements and practical methods of the proposal are properly related to each other.
Relevance	The proposal is irrelevant as it does not address the social needs of the natural sciences and the development of children. The choices of theoretical elements and practical methods are not adequately justified, which makes it inadequate.	The relevance of the proposal is limited and requires improvement. Some justifications for the choices are mentioned, but these are not completely convincing, and the proposal only partially adapts to the social needs of the natural sciences at the social level and the developments of children.	The proposal is mostly relevant at an appropriate level and is in line with the social needs of the natural sciences and the development of children. Reasonable justifications are provided for choices around theoretical elements and practical methods.	The relevance of the proposal is exceptional and comprehensively addresses the social needs of science and the development of children. The justifications are strong and demonstrate a deep understanding of the topic, making the proposal highly relevant and appropriate.
Adaptability	The proposal is not very flexible, it is not easy to replicate and adapt to different school	The proposal has the potential to be adapted to different school contexts, but in a	The presented proposal has elements that can be adapted easily to different school	The proposed proposal is easy to adapt to different school contexts, although adaptation

	contexts, as it is tied to specific characteristics of the proposal.	limited way, making it difficult to insert the elements into the realities of the classrooms.	contexts, however some elements require extensive adaptation processes to be implemented in the classroom.	processes may be needed, they are not extensive or of greater difficulty.
Application of Natural Sciences Didactics	The proposal does not demonstrate an adequate understanding of the fundamental principles of natural science didactics. The integration of concepts and methodological approaches of this discipline is scarce or non-existent, which limits the effectiveness of the proposal to develop children's scientific thinking.	The proposal shows a limited integration of knowledge from the didactics of natural sciences. Some attempts are made to integrate elements of this area, but the application is inconsistent and could be improved to achieve a development of children's scientific thinking.	The proposal demonstrates an adequate understanding and integration of the didactics of the natural sciences. Teaching strategies related to this area are effectively incorporated, which improves the quality in the development of children's scientific thinking.	The proposal uses the didactics of the natural sciences in an appropriate way. The integration of methodologies, resources, and strategies specific to this area is highly effective and contributes significantly to the development of children's scientific thinking.
Integration of childhood development	The proposal does not demonstrate adequate integration of child development milestones. Key developmental aspects are not considered in the planning and	An attempt is made to integrate some aspects of child development, but implementation is limited. The proposal shows a partial understanding of	The proposal at the appropriate level demonstrates a reasonable understanding of child development processes. Key developmental aspects are	The proposal integrates child development processes in an exceptional way throughout the pedagogical design. A deep understanding of developmental

	design of activities, which could result in a lack of adaptation to children's needs.	developmental processes and could be improved to better suit the needs of children.	considered in the planning and design of activities, contributing to an effective adaptation to children's needs.	aspects is demonstrated, and adaptation to children's needs is highly effective and enriching for their growth and learning.

Additionally, three additional questions for the experts were proposed regarding the viability, highlights, and possible limitations of the proposal, those are:

- What do you consider to be the most attractive and meaningful elements of the didactic proposal?
- What elements need to be deepened in the development of the proposal?
- What limitations and challenges can you identify in the didactic proposal for its implementation?

The answers collected from these questions where used to both the improvement of the initial proposal as well as further analyses of the potential and limitations of the proposal.

6.5. Planning and implementation of learning experiences based on the didactic proposal.

Based on the final proposal, a lesson plan for preschool students was designed. The selection of the population was done through volunteer sampling, based on McMillan & Schumacher (2005). This type of sampling conditions the study to the personal interest of the population to be part of the research. In order to have a correct analysis based on Colombian curricula, invitations were extended to institutions that fulfilled the following criteria:

- Schools in which the curriculum is based on the Colombian National curricula.
- Schools that include both preschool and formal education.

Under these conditions, the intervention was carried in a private school located in the rural area of Cajica. The pedagogical approach of the school is centered on the development of multiple intelligences across all the academic levels, also integrating methodologies based on constant practice and reproduction of students' learning. The participating group was the class Transition, with 16 students between the ages of 5 and 6.

Due to logistical and time limitations, the experience was designed as a Boot Camp, which is an intensive educational program that allows participants to develop specific skills in a short period of time (Zachariah, 1996). The data collection was conducted using a cross-sectional process, which involves gathering information from participants at a single point in time to provide a snapshot of a population's characteristics or behaviors (Zangirolami, Oliveira & Leone, 2018) This was done to identify the initial effects of the proposal, taking into account the limitations mentioned earlier.

6.5. Ethical Considerations.

To conduct the research, permission from both experts and school was granted, using the corresponding documents to confirm that information, and preserving the identity and personal information of the involved participants private. All the collected data were completely deleted once the research was completed. Additionally, to protect the children's privacy, integrity, and opinions, the assent of all participating children was obtained (Choconta, 2022). In the first moment, the assent was assumed with the participation of the children during the activity, mainly with the intention of avoiding non-natural behaviors. However, at the end, the children were informed about the research, and asked if they would like to participate handing in their drawings during the fifth moment of the lesson plan. All the children freely decided to participate in the research.

7. Results and discussion.

7.1. Natural Explorers Didactic Proposal Structure.

Based on the literature review, and reflexive process, the Didactic Proposal "Natural Explorers" is presented. According to the results of the initial evaluation by the experts, as summarized in Table 3, which includes qualitative classification with the rubric and comments, the proposal was adjusted.

Table 3. Experts evaluation summarized results[2].

Criteria	Mockingbird	Canary	Hummingbird	Average
Coherence	4	4	4	4
Relevance	3	3	4	3,3
Adaptability	3	3	4	3,3
Application of Natural Sciences Didactics	4	3	2	3
Integration of childhood development	3	2	3	2,6
Main improvements based on the evaluation	Adaptability to diverse contexts, reflection about phenomena systems and contents presented	Use of alternative evaluations, integration of specific advances in child development during preschool	More explicit articulation with natural sciences didactics, focusing on methods to carry out the teaching process	

The elements of the proposal are described in the following sections.

7.1.1. Learning goals of the proposal.

The proposal establishes three main goals to achieve. These include:

[2] In order to simplify the results, the levels presented on the rubric in section 6.4 were assigned corresponding numbers for a qualitative summary.

- To promote children's understanding through interactions with phenomena and natural systems.
- To develop a scientific culture during childhood, in which children can make connections between the learning they achieve at the preschool stage with the situations they see and live in their reality.
- To stimulate children's scientific development through actions, activities, and behaviors typical of their reality.

7.1.2. Methodological aspects.

The proposal aims to explore children's perspectives on learning science through scientific processes. Scenarios that recreate or simulate natural phenomena and systems, designed intentionally by teachers to promote the development of scientific knowledge and skills. According to this approach, children are encouraged to ask, inquire, observe phenomena, compare their previous or emerging ideas about them, and consolidate personal understandings that may lead to new questions to explore or hypotheses that expand their initial conclusions (Vartiainen & Kumpulaien, 2020). In addition, students are constantly exposed to scientific language, which allows them to incorporate scientific vocabulary into their mental schemas in a more formal way (Rumper, et al., 2021).

The explorations conducted during this stage of development must be based on processes that align with the children's abilities. According to a Piagetian approach, children make significant progress in the construction of mental representations of reality due to their cognitive development (Papalia, Feldman & Martorell, 2012). This progress enhances their ability to interact with natural phenomena and demonstrates specific potential for cognitive advancement in science education contexts (See Table 4).

Table 4. Cognitive advances during the preschool stage and their potential for scientific exploration (Adapted from Papalia, Feldman & Martorell, 2012).

Characteristic	Description	Examples of Science Education Potential
Symbolic function	Children can think of and associate specific objects, ideas or	By using Symbolic Games, children are able to reproduce events different from their

	phenomena even without having a direct sensorial interaction with them. The ability to represent specific events from the past, and emulating different events with objects that are not related.	reality; for example, using this as an opportunity for them to use a stuffed bear as an actual animal, or participating in associating activities where balls represent the planets.
Spatial distribution Comprehension	Children can understand the spatial distribution of some items and places with the use of models and maps.	Allow students to represent their findings in the natural explorations of their environment, with the use of maps or tridimensional constructions.
Relation cause effect	Children can relate different events, mainly based on "Transductional reasoning", where they connect two elements with the evidence and events within their knowledge, even if tends to be not logical.	Children could produce hypothesis based on experiments carried out in class, such as "The electricity is spreading inside the ball" when a light ball is turned on.
Capacity to classify	Children design meaningful categories to classify and organize objects, organisms, events, or processes.	Students could classify the diversity of flowers around the school based on characteristics they observed during the collection.
Counting and quantity perceptions.	Children can count up to 20 understanding the order between one number and the other to estimate quantities, and also are able to associate sizes related to the number between 1 - 10	Provides opportunities for children to stablishes comparison between different test or observations, relating sizes and quantities.

The construction of ideas and interactions with phenomena occur in three central moments within learning experiences, which are centered on the following elements:

7.1.2.1. Interaction with the phenomena and/or natural system.

The need to recreate or simulate natural phenomena or systems for children to interact with arises from the epistemological and procedural structure of each phenomenon, tailored to the specific needs of educational contexts (Moreno & Ussa, 2018). This approach stimulates children's thinking processes by providing various stimuli that help fill gaps in their understanding, either through inductive questions, problematic situations, or changes in individual perspective and action. This allows teachers to create situations that encourage children to establish connections between phenomena. This can be achieved through direct exposure when the phenomena occur spontaneously in their environment, either through teacher-guided or free exploration (Borja, Galeano, & Pinzón, 2018). For instance, children can observe changes in the sky to understand day and night patterns, variations in the weather and

their effects on our activities, study the biological diversity of fauna and flora (Martínez, 2018) or understand why objects change temperature when moved from one place to another.

Additionally, the possibility of recreating phenomena under experimental conditions arises, whether in a laboratory or not (Kronelaki and Plakitsi, 2020). This allows children to propose changes to the conditions in which the phenomena occur, enabling them to obtain meaningful results in their experiments (Åkerblom and Thorshag, 2021). In cases where phenomena cannot be observed directly due to their scale or duration, it is possible to simulate them using representative situations or analogical structures that capture their essence. This allows for the interaction and recreation of natural phenomena (Gopnik, 2012).

These three scenarios (interaction with the phenomena in nature, recreation of the phenomena under experimental conditions, or simulation) are proposed to be developed through guiding activities such as play, literature, exploration of the environment, and art (Ministerio Nacional de Educación, 2017). Teachers create moments, experiences, and procedures that enable children to enhance their developmental potential. Play enables children to integrate their own representations of the phenomena they interact with, whether with ideas constructed individually or in groups (Ministerio de Educación Nacional, 2014). This integration leads to a theoretical-practical understanding of scientific topics through play, which can be guided by either the teacher or the student (Sliogeris and Almedia, 2019). This implies that the teacher needs to act as designer of play-based learning scenarios that accurately represent the dynamics of each phenomenon or system presented to the children.

Art is also seen as a means of exploring and understanding natural phenomena, empowering children to express their ideas and share them with their peers (Fragkiadaki, Armeni, Zioga and Ravanis, 2021). Artistic expressions provide children with the opportunity to vividly explore and recreate multiple representations of their reality through sensory exploration and production (Vallecillo, 2022).

Similarly, literature serves as a means of exposing individuals to various phenomena and new concepts (Akerson, Avsar, & Elcan, 2019). It provides an ideal platform for exploring new scientific vocabulary as children discover new stories (Duran, 2015). Additionally, literature offers opportunities to recognize practical applications of language

and scientific ideas in real-life situations represented in fictional stories, as well as the development of new mental representations and inferential predictions that can arise from the readings (Garcia, 2005).

7.1.2.2. Reflection circles.

After the interaction processes with the different phenomena and systems, the need arises to generate interactions between the ideas and constructions emerging from the child's experiences (Durán Chiappe, 2003). However, there is a need to intentionally guide reflection processes mediated by Essential Questions (McTighe & Wiggins, 2013) that guide and integrate the multiple ideas and scientific skills processes (especially in the hypothesis and inquiry processes). These moments are conducted prior to the initial approaches to the phenomena and systems with which children interact, during the interactions and interpretations that emerge from the diverse situations during such processes, and the closures promoting metacognition from questioning their ideas and sensations emerging from the experience.

7.1.2.3. Ideas and perspectives production.

The process of idea development and abstraction, as observed in children, requires the provision of support to facilitate the consolidation of their mental representations and the effective communication of those ideas (Andrade, Rios & Ortega, 2005). This is done through their own representations of reality in various forms of media. Even though some authors advocate for the formalization of science through written and mathematical languages (Barnes, 1977), the proposal in this project suggests the use of expressive languages such as art, oral communication, and music to explore students' ideas and their understanding of phenomena (Instituto Colombiano de Bienestar Familiar, 2011). The use of these languages aims to prioritize cognitive development and the construction of ideas about the phenomena they are confronted with, without being constrained by the written structure of language. This allows children to create and interact with various representations, such as:

- Drawings or sculptures of processes they recognize.

- Designing prototypes of objects or elements that allow them to solve problems.
- Movement routines that show the pattern of behavior of some phenomenon (such as wave theory).

It is important to note that this proposal does not exclude the simultaneous development of reading and writing skills. Instead, it emphasizes the use of media that aligns with the children's stage of development, allowing them to better understand and express ideas. This promotes smooth transitions between early childhood education and formal education in preschool (González, Muñoz & Zubizarreta, 2011).

7.1.2.4. Articulation with practical elements and strategies.

The processes outlined in the preceding sections aim to create a tangible impact by enabling teachers to integrate students' learning, objectives, values, and scientific understanding with the transformations they can bring about within their interacting contexts. This can be achieved by implementing the strategies outlined in this proposal, using various approaches, techniques, and models including:

- Problem-based learning: Problem situations are generated that encourage children to explore natural phenomena or systems in their environment from the perspective of scientific thinking to generate meaningful solutions for their reality (Arias-Gundín, Fidalgo, Robledo, & Álvarez, 2009).

- Models and modelling: Development of models based on children's experiences in order to generate a valid representation of the phenomena and systems to which they are exposed (Oliva, 2019).

- Philosophy for children: Approach focused on the philosophical discussion of children in relation to a specific topic (Rastrojo,2016); in this case, in relation to the understanding of natural phenomena and the deconstruction of the

elements that compose it, making it possible for very abstract phenomena to be understood by children (Gasparatou, Ergazaki, Kosmopoulou, 2020).

7.1.3. Content and thematical approaches.

With respect to the content prioritized in this approach, three thematic lines are proposed to strengthen the elements of children's scientific thinking. These thematic lines include:

Biology: This focuses on the understanding of biological diversity, the concept of living and inert beings, the exploration of biological environments and the distinctive characteristics of each organism. This is projected towards the understanding of non-dynamic systems, where specific actions on a living organism generate effects on its functions.

Environmental sciences: Focuses on integrating ecological understandings of the ecosystems that surround children, including the relationship between the planet's biogeochemical cycles, human activities, and their impact on the environment. This thematic line focuses on the development of relationships and the formation of values, attitudes, and behaviors in favor of the preservation of nature and their environment.

Physics: Focuses on Newton's laws, movement and the understanding of force systems that generate interactions between different bodies, electrical systems, and static, as well as the exploration of the physical properties of the surrounding objects. This aims to develop a practical and interactive branch of science, where aspects related to the functionality of the universe are understood through the particularities of objects and their behavior in space.

Astronomy: Focuses on the identification, differentiation, and relationship of different celestial bodies, such as the sun, moon and stars, among others. It also deals with daily cycles, such as day and night. This thematic line raises the possibility of understanding bodies that, although they are not close to us, influence the dynamics of our lives.

It is important to mention that these are the thematic axes from the teacher's perspective, and as part of their professional practice. Adaptations are made according to the needs, interests, and problems present in the context of their students.

7.1.4. Teacher and students' roles.

As mentioned by Sliogeris & Almedia (2019), due to the nature of science content and the understanding of natural phenomena, the teacher is required to act as a mediator and transformer of the epistemological structures of the topics to the reality of the children. Likewise, he/she makes constant readings of the contexts in which he/she can connect scientific topics with the interests of his/her students. In addition, the teacher must act as an agent that channels the productions and ideas of the students to enhance and detonate cognitive moments, encouraging a more in-depth inquiry exercise that does not necessarily lead to immediate answers or conclusions (Ramanathan, Carter & Wenner, 2021), guiding them to possible means with which to construct their ideas.

For their part, children act as the protagonists of their learning, in which they can interact directly with the phenomena to which they are exposed, consolidating their own ideas, and transforming them as they seek to express them or integrate them with more ideas from their peers or their teacher (Rohita, et al., 2018). Similarly, they use different media to express their ideas, from the use of drawings to represent the schemes they have consolidated (Carretón, García & García, 2021), to the construction of artistic structures that reflect the models of the phenomena with which they interact, whether they are plastic (Cruz & Martínez, 2021) or symbolic theatrical representations (Fragkiadaki, et al., 2021).

7.1.5. Evaluation of the learning process.

The evaluation focuses on demonstrating progress in three central areas from a qualitative perspective, those are:

- Capacity to construct mental representations of the phenomena that children interact with which the ideas, images, symbols, examples, and concepts that

children generate after their experiences. These can be seen in their drawings, sculptures, artistic expressions, or dialogues in class.

- Evidence of the processes of inquiry, where strengths and weaknesses are identified in observing, formulating questions, and developing hypotheses related to the analyzed phenomena. The stages that students go through to explore each phenomenon in the media are traced.
- Children's reflections and proposals regarding the phenomenon from a social perspective, observed in the commitments, actions, and values in their interactions with the community.

The assessment proposed is not solely focused on the teacher's perspectives. Instead, it provides an opportunity for children to enhance their scientific discourse. This can be achieved with figurative-analogue assessments, where children connect their experiences and learning to elements of their everyday life (Lozano, et al., 2022), articulated to expressions and representations elaborated by them (mentioned in section 7.1.2.3), to assess the children's progress throughout the process.

7.2. Limitations and challenges for the proposal.

With the theoretical evaluation, there are two aspects that emerge as the biggest challenges and limitations to implement the proposal in diverse contexts. These include:

7.2.1. Integration of scientific knowledge by early childhood teachers.

Two out of the three evaluators expressed concerns regarding the theoretical and scientific skills required by the teacher to comprehend and engage with the phenomena and natural systems adequately. This is consistent with the ideas proposed by Mazzas & Bravo Torija (2018), who argue that teachers need to have specific training to teach science experiences that align with the realities of children, while still maintaining the integrity of the discipline.

Even though some evaluators suggest that teacher preparation should focus on understanding scientific thinking skills and processes rather than rigid theoretical content

exploration, there is a concern that teachers may feel afraid to be involved in these processes due to negative preconceptions of sciences in general (Barenthien & Dunekacke, 2021).

7.2.2. Disaggregation of the early childhood education processes within the proposal.

Due to the nature of science education in school contexts, there is a significant possibility that even if this proposal integrates elements of early childhood education, it may not align with formal education and scientific education in higher grades. Because of this, rhythms and perspectives surrounding the children's processes may not be respected, through the implementation of quantitative evaluations that do not honor the development of the children or their feelings and viewpoints. This can lead to inadequate learning experiences that do not address the particular needs of each child.

Attending to González, Muñoz, & Zubizarreta (2011) it is necessary to promote harmonized transitions between the different levels of education. They emphasize the importance of meaningful experiences that allow the reflection and progression of the student without the risk that this proposal turns into a way to force the development outside the appropriate moments in children's lives.

7.3. Boot camp designed in the framework of the didactic proposal.

The experience was titled "A World of Trash" with the topic of waste separation and recycling[3]; a lesson structured for a total of six hours, carried out during the week available for the research. This boot camp was divided in five main moments: Development of the story "A World of Trash", reflection about human consumption, resolution of the story "A World of Trash", artistic representations of waste materials, and the construction of communal bins. The details of each activity are presented in table 5. It is important to mention that although the lesson is presented in English, the experience was carried out in Spanish.

[3] This topic was used due to the requirements of the school.

Table 5. Lesson plan for the experience “A World of Trash”

Name of the activity	Description
Introduction to the Dumpster City	The children are introduced into a different city for the lesson of the day, going through a symbolic portal, arriving at the classroom that is adapted in a dumpster theme. This adaptation included scenography that included some piles of waste materials and musical environments for the children.
First part of the story	The teacher presents the first and second paragraphs of the story. After that, the teacher asks: What were the Patricinos doing that created all this trash? Once the question is asked, the children are allowed to explore the whole classroom and play as a regular day in the Patricinos’ life, looking for an answer to the question presented by the teacher who periodically reminds the students about the question.
Reflection circle	After play time is over, the teacher asks once again: What were the Patricinos doing that created all this trash? In this moment, the teacher elicits the children’s answers and new ideas to expand their conceptions. Following this part, the teacher introduces the question: How are the actions of the Patricinos related to the state of the city? After listening to some of the children’s ideas, the teacher continues the reading of the story and presents some effects of pollution on different organisms. Finally, the teacher relates the previous question to a new one: How is the trash affecting all the city, plants, animals, and people in it?
Improving the state of the city	The teacher reads the last part of the story, concluding with the question: What can we do? After that, the teacher asks: Is there anything we can do with the waste, leftovers, and materials left around the city? Once the students bring up some possible answers, the teacher proposes to clean the city by picking up the materials on the ground, asking them to separate them so we can reuse those materials in a different way. The students should start constructing small mountains with specific categories they come up with.

Comentado [AT1]: Be sure to ensure that you don’t leave any loose titles at the end of a page in the final version.

	Once they have finished, the teacher suggests organizing the waste into the categories: paper and cardboard, plastic, and organic material (called food waste).
Representing the icons of the waste	Based on the previous experiences, the teacher asks the students "How can you represent each type of waste?", in that moment the teacher gives each student a type from the previous classification and a piece of paper, asking them to represent what that waste means to them. Finally, the teacher collects their ideas and creates three different icons to represent each one of the categories.
Construction of the bins	Using the icons consolidated by the teacher and some used plastic gallon jugs, the students, along with the teacher, build recycling bins for each one of the type of wastes presented up to this point.
Presenting our ideas to the school	The students, along with the teacher, go around the school presenting the project and the solution to the story of the Patricinos creating waste separation spots around the school.

The productions made by the children were analyzed according to the elements of the proposal to provide an initial indicator of the effectiveness of the didactic proposal in actual preschool contexts. Additionally, during the experience, the answers and interactions of the students were collected with a field diary filled by the main researcher.

7.4. Outcomes from the Boot Camp.

After implementing the "A World of Trash" Boot Camp, specific outcomes were observed in the improvement of scientific thinking in the preschoolers' minds. This provides initial evidence supporting the effectiveness of the proposal. The main results are presented here.

7.4.1. Impact of the story and the representation of natural phenomena.

During the presentation of the story, the integration of the free game and the circles of reflection and interaction with the classroom environment designed for the activity, the children[4] expressed their reflections. This is one example.

- "It's just that all the garbage was because they had a big party, cooked a lot of food, but only took a bite (mimics the act of biting), but since they didn't like it, they just threw it around. (Es que toda la basura fue porque hicieron una gran fiesta, cocinaron mucha comida, pero solo hicieron ñam (simula el acto de mordida), pero como no les gustó cogieron y la tiraron por ahí)" (Parrot, 5 years old)

As mentioned earlier, using play-based situations could allow children to understand roles, actions, and the relationship between events. This allows them to develop specific ideas through their free interaction and self-guided play (Andrée & Lager-Nyqvist, 2013). This can be seen in Parrot's ideas, where the experiences during the game contribute to understand the reasons behind specific consequences in the story (García, 2005).

The use of environmental scenography along with the specific events told in the story showed an initial relation between the phenomena simulation and the multiple representations created in the child's mind (Papalia, Feldman & Martorell, 2012), with specific connections between pollution and their actions.

- "And also the cats because they choke, and the mice also get sick from all the garbage, because it's very dirty. (Y también a los gatos porque se atoran, y también se enferman los ratones por toda la basura, porque está muy sucio)" (Pigeon, 6 years old).

As mentioned by Astete Leiva (2017), when children are exposed to situations and topics relatable to their daily lives, children can produce more connections and analyses with

[4] The children's original ideas are presented followed by their translation into English.

stories. In the case of the “A World of Trash story”, Pigeon’s interactions and ideas show a level of implication and understanding related to the complexity of the phenomena (pollution), identifying specific elements in the construction of the mental representations children want to design, integrating their conceptions dynamically with new ideas (Oliva, 2019).

- “Our actions can lead to filling everything with garbage, everything we do can lead to more garbage and make everyone feel bad (Nuestras acciones pueden hacer que llenemos todo de basura, todo lo que hacemos puede hacer que haya más basura y todos se puedan sentir mal)” (Macaw, 5 years old).

Additionally, as can be seen in Macaw’s ideas, based on their interactions, children reflect about their actions, values, and feelings regarding environmental responsibility (Veliz Mesa, 2018). Thus, they recognize possible ways to transform their realities confronting and proposing solutions to problems around them.

7.3.2. Children’s production and mental representations.

Figures 2 and 3 present results of the activity that show how students represented a specific type of waste based on the separation done at the end of the game.

Figure 2. “It's the plastic princess with her bottle scepter (Es la princesa de plástico con su cetro de botella)” by Toucan; drawing to represent plastics.

Figure 3. “It’s me, throwing the paper into the bin (Soy yo, botando en la caneca el papel)” by Eagle, drawing to represent paper.

In both pictures, there is a clear relation between the concepts of the phenomena with the students’ conceptions, personal interests, and feelings in their respective drawings, involving elements of their immediate context and their immersion within it to express their own actions and values. (Carretón, García & García, 2021). Additionally, in figure 2, we can see how the child created specific representations according to their own beliefs; in this case, a plastic bottle as it is a familiar item for them that could be used to symbolize a category.

8. Conclusions.

Science education in preschool allows for multiple transformations by enhancing children's development through their active engagement with natural phenomena and systems. This interaction allows children to generate ideas, explanations, and scientific reasoning through their explorations. This allows for the reinterpretation of scientific theories based on the scientific actions taken during these preschool moments.

The "Natural Explorers" proposal combines scientific thinking processes and skills with Guiding Activities through experiences designed or provided by the teacher, promoting the direct interaction between children and multiple ways of representing phenomena, including games, stories, natural explorations and some more.

The use of guiding activities in various forms, such as storytelling, play moments, scenographic adaptation, and drawing throughout the proposal, promote the mental representations construction done by the children, transforming the ways they interact and participate in cultural and scientific experiences in their families and communities.

Now, the interactions and ideas obtained in the implementation of the boot camp yield positive results, with outcomes arising from the experience itself. There is a clear connection between the events of the story (in this case, the phenomenon of pollution) and the children's ideas, providing an opportunity to develop concepts or systems in the children's minds. This creates associations between actions, events, and cause-and-effect relationships.

However, this proposal presents several challenges in achieving high-quality scientific education in preschool. One of the key challenges is the need to improve the processes of scientific education, which can be achieved through the training of early childhood education teachers or by enhancing science training for teachers specializing in childhood education. Similarly, it is important to comprehend the developmental processes of children without imposing evaluation and educational processes influenced by formal education. Instead, we should respect and appreciate the progress children achieve.

Even if the theoretical structure and initial evidence present a meaningful opportunity to use this proposal to teach science in preschool contexts, further implementations, research and validation are necessary in diverse contexts to determine its effectiveness, and its potential regarding the current proposals in local contexts.

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Appendix 1: Experts' Evaluation of proposal #1

Name: Mockingbird.

Criterio	No cumple	En desarrollo	Cumple parcialmente	Cumple
Coherencia	La propuesta carece de coherencia interna entre sus elementos, estando desconectados los objetivos y los elementos teóricos con los métodos prácticos. La falta de alineación dificulta la comprensión de cómo los componentes de la propuesta se relacionan entre sí y con los objetivos, lo que genera confusión y desorden.	La coherencia de la propuesta es limitada, y se requieren mejoras para establecer una relación clara entre los elementos teóricos y los métodos prácticos. Aunque algunas conexiones son evidentes, no todos los elementos se relacionan de manera efectiva, lo que resulta en una propuesta que necesita una mayor estructuración.	En este nivel, la propuesta muestra una coherencia adecuada en general y se relaciona de manera efectiva los elementos teóricos y los métodos prácticos. La mayoría de los elementos de la propuesta están alineados de manera adecuada con el tema y los objetivos a desarrollar.	La coherencia de la propuesta es excepcional y se ajusta perfectamente a los objetivos que se plantean en la propuesta. Todos los elementos teóricos y métodos prácticos de la propuesta se relacionan adecuadamente entre sí.
La veo muy general, considero importante detallar en el cómo, teniendo en cuenta los objetivos que estás planteando, ¿cómo vas a lograr cada uno de esos objetivos específicos? Es que veo la propuesta muy genérica, siento que falta mucho detalle o ser más explícito en la descripción.				
Pertinencia	La propuesta carece de pertinencia al no abordar las necesidades sociales de las ciencias naturales y lo desarrollos de los niños y niñas. Las elecciones de elementos teóricos y métodos prácticos no se justifican adecuadamente, lo que la hace inadecuada.	La pertinencia de la propuesta es limitada y requiere mejoras. Se mencionan algunas justificaciones para las elecciones, pero estas no son completamente convincentes, y la propuesta solo se adapta parcialmente a las necesidades sociales de las ciencias naturales a nivel social y los desarrollos de los niños y niñas.	La propuesta es pertinente en su mayoría a nivel adecuado y se ajusta a las necesidades sociales de las ciencias naturales y los desarrollos de los niños y niñas. Se proporcionan justificaciones razonables para las elecciones en torno a los elementos teóricos y los métodos prácticos.	La pertinencia de la propuesta es excepcional y aborda de manera integral las necesidades sociales de las ciencias y los desarrollos de los niños y niñas. Las justificaciones son sólidas y demuestran un profundo conocimiento del tema, lo que hace que la propuesta sea altamente relevante y adecuada.
Adaptabilidad	La propuesta es poco flexible, no resulta fácil de replicar y	La propuesta tiene potencial para ser adaptado a diferentes	La propuesta planteada posee elementos que	La propuesta planteada resulta de fácil adaptación

	adaptar a diferentes contextos escolares, ya que está atada a características específicas de la propuesta.	contextos escolares, pero de manera limitada, resultando difícil la inserción de los elementos a las realidades de las aulas.	pueden adaptarse con relativa facilidad a diversos contextos escolares, sin embargo algunos elementos requieren de procesos de adaptación extensos para ser implementados en el aula.	a diferentes contextos escolares, si bien se pueden necesitar procesos de adaptación no son extensos ni de mayor dificultad.
Me preocupa un poco en cuanto a la simulación de fenómenos en los diversos contextos ¿es posible en todos los contextos con los recursos que se tengan a la mano?				
Uso de las Didácticas de las Ciencias Naturales	La propuesta no demuestra una comprensión adecuada de los principios fundamentales de la didáctica de las ciencias naturales. La integración de conceptos y enfoques metodológicos de esta disciplina es escasa o inexistente, lo que limita la eficacia de la propuesta para desarrollar el pensamiento científico infantil.	La propuesta muestra una integración limitada del conocimiento de la didáctica de las ciencias naturales. Se hacen algunos intentos de integrar elementos de esta área, pero la aplicación es inconsistente y podría mejorarse para lograr un desarrollo del pensamiento científico infantil-	La propuesta demuestra una comprensión e integración adecuada de la didáctica de las ciencias naturales. Se incorporan estrategias de enseñanza relacionadas con esta área de manera efectiva, lo que mejora la calidad en el desarrollo del pensamiento científico infantil.	La propuesta utiliza la didáctica de las ciencias naturales de manera adecuada. La integración de metodologías, recursos y estrategias específicas de esta área es altamente efectiva y contribuye significativamente al desarrollo del pensamiento científico infantil.
Integración de los procesos del desarrollo infantil	La propuesta no demuestra una integración adecuada de los hitos del desarrollo infantil. No se consideran los aspectos clave del desarrollo en la planificación y diseño de las actividades, lo que podría resultar en una falta de adaptación a las necesidades de los niños.	Se hace un intento de integrar algunos aspectos del desarrollo infantil, pero la aplicación es limitada. La propuesta muestra un conocimiento parcial de los procesos de desarrollo y se podrían mejorar para adaptarse mejor a las necesidades de los niños.	La propuesta a nivel adecuado demuestra una comprensión razonable de los procesos de desarrollo infantil. Se consideran aspectos clave del desarrollo en la planificación y diseño de las actividades, lo que contribuye a una adaptación efectiva a las necesidades de los niño.	La propuesta integra de manera excepcional los procesos de desarrollo infantil en todo el diseño pedagógico. Se demuestra un profundo conocimiento de los aspectos del desarrollo, y la adaptación a las necesidades de los niños es altamente efectiva y enriquecedora para su crecimiento y aprendizaje.

Me parece que hace falta el centrarse más en el desarrollo del niño de preescolar, me parece excelente que incluyas los lenguajes expresivos como parte de tener en cuenta ese desarrollo, pero también es importante tener en cuenta sus posibilidades de acción según sus edades				

¿Cuáles considera que son los elementos más atractivos y significativos de la propuesta didáctica?

El uso de los lenguajes expresivos y la simulación para el aprendizaje de las ciencias

¿Qué elementos requieren profundizarse en el desarrollo de la propuesta?

Teniendo en cuenta estas líneas temáticas, se podría hablar solo de fenómenos? En mi ignorancia científica cuando me hablan de fenómenos se refiere más a elementos relacionados con la física, pero tu incluyes biología y ciencias ambientales. (No lo sé, por eso te digo que en mi ignorancia científica)

¿Cuáles limitaciones y retos puede identificar en la propuesta didáctica para su implementación?

Creo que una limitación es la comprensión del término de fenómeno, me parece que como imaginario social, es muy enfocado hacia sucesos físicos. Considero importante explicar por qué los llamas fenómenos en los cuatro ejes o líneas de trabajo que incluyes. Uno delos retos es lograr aplicarlo en los diversos contextos teniendo en cuenta heterogeneidad de población (tanto diversidad de niños como diversidad sociocultural)

Appendix 1: Experts Evaluation of the proposal #2

Name: Canary

Criterio	No cumple	En desarrollo	Cumple parcialmente	Cumple
Coherencia	La propuesta carece de coherencia interna entre sus elementos, estando desconectados los objetivos y los elementos teóricos con los métodos prácticos. La falta de alineación dificulta la comprensión de cómo los componentes de la propuesta se relacionan entre sí y con los objetivos, lo que genera confusión y desorden.	La coherencia de la propuesta es limitada, y se requieren mejoras para establecer una relación clara entre los elementos teóricos y los métodos prácticos. Aunque algunas conexiones son evidentes, no todos los elementos se relacionan de manera efectiva, lo que resulta en una propuesta que necesita una mayor estructuración.	En este nivel, la propuesta muestra una coherencia adecuada en general y se relaciona de manera efectiva los elementos teóricos y los métodos prácticos. La mayoría de los elementos de la propuesta están alineados de manera adecuada con el tema y los objetivos a desarrollar.	La coherencia de la propuesta es excepcional y se ajusta perfectamente a los objetivos que se plantean en la propuesta. Todos los elementos teóricos y métodos prácticos de la propuesta se relacionan adecuadamente entre sí.
Es importante centrarse desde el inicio en preescolar, porque si se deja abierto a primera infancia, esto implica elementos para desarrollar con mayor profundidad dependiendo el momento de desarrollo.				
Pertinencia	La propuesta carece de pertinencia al no abordar las necesidades sociales de las ciencias naturales y lo desarrollos de los niños y niñas. Las elecciones de elementos teóricos y métodos prácticos no se justifican	La pertinencia de la propuesta es limitada y requiere mejoras. Se mencionan algunas justificaciones para las elecciones, pero estas no son completamente convincentes, y la propuesta solo se adapta parcialmente a las necesidades sociales de las ciencias naturales a	La propuesta es pertinente en su mayoría a nivel adecuado y se ajusta a las necesidades sociales de las ciencias naturales y los desarrollos de los niños y niñas. Se proporcionan justificaciones razonables para las	La pertinencia de la propuesta es excepcional y aborda de manera integral las necesidades sociales de las ciencias y los desarrollos de los niños y niñas. Las justificaciones son sólidas y

	adecuadamente, lo que la hace inadecuada.	nivel social y los desarrollos de los niños y niñas.	elecciones en torno a los elementos teóricos y los métodos prácticos.	demuestran un profundo conocimiento del tema, lo que hace que la propuesta sea altamente relevante y adecuada.
Interesantes todos los estudios relacionados ya que permiten argumentar de manera sólida la propuesta.				
Adaptabilidad	La propuesta es poco flexible, no resulta fácil de replicar y adaptar a diferentes contextos escolares, ya que está atada a características específicas de la propuesta.	La propuesta tiene potencial para ser adaptado a diferentes contextos escolares, pero de manera limitada, resultando difícil la inserción de los elementos a las realidades de las aulas.	La propuesta planteada posee elementos que pueden adaptarse con relativa facilidad a diversos contextos escolares, sin embargo algunos elementos requieren de procesos de adaptación extensos para ser implementados en el aula.	La propuesta planteada resulta de fácil adaptación a diferentes contextos escolares, si bien se pueden necesitar procesos de adaptación no son extensos ni de mayor dificultad.
Para lograr una adecuada adaptación, sería ideal que quedara claro que lo primero que debería hacer el docente es situarse en el contexto; conocer el territorio, la cultura, los ecosistemas, la población con el objetivo también de que la propuesta esté situada. Por ejemplo, cuáles son los fenómenos naturales que más se presentan en esa zona, esto le permitirá conectarse más con los estudiantes y sus intereses. Te recomiendo profundizar más en Place-Based Education.				
Uso de las Didácticas de las Ciencias Naturales	La propuesta no demuestra una comprensión adecuada de los principios fundamentales de la didáctica de las ciencias naturales. La integración de conceptos y enfoques metodológicos de esta	La propuesta muestra una integración limitada del conocimiento de la didáctica de las ciencias naturales. Se hacen algunos intentos de integrar elementos de esta área, pero la	La propuesta demuestra una comprensión e integración adecuada de la didáctica de las ciencias naturales. Se incorporan estrategias de enseñanza relacionadas con esta	La propuesta utiliza la didáctica de las ciencias naturales de manera adecuada. La integración de metodologías, recursos y estrategias específicas de esta

	disciplina es escasa o inexistente, lo que limita la eficacia de la propuesta para desarrollar el pensamiento científico infantil.	aplicación es inconsistente y podría mejorarse para lograr un desarrollo del pensamiento científico infantil-	área de manera efectiva, lo que mejora la calidad en el desarrollo del pensamiento científico infantil.	área es altamente efectiva y contribuye significativamente al desarrollo del pensamiento científico infantil.
Tener en cuenta algunas metodologías propias de la primera infancia que deberían incorporarse más allá de las actividades rectoras.				
Integración de los procesos del desarrollo infantil	La propuesta no demuestra una integración adecuada de los hitos del desarrollo infantil. No se consideran los aspectos clave del desarrollo en la planificación y diseño de las actividades, lo que podría resultar en una falta de adaptación a las necesidades de los niños.	Se hace un intento de integrar algunos aspectos del desarrollo infantil, pero la aplicación es limitada. La propuesta muestra un conocimiento parcial de los procesos de desarrollo y se podrían mejorar para adaptarse mejor a las necesidades de los niños.	La propuesta a nivel adecuado demuestra una comprensión razonable de los procesos de desarrollo infantil. Se consideran aspectos clave del desarrollo en la planificación y diseño de las actividades, lo que contribuye a una adaptación efectiva a las necesidades de los niño.	La propuesta integra de manera excepcional los procesos de desarrollo infantil en todo el diseño pedagógico. Se demuestra un profundo conocimiento de los aspectos del desarrollo, y la adaptación a las necesidades de los niños es altamente efectiva y enriquecedora para su crecimiento y aprendizaje.
Hace falta profundizar más en el desarrollo infantil en esas edades. Se recomienda revisar a Diane Papalia y/o a John Santrock para profundizar más en el desarrollo de los preescolares.				

¿Cuáles considera que son los elementos más atractivos y significativos de la propuesta didáctica?

Que desde el preescolar los niños y las niñas puedan vivir experiencias más centradas en las ciencias naturales y conocer conceptos y vocabulario que contribuya a su aprendizaje.

¿Qué elementos requieren profundizarse en el desarrollo de la propuesta?

Más allá de las evaluaciones cualitativas, pensarse en evaluaciones figuroanalógicas para estas edades que denotan más la experiencia de niños y niñas con la vivencia en términos de sus emociones, gustos, percepciones y aprendizajes y no tanto desde la perspectiva del profesor y lo que él o ella considera.

Dejar muy claro que lo más importante es que los niños y las niñas tengan la posibilidad de tener una participación genuina en todo el proceso; de lo contrario, se va a seguir perpetuando el enfoque conductista donde el profesor es el que sabe, explica, da las respuestas y espera que los estudiantes aprendan.

¿Cuáles limitaciones y retos puede identificar en la propuesta didáctica para su implementación?

Limitaciones:

- Más que una limitación es una preocupación que desde el preescolar no se respeten los ritmos y momentos de vida de niñas y niños y sus expresiones, por la necesidad de cualificar el aprendizaje y medirlo o hacerlo evidente en los resultados de las evaluaciones, donde el currículo sea estático y pasemos a tener un preescolar “menos libre”, y desde ahí los centremos en contenidos pre establecidos por el afán de iniciar desde antes.

- En el preescolar niños y niñas se relacionan con el mundo e inician muchas de sus comprensiones, en gran medida por sus experiencias y conocimientos previos, me inquieta que a partir de las evaluaciones se empiece a hacer perder este grado a los niños que no cumplen con lo esperado.

Desafíos

- Uno de los desafíos es contar con profesores de educación infantil que conozcan contenidos específicos y procesos de ciencias naturales, o viceversa, profesores de ciencias naturales que conozcan de educación y desarrollo infantil.

- Que la propuesta sea lo suficientemente abierta y permita flexibilizar los temas que se vayan a tratar.

- Que el profesor sea un excelente observador y esté más atento a los procesos de desarrollo de los niños y sus experiencias de observación, contrastación, creación de preguntas e hipótesis, indagación, experimentación, cuidado y respeto del medio ambiente, más allá de saberse los nombres técnicos de los contenidos o de los fenómenos.

Appendix 1: Experts Evaluation of the proposal #3

Criterio	No cumple	En desarrollo	Cumple parcialmente	Cumple
Coherencia	La propuesta carece de coherencia interna entre sus elementos, estando desconectados los objetivos y los elementos teóricos con los métodos prácticos. La falta de alineación dificulta la comprensión de cómo los componentes de la propuesta se relacionan entre sí y con los objetivos, lo que genera confusión y desorden.	La coherencia de la propuesta es limitada, y se requieren mejoras para establecer una relación clara entre los elementos teóricos y los métodos prácticos. Aunque algunas conexiones son evidentes, no todos los elementos se relacionan de manera efectiva, lo que resulta en una propuesta que necesita una mayor estructuración.	En este nivel, la propuesta muestra una coherencia adecuada en general y se relaciona de manera efectiva los elementos teóricos y los métodos prácticos. La mayoría de los elementos de la propuesta están alineados de manera adecuada con el tema y los objetivos a desarrollar.	La coherencia de la propuesta es excepcional y se ajusta perfectamente a los objetivos que se plantean en la propuesta. Todos los elementos teóricos y métodos prácticos de la propuesta se relacionan adecuadamente entre sí.
Pertinencia	La propuesta carece de pertinencia al no abordar las necesidades sociales de las ciencias naturales y lo desarrollos de los niños y niñas. Las elecciones de elementos teóricos y métodos prácticos no se justifican adecuadamente, lo que la hace inadecuada.	La pertinencia de la propuesta es limitada y requiere mejoras. Se mencionan algunas justificaciones para las elecciones, pero estas no son completamente convincentes, y la propuesta solo se adapta parcialmente a las necesidades sociales de las ciencias naturales a nivel social y los desarrollos de los niños y niñas.	La propuesta es pertinente en su mayoría a nivel adecuado y se ajusta a las necesidades sociales de las ciencias naturales y los desarrollos de los niños y niñas. Se proporcionan justificaciones razonables para las elecciones en torno a los elementos teóricos	La pertinencia de la propuesta es excepcional y aborda de manera integral las necesidades sociales de las ciencias y los desarrollos de los niños y niñas. Las justificaciones son sólidas y demuestran un profundo conocimiento del

			y los métodos prácticos.	tema, lo que hace que la propuesta sea altamente relevante y adecuada.
Adaptabilidad	La propuesta es poco flexible, no resulta fácil de replicar y adaptar a diferentes contextos escolares, ya que está atada a características específicas de la propuesta.	La propuesta tiene potencial para ser adaptado a diferentes contextos escolares, pero de manera limitada, resultando difícil la inserción de los elementos a las realidades de las aulas.	La propuesta planteada posee elementos que pueden adaptarse con relativa facilidad a diversos contextos escolares, sin embargo algunos elementos requieren de procesos de adaptación extensos para ser implementados en el aula.	La propuesta planteada resulta de fácil adaptación a diferentes contextos escolares, si bien se pueden necesitar procesos de adaptación no son extensos ni de mayor dificultad.
Uso de las Didácticas de las Ciencias Naturales	La propuesta no demuestra una comprensión adecuada de los principios fundamentales de la didáctica de las ciencias naturales. La integración de conceptos y enfoques metodológicos de esta disciplina es escasa o inexistente, lo que limita la eficacia de la propuesta para desarrollar el pensamiento científico infantil.	La propuesta muestra una integración limitada del conocimiento de la didáctica de las ciencias naturales. Se hacen algunos intentos de integrar elementos de esta área, pero la aplicación es inconsistente y podría mejorarse para lograr un desarrollo del pensamiento científico infantil-	La propuesta demuestra una comprensión e integración adecuada de la didáctica de las ciencias naturales. Se incorporan estrategias de enseñanza relacionadas con esta área de manera efectiva, lo que mejora la calidad en el desarrollo del pensamiento científico infantil.	La propuesta utiliza la didáctica de las ciencias naturales de manera adecuada. La integración de metodologías, recursos y estrategias específicas de esta área es altamente efectiva y contribuye significativamente al desarrollo del pensamiento científico infantil.

Integración de los procesos del desarrollo infantil	La propuesta no demuestra una integración adecuada de los hitos del desarrollo infantil. No se consideran los aspectos clave del desarrollo en la planificación y diseño de las actividades, lo que podría resultar en una falta de adaptación a las necesidades de los niños.	Se hace un intento de integrar algunos aspectos del desarrollo infantil, pero la aplicación es limitada. La propuesta muestra un conocimiento parcial de los procesos de desarrollo y se podrían mejorar para adaptarse mejor a las necesidades de los niños.	La propuesta a nivel adecuado demuestra una comprensión razonable de los procesos de desarrollo infantil. Se consideran aspectos clave del desarrollo en la planificación y diseño de las actividades, lo que contribuye a una adaptación efectiva a las necesidades de los niño.	La propuesta integra de manera excepcional los procesos de desarrollo infantil en todo el diseño pedagógico. Se demuestra un profundo conocimiento de los aspectos del desarrollo, y la adaptación a las necesidades de los niños es altamente efectiva y enriquecedora para su crecimiento y aprendizaje.

¿Cuáles considera que son los elementos más atractivos y significativos de la propuesta didáctica?

1. La intencionalidad del ejercicio me parece que es clara y de gran impacto en cuanto a enseñanza de las ciencias en niños y niñas se trata, las metas del enoque como es fomentar la comprensión de los fenómenos naturales, responde a una de las competencias del aprendizaje de las ciencias naturales, el aportar a una cultura científica desde la primera infancia permitiría mayor empoderamiento de la disciplina en el transcurso e su vida escolar ya que iniciaría con el potenciamiento de un pensamiento científico. Los contenidos a desarrollar son pertinentes

para las edades y la forma de evaluación abarca procesos de pensamiento científico, lo cual se convierte en una fortaleza en el discurso.

¿Qué elementos requieren profundizarse en el desarrollo de la propuesta?

A pesar de que hay unos momentos claros de la propuesta didáctica para trabajarse con los niños, que se encuentran fundamentadas y soportadas desde diferentes autores, lineamientos y políticas públicas, no está explicita la estrategia de enseñanza que moviliza las metas propuestas, los conceptos y los procesos de evaluación. Desde el rol del profesor se mencionan elementos claves como ideas previas, arte, juego; sin embargo, no están enmarcadas en una estrategia especifica clara, ésta permite que la propuesta pedagógica y el discurso didáctico se fortaleza y muestre una articulación en lo que se quiere enseñar, a quién, cómo, para qué.

¿Cuáles limitaciones y retos puede identificar en la propuesta didáctica para su implementación?

La limitación y/o reto es que, para lograr identificar la capacidad de construir representaciones mentales de los fenómenos, los procesos de indagación y las reflexiones y propuestas de los niños frente a la apropiación del fenómeno, debe haber una estrategia que aporte a esos alcances y además que permita a través de la evaluación (Rúbricas) visibilizar los subprocesos que permiten el alcance de estas habilidades, de lo contrario la propuesta se limita a idealizar el ejercicio sin aterrizarse a una propuesta didáctica.