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SCIENTIFIC LITERACY AND THE SUSTAINABLE DEVELOPMENT GOALS IN EARLY CHILDHOOD EDUCATION: POSSIBILITIES FOR RESPONSIBLE SCIENTIFIC LITERACY

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Joelma Auxiliadora Cabral[1] and Maria Auxiliadora Motta Barreto[2]

ABSTRACT
Scientific Literacy (CA) is crucial in citizen education, integrating scientific knowledge with interdisciplinary and contextualized teaching. The objective of this research was to analyze the children's discourses to verify didactic practices in the promotion of the CA process in early childhood education. The project developed was applied to two groups of children aged five and six, using experiments from a vegetable garden. Documented by observations, photos, videos and reports, it was evidenced that, through experiments, the children developed a perception of "little researchers", improving reflection and critical thinking. The data collected allowed an in-depth analysis of the children's cognitive and behavioral changes during the project, contributing to progress towards the Sustainable Development Goals (SDGs). This approach not only imparted scientific concepts but also fostered practical skills applicable to everyday life, benefiting both students and educators.

Keywords: Scientific Literacy, Early Childhood Education, Sustainable Development.

[1] Master of Science
EEL-USP
[2] Dr. in Psychology as a Profession and Science
EEL-USP

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INTRODUCTION

Scientific Literacy (CA) understood as the ability to understand and use concepts, processes and methods of science to interpret the world around us (Bybee, R.W, 2015) is fundamental in the formation of citizenship and in the acquisition of scientific knowledge in schools. As highlighted in the texts of the National Common Curriculum Base (BNCC), it is essential to integrate literacy and CA in elementary school, so that children develop skills and competencies to understand and apply knowledge in different contexts.

Despite this recommendation, CA practice still faces significant challenges in basic education. As pointed out by Soares, Mauer and Kortmann (2013) and reiterated by Nunes (2022), many educators do not master effective CA practices, resulting in fragmented and superficial science teaching. Carvalho and Gil-Pérez (2011) point out that the teaching of science is often neglected in early childhood education schools, not reaching the level of knowledge necessary for students.

In this context, the present research aimed to explore the discourse of children in early childhood education to verify the processes of CA through the application of didactic sequences that provided not only scientific literacy, but also awareness about the importance of the Sustainable Development Goals (SDGs).

EARLY CHILDHOOD EDUCATION AND ITS ACTIVE LEARNING METHODS

Early childhood education always presents an opportunity to cultivate children's curiosity and imagination. In the dynamic environment of early childhood education, the implementation of active learning methods emerges as an enriching approach, providing children not only with knowledge, but also stimulating cognitive development through interactive and engaging experiences.

Bacich and Moran (2018) present hybrid teaching as the union of face-to-face methodologies with online teaching strategies , making classes more interactive and participatory, adapting to the individual needs of students, preparing them for an increasingly connected and technological world. This pedagogical approach gained prominence, even during the Covid-19 pandemic (Valente, Almeida & Geraldini, 2017).

Different active methodologies and strategies, such as the Flipped Classroom, Station Rotation, Rotational Laboratory and Flex Model, Project-Based Learning (PBL), as pointed out by Horn, Staker and Christensen (2015), Bacich & Moran (2018), Siqueira, Sousa Neto and Oliveira (2020) are aligned with the idea of making children active participants in their education and educators mediators of knowledge, in a collaborative and individualized environment.

In light of these perspectives, the integration of differentiated practices is not only essential to broaden children's scientific understanding, but also to promote meaningful and contextualized learning. The approach proposed by Amaral e Silva (2000) and Gasparin (2002) highlights the importance of theoretical transcendence and practical relevance, fundamental elements for the solid construction of knowledge in early childhood education.

SCIENTIFIC LITERACY AND SUSTAINABLE DEVELOPMENT GOALS

One of the main challenges in science teaching is to integrate natural phenomena into children's daily lives, using experimentation as a key tool to arouse scientific interest, as indicated by Giani (2010).

Defined by Sasseron and Carvalho (2011) and Miller (1983) as the understanding of science, technology and their impact on society, CA is considered a process of 'scientific enculturation' or 'scientific literacy', providing interaction with the world and scientific knowledge, promoting scientific literacy without the pressure of precision and systematization required in the scientific world (Rosa, Perez & Drum, 2007).

The National Common Curriculum Base (2018) highlights in its texts the importance of playful and experimental activities in the teaching and learning process, recognizing the child as an observant and questioning being, as he develops critical and reflective thinking, preparing classes to act assertively in society, in the environment and to make conscious decisions.

In this context, the Sustainable Development Goals (SDGs), established by the UN in 2015, present themselves as an important field to be thought about and discussed from the early years. These goals, with 17 targets and 169 objectives to be achieved by 2030, cover crucial areas such as quality education, gender equality, environmental conservation, and reducing social inequalities.

SDG n. 4 - which deals with Quality Education and n. 12 - Responsible Consumption and Production, were highlighted in this research, focusing, respectively, on quality education and sustainable consumption and production patterns. Libório (2021) argues that education is key to reducing historical inequalities and promoting well-being, while effective management of natural resources and the promotion of sustainable consumption and production practices are essential to achieving global goals. Therefore, education is seen

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as a means of transforming lives and realities, recognizing the importance of the SDGs in the formation of conscious and active citizens in sustainable development.

The child's initial contact with CA, if positive, can drive significant advances in the subsequent stages of schooling. CA, in early childhood, establishes a solid foundation to deal with real everyday problems, developing skills such as formulating hypotheses, testing ideas and building conclusions related to society and the environment. The BNCC, (2018) highlights the importance of working with investigation, critical analysis, imagination and creativity from an early age.

Belluzzo (2018) discusses the need for an education that promotes skills to reflect on actions with social, cultural, economic, and environmental impacts. Science education, therefore, not only facilitates access to scientific knowledge, but also commits to a critical and ethical perspective, essential to understand the advances and impacts of scientific, environmental, and technological development.

METHODOLOGY

An applied qualitative approach was adopted, with exploratory and explanatory objectives, using Grounded Theory (GT) and Artificial Participant Observation (OPA). GT, developed by Glaser and Strauss in the 1960s, seeks to generate theories from the data collected, rather than testing existing theories. This is done by collecting and analyzing data simultaneously, allowing researchers to identify emerging patterns and develop theoretical concepts based on the observed data. This method is used to understand experiences and meanings experienced by participants in a specific scenario.

Both the collected data and the previous knowledge of the researcher and the participants were considered, including various sources of information such as field observations, interviews and questionnaires, as described by Charmaz (2009). The interactions discovered between categories form conceptual hypotheses, integrated to produce an inductive theory about the area of study.

OPA is a research technique that combines aspects of participant observation, in which the researcher engages directly with the group studied, with natural and artificial elements, such as simulations or controlled scenarios. This allows researchers to observe participants' behavior in specific situations and analyze their interactions in a more controlled manner. The OPA was used to analyze the advancement of children's knowledge, supported by Discursive Textual Analysis (DTA) as defined by Moraes and

Galiazzi (2020). The authors highlight the idea that DTA is a qualitative data analysis approach that focuses on the interpretation and understanding of discourses and texts. It involves identifying patterns and themes in textual data, as well as interpreting the meanings underlying participants' discourses, allowing for the reconstruction and interpretation of discourses, analyzing qualitative information to generate new understandings about natural and artificial phenomena.

The Scientific Literacy Indicators (IAC) of Sasseron and Carvalho (2008) were used to analyze the students' discourses. These indicators, divided into groups related to data collection, structuring of thought and search for relationships, are crucial to clarify situations or report events and contents studied. The IAC are a set of indicators developed to assess the level of scientific literacy of students. They cover various skills, such as serialization of information, data organization, logical reasoning, hypothesis raising, among others. These indicators are used to analyze students' discourse and assess their cognitive and scientific development.

The research was carried out in a school located in a city in the interior of São Paulo, which serves about 150 children, most of them low-income. With eight classrooms, the school has limited resources and a team composed of principals, coordinators, teachers, monitors, assistants and inspectors. The project, focused on children aged five and six, was carried out for three months in two classrooms. The research was analyzed through visits, photos, videos, reports and online meetings.

The Active Methodology of Project-Based Learning (PBL) was used, which is an educational approach that places students at the center of the learning process, involving them in meaningful and practical projects. It promotes the construction of knowledge through investigation and resolution of real problems, encouraging students' critical thinking, collaboration, and creativity. Experimentation, which is a fundamental approach in scientific research, particularly in science education, was also present during this process. It involves conducting hands-on activities that allow students to explore scientific concepts, test hypotheses, and develop investigative skills. In the aforementioned research, the experimentation was conducted using the Active Methodology of Project-Based Learning (PBL), with the objective of promoting scientific literacy and reflective thinking of students, both in the classroom and in the external environment of the school.

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PROJECT DEVELOPMENT

The project was implemented in two classrooms, for all children at the same time, centered on scientific experiments in a vegetable garden. The activities were led by the teachers with the guidance of the researcher. The project sought to develop in students the understanding of the importance of the sustainable use of natural resources, in line with the SDGs.

Initially, there were preparatory meetings with the teachers, addressing the objective of the project and clarifying doubts. The orientations were carried out both in person and *online,* covering a total of four hours per week emphasizing the development of scientific experiments and the importance of adapting technical language to children's understanding, encouraging student interaction and engagement.

At first, previous knowledge was explored through conversation circles. In this initial phase, it is more challenging to identify any Scientific Literacy Indicators (HAI) in the students' speech, since such indicators are skills inherent to the scientific method, which students will acquire and develop throughout the execution of experimental activities. For this reason, at this stage, although it is fundamental for the learning process, the IAC were not addressed.

In the second moment, the children were encouraged to explore materials and carry out experiments, observations and formulation of hypotheses freely. After the experiments, a variety of activities were employed to consolidate knowledge, addressing concepts of sustainable development.

In this subsequent stage, after the exploration of the materials, the experiments were conducted, providing opportunities for observations, questioning, formulation and testing of hypotheses, and attempts to solve the challenges presented. Throughout the process, moments were reserved for the children to express their ideas, think and reflect on their hypotheses, where they could share ideas with their peers and put their skills into practice.

To reinforce the knowledge acquired, printed activities, games, practical activities, other experiences, informative texts, artistic activities, among others, were implemented.

In the third moment, conversation circles were held after the experiences, allowing the children to express their ideas and reflections on the topics addressed.

The children were encouraged to explore, question and interact with scientific knowledge in a playful and meaningful way, following a script of experiences as shown in figure 1.

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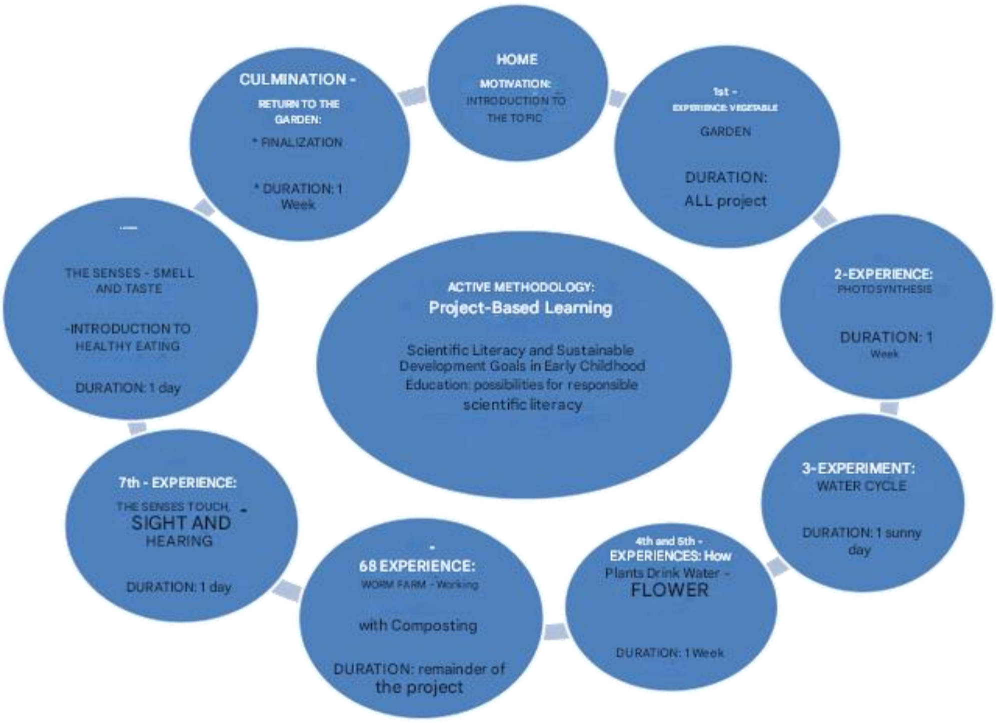
FIGURE 1
EXPERIENCES CARRIED OUT IN THE PROJECT



RESULTS AND DISCUSSION

The BNCC defines the Learning Objectives as educational goals to be achieved at each stage of Basic Education in Brazil. These goals provide guidelines for the construction of competencies and skills that are essential for the integral development of students, establishing clear expectations in terms of knowledge, skills, attitudes, and values that students must acquire throughout their school career.

The results were obtained through the implementation of the experiences, in which the children were able to experience different sensations and learning. They have developed several skills necessary to acquire and improve skills in understanding science teaching and learning. To potentially reach a level that would allow students to learn meaningfully, it was necessary to provide them with moments in which they could recognize themselves as protagonists in the construction of their own knowledge within the environment in which they were inserted.

In this context, the line of action of this project was based on the life of plants, addressing concepts such as nutrition, water absorption, water cycle, life in the garden, the need for solar energy, among others, this didactic approach aimed to deepen children's understanding of fundamental natural processes. The connection between the BNCC

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Learning Objectives and the theme of plants allowed the integration of theoretical knowledge with practical experiences, contributing to a more meaningful learning.

All experiences were planned in advance, with the advance definition of the contents to be addressed, the didactic resources to be used and the learning objectives to be achieved during the execution of the project.

The children's speeches generated during the execution of the project, based on the proposed experiments, were analyzed based on the Scientific Literacy Indicators (HAI) of Sasseron and Carvalho (2008) and reflected emerging knowledge about natural phenomena.

Sansseron and Carvalho's scientific literacy indicators focus on students' ability to understand and apply scientific concepts in everyday situations. They highlight skills such as observation, investigation, analysis of information and formulation of hypotheses. with the objective of developing the student's autonomy in the scientific learning process. They are divided into three distinct groups, totaling ten indicators, each identified by specific descriptions.

Each experiment was recorded on video or filmed throughout its execution. In addition, reports were collected from teachers and students. All the transcriptions of the videos and reports of the teachers responsible for the implementation of the project were organized, as exemplified in chart 1, as well as the students' speeches, to facilitate the analysis of the group or the Scientific Literacy Indicators to which they may belong, aiming to build a scientific line within this research.

CHART 1 - Model of the table for analyzing the students' discourses during the execution of the experiments.

TEACHER'S SPEECH	STUDENT SPEECH	GROUP	INDICATOR
Targeted questions were asked during the conversation circles to identify previous knowledge, acquired later and developed throughout the experiences.	Transcriptions of the students' speeches were made, addressing the previous knowledge, acquired later and developed throughout the experiences.	Indication of the group to which the discourse belongs, according to the IAC table of Sasseron and Carvalho (2008).	Indication of the Indicator to which the discourse belongs according to the IAC table of Sasseron and Carvalho (2008).
What are you thinking about the project?	Student 2: It's really cool to see the plants grow, and you have to be very careful with them so they don't die. Student 5: Plants need the earth, the land is their food.	First 2nd First	Organization of information; Logical reasoning; Information classification.

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EXPERIENCE 1: VEGETABLE GARDEN - INTRODUCE AUTONOMOUS PARTICIPATION COLLECTIVELY AND INDIVIDUALLY AT EACH STAGE OF THE PROJECT DEVELOPMENT

The project developed began with a practical experience of planting and growing in a vegetable garden, chosen for its ability to engage children in rich and interesting activities. The experience aimed to sensitize children about the interdependence between life and the environment, arouse interest in the cultivation of vegetable gardens and promote awareness about healthy eating and sustainability. The goals were aligned with the concepts proposed by SDGs 4 and 12, integrating environmental and food education.

During the activity, the children interacted with the earth, water and plants, providing direct and practical contact with natural elements. This experience of planting the garden at school provided the children with active learning, where they were able to practice hypothesis formulation skills. After analyzing the children's discourses, it was possible to observe a significant emergence of concepts corresponding to group 3, which includes the IAC of Survey and Hypothesis Testing, Prediction, Explanation and Justification. This highlights the effectiveness of the Scientific Literacy Indicator (SCI) of Hypothesis Raising and Explanation that appeared seven and three times during the analyses evidenced by the students' discourses, such as "plants need the earth, the earth is their food", "plants need water and sun" and "Why did some little plants die? I think it was because there was a lack of water."

The implementation of the project involved the conscious use of scientific vocabulary by the teachers, including terms such as "drainage", "fertilizer", "compost" and "germination". They were guided to explain these concepts in an accessible way to children, connecting scientific knowledge with children's language. This allowed the children to understand the processes involved in horticulture and relate them to their reality, developing scientific concepts with environmental and nutritional awareness.

EXPERIMENT 2: PHOTOSYNTHESIS

The photosynthesis experiment, as part of the educational project, focused on explaining to the children how plants grow and feed. The objectives included identifying elements necessary for photosynthesis, understanding the process and its relationship with life on Earth, this helped the children to expand their vocabulary and understanding of environmental preservation.

The hands-on activity involved planting beans in cotton, followed by observations and discussions about the importance of sunlight and water for plant growth, allowing the children to compare plant growth under different conditions, reinforcing their understanding of natural processes.

This experience helped the children understand photosynthesis and its essential role in the food chain and in maintaining life on the planet, also reinforcing awareness about environmental preservation. The experiment aimed to deepen the knowledge obtained in the first experiment of the garden, connecting plant growth to photosynthesis.

The experience was enriched with activities such as hunting for seeds and leaves, which were later used in creative activities. The transcriptions of the videos made during the experiments revealed a significant evolution in the children's vocabulary and comprehension. This was identified through the analysis of the students' discourses, as exemplified in the text: "Auntie without sunlight, the little plant can't make food for her to eat, right?" Staying too long in the sun, they will die of thirst and burn. But they need a little sun too, but not too much, right?" Prominent in the Scientific Literacy Indicators (HAI) of Prediction, Hypothesis Raising and Explanation, These IAC Indicators, such as Prediction (4), Hypothesis Raising (4) and Explanation (3), were repeatedly observed during the analysis, which does not exclude the appearance of other HAIs. This IAC indicating times when assumptions are made about a given topic, either by asserting an action or phenomenon associated with certain events, or by providing a justification for a claim. These indicators demonstrate the children's ability to relate information and hypotheses, evidencing the improvement in scientific knowledge acquired through practical experience.

EXPERIMENT 3: WATER CYCLE

The third experience of the project, focused on the water cycle, was introduced with an animated video and music to highlight the relevance of water in human life and well-being. The children explored issues such as the origin of drinking water and the processes of the hydrological cycle, with educational objectives covering understanding the water cycle, the physical states of water, the importance of water for living beings, and awareness of environmental preservation and individual responsibility.

The scientific concepts worked on included the physical states of water, solar energy, water evaporation, density, runoff and supply. The children were encouraged to question

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and reflect on phenomena such as the evaporation of water and its transformation into steam and then into rain, using simple materials to visualize the process.

The proposed experiment involved coloring the water and drawing elements such as the sun and clouds on the bags, which were partially filled with water and exposed to the sun. The children observed and discussed the transformations of water, understanding how solar energy induces evaporation and cloud formation, and how water returns to Earth in the form of rain. The experiment, although simple, faced challenges with cloudy days, promoting the opportunity for the children to formulate hypotheses about the delay in completing the experiment.

After the experiment, activities were promoted to reinforce learning, such as paintings and visual records of the water cycle. The interactions and participation of the children during the experiment evidenced the development of observation and analysis skills, as demonstrated by the discourses highlighted in the text "There is water that is born from the earth, like a source." "I think the water comes from the sky along with the rain." "What happens when we leave or stay in the sun for a long time? When we stay in the sun we get all stinky with sweat" "I think that when the water turns to smoke it goes up to the sky and looks like a white cloud."

This is indicated by the presence of several Scientific Literacy Indicators (HAI), including Information Classification (4), Hypothesis Raising (4), and Prediction (4). These indicators are evidenced when describing an action or phenomenon that is associated with specific events, and arise when trying to establish connections between information and previously considered hypotheses.

Investigative experimental activities are fundamental in scientific literacy, as they expand the understanding of phenomena and enrich the understanding of scientific descriptions in the context of discussions and educational practices in science.

EXPERIMENTS 4 AND 5: HOW DO PLANTS DRINK WATER?

For the fourth and fifth experiments, a rose was introduced into a vase in the classroom, raising the question: "how do plants drink water?". The objective was for the children to observe the absorption and transport of water by plants, from the roots to the leaves, addressing the objectives and arousing curiosity about the water needs of plants, observing the absorption of water, recognizing the importance of water for plant health,

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stimulating active participation, the development of observation skills, communication and expression, in addition to promoting respect for the environment and cooperation.

It was emphasized that plants, being vascular, have conductive vessels for the circulation of water and nutrients. This understanding began with the observation that plants absorb water from the soil and distribute it through the trunk and leaves.

The children had the chance to examine the rose, explore its textures and smell, and represent it in drawings. These activities aimed to deepen children's understanding of the relationship of plants to water and the environment.

After portraying the rose, they planted it near the vegetable garden. The place was chosen collectively with the help of all the children. At this point, a student questioned whether the chosen place received "sunlight", showing that even in a simple way the children were already incorporating some more scientific terms and concepts into their vocabulary.

The experiments allowed the children to follow the process of coloring the flower petals on a daily basis, helping them to understand how plants transport water from the earth to the leaves.

In the fourth experiment, following the experiments on water conduction, two transparent plastic cups were used, one with colored water and the other empty. The children actively participated, raising hypotheses about what would happen in the experiment.

During the experience, the teachers stimulated the children's curiosity with questions about the movement of water on paper towels, such as "Why does water walk on paper towels?" and "How is water transported to the empty container?". They used blue food coloring to make the flowing water visible, demonstrating how water molecules adhere to those of paper towels, as described by Mourad (2013).

This process has been explained as a kind of conduction of water through the paper, similar to a hose or straw. The children observed two containers, one with water and one without, formulating hypotheses about how the water would be transferred from one to the other. One student was asked to mix the dye in the water, and everyone observed and discussed the hypotheses about the flow of the water.

After some time for reflection, the children shared their ideas on how to transport the coloured water into the empty cup, with one of them presenting a solution close to the real method. The student had the chance to test her hypothesis by folding the paper towel and

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placing it between the glasses for collective observation. Many questions and hypotheses occurred during the execution of the experiment and after its end, and all were analyzed later.

In the project, after previous experiments focused on the absorption and transport of water by plants, the children were introduced to a fifth experiment that integrated the concepts of primary and secondary colors with water absorption. The experiment involved food dyes of primary colors (yellow, red and blue) and the observation of how these colors mixed when absorbed by the paper towel, passing from one cup to another. This process illustrated the formation of secondary colors, encouraging children to explore and understand color mixing.

For the experiment, the cups were organized alternating one with colored water and an empty one, with paper towels connecting them. During the experiment, the children made observations and raised hypotheses about the result of the mixing of colors and the absorption of water. They realized that specific mixtures of primary colors form distinct secondary colors, such as green, purple, and orange. This has sparked discussions about where these colors can be found in nature and has led to new hypotheses, such as the impact of cup height on water transfer and the possible colors resulting from additional mixes.

After the end of the experiences, the children carried out a gouache painting activity, when they were able to explore the colored paints forming new colors, in this activity they were able to experiment with the textures of leaves and tree branches in the final collage.

This experiment combined scientific and artistic learning, allowing the children to explore various concepts and learning. Through observation and hands-on experimentation, they developed a deeper understanding of the science behind color and water transport, while also exploring their creativity and ability to formulate and test hypotheses. In the speeches highlighted in the text, comments such as "just wet the paper to fill the cup, but it will put the paper on us, but it will tear, it will get wet." "I think that if you turn the water in the other glass, if you put it in the glasses, it becomes a pipe. (paper)" "paper is like the branch of plants and carries water to the plant." It's going to mix, all the colors and turn black. "So, roll up the paper and put it here (put it in the glasses) so that the waters will mix and everything will be colored." "Two straws there will go by faster." These discourses evidence the emergence of characteristics when seeking to establish characteristics for the data obtained, as well as providing a guarantee for what is proposed in a statement. When analyzing the children's discourses, the evident appearance of groups 1, 2 and 3 is observed, which highlights even more clearly the predominance of the Information Classification Indicators (5), Proportional Reasoning (6), Hypothesis Raising (14), Hypothesis Test (7) and Explanation (3). According to Sasseron and Carvalho (2008), these indicators arise when seeking to establish characteristics for the information collected and the assumptions raised by them, in addition to relating this information to the hypotheses already formulated.

EXPERIMENT 6: WORM FARM – WORKING WITH COMPOSTING

In the sixth experience of the project, focused on the garden environment, the children were encouraged to explore the presence of life beyond plants. The objective was to provide sensory experiences with matter and natural cycles, build a worm farm to understand the soil as a habitat and raise awareness about the correct disposal of organic waste. The experience included understanding the role of detritivores and decomposers, as well as learning about the life of earthworms.

Frequent visits to the garden, using magnifying glasses, shovels and rakes, allowed the children to closely observe composting, an essential technique for growing plants and managing organic waste. The activity aimed to educate about reducing waste in landfills, increasing soil fertility and crop productivity. Students were encouraged to practice food separation at home and at school.

Scientific concepts explored included composting, scavengers, decomposers, and the formation of leachate. The children learned about selecting plant waste for efficient decomposition, avoiding meats and citrus fruits, and adding earthworms and sawdust to the soil.

During the visits to the garden, the students observed the activity of the soil and the animals that inhabit it, including butterflies, ants and earthworms. The experiment culminated in the construction of a worm farm, where the students piled alternating layers of earth, chalk dust, sand and manure in a container, as illustrated in Figure 3. This experiment provided a practical and visual understanding of the life cycle in the soil and the importance of biodiversity in the garden ecosystem.

The activity highlighted the need for hands-on and observational experiences in early childhood education, as suggested by Carson (2010), to maintain children's innate curiosity and encourage them to rediscover the natural world.

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This moment provided a rich discussion about the importance of earthworms for soil health, highlighting Carson's (2010) concept that a healthy soil harbors diverse life and is essential for ecosystem sustainability. The children explored the worm farm, observing the texture, movement, and other aspects of the worms.

During the experience, there was a significant interaction between the students, promoting socialization, the exchange of ideas and the construction of collective knowledge. Moll (2004) emphasizes the importance of collaborative learning and inclusion in groups, and this experience reflected these values. The children also participated in a "worm race", a playful activity that allowed the observation of the movements of the worms.

The stage of the project that involved the experiment with the worm farm was one of the most prolonged. Its focus was on helping children understand how the decomposition of organic matter transforms the soil, highlighting the essential role of earthworms in this process. After the activity, moments were reserved for reflection and sharing, in which the students expressed their observations and learnings.

The experience with the worm farm played a fundamental role in teaching children about natural cycles, the relevance of decomposers in the ecosystem and the interdependence between all living beings. When observing the discourses highlighted by the students, we noticed comments such as "we put the leaf because the leaves will serve as food for the worm." “. It was light there in the park, right? And when the aunt put the alcohol near her, what happened? in the earth (movements of the hands downwards, signaling that they have entered the earth)" "Why has the number of earthworms we put in the garden increased? - It was very cute to see the little worms, they were born because the worms had a baby, she got pregnant then they had a little baby."

Through practical observations and discussions by the students, knowledge about ecology, sustainability and respect for nature were observed, consolidating concepts of science and the environment. When analyzing the children's discourses, we found that they present a consistency similar to the analysis carried out in the previous experimental stage. Different Scientific Literacy Indicators (HAI) were identified, with emphasis on the IAC of Information Classification (4), Hypothesis Raising (4), Hypothesis Test (4), Justification (6) and Explanation (9), which manifest themselves by providing a guarantee for what is suggested in any discourse, establishing connections between information and previously considered hypotheses. The students' Proportional Reasoning (3) is also highlighted, indicating that they are beginning to structure their thoughts more effectively. It is noticed that the children were able to relate ideas and knowledge between the different experiments.

EXPERIMENT 7 AND 8 - WORKING THE BODY: THE FIVE SENSES

The final experiences integrated scientific concepts about the five senses, promoting interactive learning that is sensitive to children's needs and curiosities, while reinforcing the connection between the concepts learned and everyday experiences. The methodology applied highlighted the importance of sensory experiences for child development, offering an enriching and inclusive educational environment.

The experiences were enriched by the discussion about the function of each sense in the human body and the importance of respect and empathy for people with sensory or physical disabilities.

In the seventh experience, the Rotation of Seasons methodology was applied, providing students with a rich and diversified exploration of the human senses. Through playful activities, the children were encouraged to develop their cognition, language, social and emotional skills, while exploring their senses of sight, touch and hearing.

In one of the stations, the theme of the coronavirus was addressed, illustrating the importance of hand hygiene through a practical and fun activity entitled How to prevent the coronavirus. This station aimed to shed light on the process of viral infection and transmission of the coronavirus, as well as to emphasize the importance of prevention measures such as hand washing.

According to Moll (2004), the school creates social spaces to build behaviors and knowledge. In this activity, bacteria and viruses were represented using seasoning in water. The students observed how the spice adhered to the finger without detergent, symbolizing the ease with which germs adhere to the skin.

Later in the activity on the prevention of the coronavirus, the effect of detergent in repelling the seasoning was demonstrated, representing the effectiveness of soap in removing germs. This experiment was used to explain the need to wash hands properly with soap and water and the importance of avoiding touching eyes, nose and mouth to prevent contamination. The teachers guided the children on the proper hand washing technique, emphasizing the relevance of this habit for health.

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Another station allowed students to explore varied grains, using touch to differentiate their textures and hearing to identify the sounds produced by them in PET bottles. This activity explored the children's capacity for sensory and auditory discrimination.

In the last station, the children explored the sense of hearing. The activity included musical videos and the use of instruments built by the children themselves, providing a fun and interactive learning moment. This season was especially appreciated by the students, being a playful and educational moment to close the group activities.

The experiments aimed not only at scientific knowledge, but also at the development of social, cognitive and emotional skills, in a dynamic and interactive learning environment.

After the analysis of the children's discourses, it was observed that the students made use of almost all the IAC, appearing more frequently the indicators of Proportional Reasoning and Explanation, thus, it is observed that in the students' speeches appear the structuring of their thinking attributing a certain coherence to their arguments, they demonstrated that they perceive that there is a relationship between the experiences carried out.

EXPERIMENT 8: WORKING THE BODY, THE SENSES - SMELL AND TASTE - INTRODUCTION HEALTHY EATING

For the eighth and final experiment of the project, a divination activity involving smell and taste was organized, where the students, blindfolded and blindfolded, tried to identify different foods. The activity revealed that with their noses covered, it was more difficult for children to identify tastes, while with only blindfolded, they could discern smells and tastes more easily.

During the experiment, students were asked about the characteristics of the foods, such as acidity and sweetness, and their food preferences. The activity also served as an introduction to the conversation about healthy eating and the consumption of natural products. The children were taken to the school's vegetable garden, where they picked vegetables such as carrots, tomatoes and lettuces. Then, in the classroom, they handled and prepared the food harvested for tasting, integrating practical learning with healthy eating concepts. This playful and interactive approach, as described by Fortuna (2011), creates a safe and continuous learning environment where children's active participation is encouraged.

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Buck (2002) explains that smell and taste are interconnected sensory organs that transmit the properties of food to the brain. Smell is more sensitive than taste and therefore transmits information to the brain more quickly. This means that often what is perceived as taste is actually the smell detected by specialized cells.

The experiment was carried out in small groups, with students alternating between being the blindfolded tasters and those offering food, and one student writing down the results with the help of the teacher. This activity allowed us to explore sensory concepts in a practical and engaging way.

Finally, the analysis of the last discourses that the children presented during the experience and the conversation circles were carried out. The evaluation of the experiments showed a lower incidence in the use of the indicators belonging to the first group, while a notable increase was observed in the indicators of Hypothesis Testing and Explanation. These findings indicate that the proposed activities offered students an effective structure to conduct experiments and explore new approaches, encouraging them to present the explanation and demonstrate understanding of the topics studied.

Throughout the experiments, students developed a deeper understanding of how we use our bodies to explore the world. They recognized the function and name of each sense and associated them with their respective organs. This understanding helped them realize that each sense plays a specific role in different experiments.

The students demonstrated the acquisition of skills relevant to Scientific Literacy (CA) and acquired considerable knowledge about the Sustainable Development Goals (SDGs), as expressed in their speeches throughout most of the experiments. "Auntie, we are going to use eye vision and touch. We will come here to find the same pair." "People who can't see can't play, right, auntie." What happens when we touch an object, which sense do we use? If these objects are dirty and we don't wash our hands properly, what happens? - It's the touch. - Everything will be on his finger, just like when we put our hand in a place dirty with dust and bacteria, right aunt." "And how can we avoid these dirt and bacteria? – We have to wash our hands with soap, it will clean up the dirt." "What happened to the bacteria (oregano) when we put detergent? – Wow, auntie, the dirt and bacteria "fled" from the finger. It is because the finger becomes slippery and the viruses slip. My father, when I caught coronavirus, aunt, lost the smell of his nose."

These skills and knowledge are fundamental for the development of logical and objective ideas about natural phenomena, as described by Sasseron and Carvalho (2008).

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Scientific learning was identified as a process of dialogue, in which students move from an abstract and common language to a scientific language with specific aspects. The languages used are considered symbolically complementary, rather than mutually exclusive.

Throughout the implementation of the eight experiments during the course of the project, the students' speeches were recorded and subsequently transcribed from the videos recorded during the execution of the experiments. Table 1, below, provides an overview of the emergence of Scientific Literacy Indicators (HAI) throughout the eight experiments. The analysis of the indicators shows how the students were able to apply and develop scientific skills, using a more sophisticated scientific language and demonstrating a broader understanding of the concepts and phenomena addressed.

TABLE 1 - Scientific Literacy Indicators

GROUP	IAC	EXPERIENCES								
		First	Second	Third	4th	5th	6th	7th	8th	Total
First	Information Ranking									0
	Information Organization	1	1	2	2	0	2	1	0	9
	Information Classification	1	2	4	3	2	4	1	2	19
2nd	Logical Reasoning	1	1	2	1	1	1	2	2	11
	Proportional Reasoning	1	1	2	4	2	3	3	3	19
Third	Hypothesis Raising	7	4	4	8	6	4	2	3	38
	Hypothesis Testing	0	2	1	7	0	4	2	5	21
	Justification	2	3	2	2	1	6	2	2	20
	Forecast	1	4	4	3	3	3	2	0	20
	Explanation	3	3	4	5	0	9	4	7	35

Source: authorship based on data collected

Table 1 details the IAC based on teachers' reports, video transcripts, and researcher's observations. The data show that, while most indicators remained stable, there was a significant increase in the Explanation indicator. This indicates a progressive growth in the children's argumentation ability as they participated in more experiments.

The development of the IAC in this educational context emphasizes the importance of the investigative process guided by the teacher, showing that interactivity in the construction of discourse is a key aspect, as pointed out by Sasseron and Carvalho, (2008). This didactic process is flexible and can be integrated with various educational tools, as long as there is practice and investigative realization according to the teacher's orientation.

Figure 2 included in the study clearly illustrates the frequency of each HAIs throughout the experiments, providing a comprehensive view of the results obtained in the

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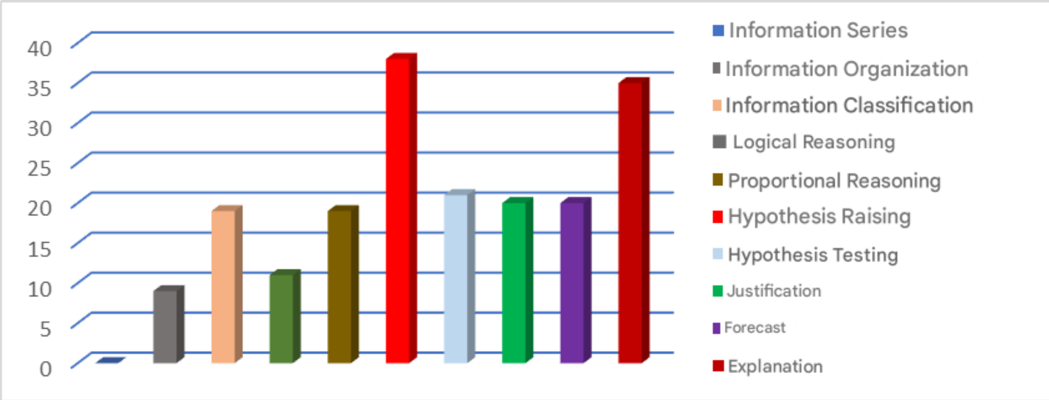
research. This visualization allows for a clearer understanding of the evolution of the development of students' scientific skills throughout the project.

FIGURE 2 - GRAPH WITH THE RESULTS OF THE IAC DURING THE PROJECT.



Source: authorship based on the data collected.

The graph in Figure 4 of the developed project shows high indices in the Hypothesis Raising indicator, followed by Explanation and other indicators such as Proportional Reasoning and Hypothesis Testing. Notably, the Information Seriation indicator did not stand out, suggesting, according to Sasseron and Carvalho (2008), limitations in the students' investigative capacity, possibly due to the lack of experience in conducting experiments. This aspect indicates a more initial level of Scientific Literacy (CA).

The low occurrence of logical thinking indicators can be attributed to the developmental characteristics of preschool children, who continue in the concrete manipulation phase and have difficulties with abstract concepts. According to Silva and Lorenzetti (2020), children at this age prioritize the logic of mental processes and the ability to distinguish objects by their similarities and differences.

The graph demonstrates that the indicators of Survey and Hypothesis Testing, as well as Explanation, are fundamental to assess the appropriation of scientific language and skills related to CA. These indicators, even when children present inconsistent or incoherent initial arguments, provide opportunities for the development of ideas and explanations that become more complex and coherent over time.

CA does not require comprehensive knowledge about science, but rather a solid understanding of specific areas and how this knowledge impacts life and the environment. This approach is not limited to conveying scientific concepts and methods; It includes understanding the nature of science and its reciprocal impact on society and the

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environment, allowing the formation of individuals capable of interacting in an informed and responsible way with their surroundings.

CULMINATION

To conclude the project, a series of records of the activities carried out were compiled, producing a collection of drawings, photos and descriptions of the activities developed, in the form of a "book". Each student was given a copy and a seedling to plant at home or near school so that it would be meaningful to them.

FINAL CONSIDERATIONS

This research investigated the children's discourses, which were used as a basis to understand the process of Scientific Literacy (CA) in early childhood education. The results showed that CA was developed through a didactic sequence based on experimentation. Throughout this process, it was observed that the children acquired an awareness that led to Scientific Literacy, consolidating and developing through the understanding of the Sustainable Development Goals (SDGs). This awareness revealed an understanding, even if superficial, of scientific concepts. Thus, the research reinforces the UN's view of education as a transformative element, intrinsically linked to sustainable development.

The children, throughout the project, showed significant changes in their behavior and thinking, building solid knowledge based on concrete observations and understanding the relationships between natural phenomena. The research highlighted the relevance of the teacher's role in guiding and strengthening students' ideas, stimulating the formulation of hypotheses and clarifying doubts. CA, approached in a way that is sensitive to the peculiarities of children, prepares individuals for a world influenced by science and technology, demonstrating the importance of practical and investigative activities in the construction of CA.

Results indicate that while some Scientific Literacy Indicators (HAI) maintained a constant average, others, such as the Explanation Indicator, showed significant growth, reflecting the development of children's argumentative capacity. This progress in the IAC suggests the development of logical reasoning, interconnection of ideas and contextualized understanding of the phenomena studied. The practice of Scientific Literacy (CA) is essential to equip children with critical and informed skills to address scientific issues, underscoring the importance of experiences that develop scientific understanding in the

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school context and motivate the application of this understanding in a practical and relevant way.

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