education sciences

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Inquiry-Based Activities with Woodlice in Early Childhood Education

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Abstract: This study aims to describe the implementation of a teaching sequence where preschool-age children participate in activities related with woodlice. Although there is extensive literature on inquiry-based activities, most studies have been conducted in higher educational stages. Data were collected though audio and video recordings of the sessions, which have then been transcribed. The children participated in research activities in which they had no difficulty in posing hypotheses and making predictions. In relation to the experimental design, we observed difficulties in understanding the purpose of the experiment and how to reach conclusions from the experimental results. From the results of this study, we can conclude that children from an early age can engage in inquiry activities where they are given opportunities to make predictions, formulate hypotheses, and, with the help of the teacher, plan simple experiments to test their ideas.

Keywords: preschool-age children; case study; inquiry-based approach; scientific practices; living being woodlice

1. Introduction

There is growing recognition that science can be a particularly important domain in early childhood, building a foundation for future scientific understanding, as well as developing critical skills and positive attitudes towards learning [1].

It has been noted that children have an innate curiosity about things related to science, and well-designed science activities provide them with a structured way to explore the world to satisfy their curiosity [2]. Moreover, there are various studies that show the importance of carrying out science activities from an early age to promote scientific practices [3]. Well-designed science activities can stimulate thinking, reasoning ability, and contribute to children's cognitive development [4,5]. Likewise, early exposure to scientific content and practices can promote favorable attitudes toward science and contribute to children's cognitive development by giving them the opportunity to plan, predict, make inferences, and confront cognitive conflicts [1].

Some teachers and researchers believe science activities for children should focus more on developing creativity or fostering skills, such as learning to ask questions or make observations, since scientific concepts are considered too advanced for children to comprehend. This perspective leads us to think that for children to participate in inquiry activities, the teacher must create spaces where children can carry out explorations with little intervention from the teacher. However, while it makes sense that a goal of teaching science at an early age is not the acquisition of sophisticated scientific concepts, we do believe that science activities should promote the construction of precursor models of scientific concepts. When we talk about precursor models, we refer to the idea of the mental model. We currently know that from an early age, children build their own mental models about the world around them and revise these models as they access new information [6]. The construct of the mental model refers to a mental representation created by subjects based on their innate predispositions and their previous experiences in order to predict, describe, or explain facts or phenomena [7]. The idea of a precursor model is a fruitful

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Citation: García-Rodeja, I.; Barros, S.; Sesto, V. Inquiry-Based Activities with Woodlice in Early Childhood Education. *Educ. Sci.* **2024**, *14*, 710. https://doi.org/10.3390/educsci14070710

Academic Editors: Alice Delserieys Pedregosa and Maria Kampeza

Received: 30 May 2024
Revised: 20 June 2024
Accepted: 27 June 2024
Published: 29 June 2024

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approach to observing children's cognitive progress. Precursor models are generated in the educational context and can be built under certain teaching conditions from an early age; they are the first step in the construction of more sophisticated models [8]. They are models compatible with scientific knowledge, since they are built based on certain elements included in the scientific model, but they have a limited range of applications [9,10]. These are models that constitute the basis for subsequent constructions [11]. We can imagine that a precursor model constitutes a kind of "conceptual tricycle" that children can handle to think and generate new knowledge, compared to adult models, characterized by being more complex and difficult to execute and, to continue with the metaphor, they could be associated with "conceptual trucks". The design of well-planned interventions, in which adequate empirical data are provided, is crucial so that precursor models can be developed [10].

Eshach and Fried [2] refer to the importance of carrying out science activities at an early age that give children the opportunity to build references for scientific concepts by making observations, predictions, making inferences, and being able to discuss and try to explain and interpret what happens. The term "inquiry-based activities" is used to refer to science activities where children are given the opportunity to make observations and predictions. Thus, "inquiry learning" refers to educational activities in which, either individually or in groups, students investigate a phenomenon. Inquiry activities typically follow a series of steps: the formulation of a question or problem, the development of hypotheses, the design and conduct of experiments or investigations, the collection and analysis of data, and the formulation of conclusions based on the evidence obtained. Inquiry-based activities can vary in their degree of openness, depending on who poses the question to be investigated, whether the teacher or the students, who formulated the hypotheses, who planned the experimental design, and so on.

In this work, we wanted to differentiate inquiry-based activities, where the teacher's role would facilitate meaningful discussions to advance knowledge in an experimental environment from exploratory activities, where the teacher's role would only be to generate spaces with materials where children can explore and experiment on their own [12]. The inquiry-based activities are more structured activities with greater teacher involvement. Through inquiry-based activities, students formulate questions, interpret data, and coordinate evidence with theories, thus developing intellectual skills that enable them to construct new knowledge [13]. Studies from cognitive psychology have shown that inquiry-based activities stimulate brain development [14]. In addition, inquiry-based activities contribute to the development of scientific reasoning by providing opportunities to ask questions, make predictions, carry out inquiries, and begin to interpret data and coordinate evidence with theories [13].

However, we must consider the extent to which inquiry-based activities are suitable for early childhood education and whether or not the cognitive demand of these activities is too high [3]. Although there is much research available to support inquiry-based activities, there has been some doubts about how to fit them with children aged three to five. There is no agreement on which activities would be most appropriate for early childhood education. Although studies have been carried out to characterize the demand for science activities in relation to the cognitive abilities of the students [15], there are no studies that allow us to clearly say what preschool-age children are capable of doing when they engage in inquiry activities or what they are capable of doing with the support that the teacher can provide. In fact, by analyzing the literature, we can think that age limits what children can do and learn in science activities, and we can reach the conclusion that science activities for early childhood education should be limited to developing skills with less cognitive demand such as learning to observe, compare, or find similarities and differences. However, there is evidence that children can carry out inquiry-based activities that involve carrying out investigations or experimentation to test ideas despite the greater cognitive demand, and it seems that children are able to use empirical evidence to formulate explanations. One of the skills that children must manage is causal reasoning. Some authors consider that such

reasoning is underestimated due to its dependence on domain-specific prior beliefs, thus masking children's reasoning ability [16].

Some of the evidence that has been obtained in other studies [17] contrasts with the finding that many primary school children are not very skilled in designing experiments [18,19]. As Hsin et al. observe, science learning involves a variety of scientific practices, and some may be more challenging for young children [20]. For example, planning research seems to require greater cognitive demand than other scientific practices such as conducting systematic observations (see, e.g., [21,22]). However, there is little research that has explored what instructional strategies teachers use to support children (3–5 years old) in inquiry-based activities [20].

It is crucial to know more about children's abilities regarding questioning, planning and designing experiments, identifying relevant evidence, making hypotheses and predictions, and identifying variables. Despite its importance, empirical studies on the outcomes of scientific learning in preschool age are rare [23,24]. Above all, we must know more about the achievements of children when implementing inquiry-based activities in collaboration with an adult and in collaboration with their peers. There are many ways to try to build knowledge on this topic. One possible way is to describe and analyze what happens in a classroom when implementing inquiry activities with younger children. Introducing science in early childhood education is an extremely delicate task and requires exploring and understanding children's perceptions, knowing the key aspects of the scientific content, and being able to design appropriate interventions and learning environments [25].

In this study, activities on isopods were implemented. Specifically, the teaching sequence dealt with a terrestrial crustacean commonly known as a woodlouse or pill bug. Carrying out activities with living beings in early childhood education can be beneficial as long as it is carried out ethically, with care towards the animals and environment. Activities with living things provide children with experiences that help them better understand the natural world. Interacting with live animals stimulates their curiosity and connection with nature and fosters respect and empathy towards other living beings, contributing to the development of ethical values and care for the environment. Observing, caring for, and feeding small animals helps children develop responsibility and cooperation. Additionally, working with living things can be easily integrated into interdisciplinary activities that span areas such as science, mathematics, language, and the arts. Given the alarming loss of biodiversity, it is essential to educate about the value of the diversity of organisms and learn to value and know local organisms [26]. Young children are especially interested in living organisms. Woodlice or pill bugs are attractive and interesting, they are harmless and easy to collect, and they provide an excellent opportunity for children to learn about invertebrates [27–29].

The interest of this work lies in the fact that it shows how children in early childhood education develop inquiry activities in a classroom context with the help of the teacher.

Research Questions

This work presents a case study that aimed to describe the implementation of a proposal where preschool children make observations and design experiments. The activities in which the children participated involved a terrestrial isopod crustacean belonging to the Armadillidiidae family. This kind of crustacean is known in colloquial language as a woodlouse or pill bug. Children investigated aspects related to the morphology and behavior of woodlice by taking data, making drawings, completing diagrams, or designing objects. During the activities, the teacher helped them detail the observations with some questions such as: Do woodlice have eyes? How many legs do they have? How would we know if woodlice prefer dry or humid places? The aim of this study is to know to what extent preschool children can engage in inquiry-based activities. Specifically, the main research questions that this study aims to answer are the following: What are children's ideas about woodlice? To what extent do children participate in the inquiry activities about woodlice? To what extent are they involved in the activities where they have to

make predictions about the behavior of woodlice? To what extent are they involved in the activities where they have to plan and design an experiment? To what extent are they able to draw conclusions from the experience?

2. Materials and Methods

This study involved a qualitative methodological approach and, in particular, constitutes a case study. This approach is characterized by being descriptive and qualitative in nature and is recommended when little is known about the phenomenon to be analyzed [30]. Case studies can intensively address a unit of analysis that may consist of a single student, a teacher, or a class [31]. Thus, a case study aims to describe, know, and understand a phenomenon of interest within its own context [32] and allows the exploring of individual experiences, providing a deeper understanding of social interactions and offering detailed information about particular cases [33]. In this work, participant observation was chosen, given the level of involvement of the person collecting the data.

2.1. Context and Participants

This research was developed in a rural school where the second cycle of early childhood education (3–6 years) is taught. The school belongs to a public grouped rural school. It is an organization model that is implemented in rural areas where the student population is small and dispersed. This model allows resources to be optimized and offers advantages in terms of socialization since students of different ages share resources and learning experiences. In the school where this study was carried out, there is a pedagogical approach that adapts to the particular needs of the community and activities are developed that promote the knowledge and appreciation of the natural environment and local culture. Since there are few students, personalized attention is favored. In this school, it is common to work on projects and coordinate work between different schools.

In the classroom where the study was carried out, the teacher started from the interests of the students and the characteristics of the environment to achieve greater motivation among the students. The person who taught the class is a trainee teacher who is studying a professional Master's degree. At the time that the teaching sequence was implemented, a total of ten preschool-age children, five girls and five boys, attended this school. As shown in Table 1, the participants' ages ranged between three and five years old. To ensure the anonymity of the children, their real names were replaced by pseudonyms. The three-year-old participants were children who responded very well to the activities proposed by the teacher. In terms of the ethical considerations, it is important to mention that we requested the informed consent of the parents for the participation of each child.

Table 1. Participants sorted by age.

Participants	Age
Carmen, Casto, Carlos	5 years old
Bea, Brais, Breogán	4 years old
Ana, Ara, Antón, Alex	3 years old

2.2. Description of the Teaching Sequence

The teaching sequence took place in a dialogic context where the teacher and the children spoke, acted, and thought about the phenomena, and where social interaction was one of the main factors in the construction of knowledge, framed in a socio-constructivist perspective [34]. It was implemented with a total of seven 50 min sessions.

We selected woodlice because they are unique, abundant, and harmless animals that children can handle. Woodlice are terrestrial crustaceans belonging to the order of isopods. The body is divided into the head, thorax (pereion), and abdomen (pleon). On the head, you can see the antennae, maxillipeds, and eyes. The thorax has seven segments. They have seven pairs of legs (isopods) and two uropods in the last segment of the abdomen.

These animals have gill or pseudogill respiration, depending largely on water, which is why they always live in shady and humid places such as under stones, logs, etc. Regarding their diet, they are detritivorous animals. They feed on the remains of living beings, mainly plants, and are important in the recycling of materials in the soil [35].

The teaching sequence is described in more detail in Table 2. In the first activity, children had to find cards in the classroom. The cards had a photograph of a woodlouse. The teacher asked the children questions about woodlice. Then, the children went out to the yard in search of woodlice. In the second session, the teacher asked questions about the morphology of woodlice and introduced new terms. "What parts does the woodlouse's body have?" "How many legs does it have?" "Will it have eyes?" Subsequently, the children worked in small groups using magnifying glasses, making more systematic observations and recording them. In the third session, the preschoolers completed drawings of pill bugs to work on symmetry. In the fourth session, the children had to design and carry out an experiment to study the behavior of woodlice in front of light. In the fifth session, the preschoolers had to design and carry out an experiment to study the behavior of woodlice in humidity. The sixth activity was about applying ideas about the parts of the woodlouse and, at the same time, working on fine motor skills when building a cardboard woodlouse. In the seventh activity, the children were given the opportunity to apply the ideas built through experimentation when designing a habitat for woodlice.

Table 2. An overview of the activities of teaching intervention.

Session	Learning Objectives and Overview
No. 1 What do we know about woodlice?	This activity is aimed at the children's knowledge. First, a series of cards with photos of woodlice are hidden in the classroom and the children must find them. The teacher with the children asks the children questions about the woodlice that appear on the cards. "What appears in the photo?" "Have you ever seen it?" "Where do you think they live?" "How many legs do they have?" "What do they eat?" "Do they have eyes?" Later, the children go out to the yard in search of woodlice. When they return to the classroom they discover a box with woodlice. The woodlice obtained in the yard are introduced. Children handle them freely and observe them. After interacting with the pill bugs, they leave them in the box and make a drawing. Materials: Cards with photographs of woodlice and a box.
No. 2 What are woodlice like?	This activity aims for children to make systematic observations and identify the head, eyes, antennae, thorax, abdomen, legs, and uropods of woodlice. The teacher asks questions such as: What are woodlice like? What parts does the body have? How many legs do they have? Can you see their eyes? In small groups, the children make observations with the magnifying glass. The teacher introduces new terms and the children, with the help of the teacher, place the labels with the names in the corresponding places on a drawing of a woodlouse. In addition, they make drawings of the woodlice. Materials: Woodlice, magnifying glasses, drawings, and labels.
No. 3 Symmetry of woodlice	This activity is intended for children to apply terms introduced in the previous session. In this activity, they work individually, completing a sheet where a drawing of half of a woodlouse appears, having to complete the symmetrical half using a mirror. Materials: Sheet and mirrors.
No. 4 Behavior of woodlice in front of light	This activity is intended for students to design an experiment, formulate predictions, make observations, and draw conclusions. It is about learning the behavior of woodlice in front of light. The teacher asks questions such as: "Do they prefer bright or dark places?" "How can we know?" First, they design the experience, recording the predictions in tables. Afterwards, they place the woodlice in places with different light conditions and wait a few minutes. Then the children write down the observations and draw their own conclusions. Materials: Shoe boxes and cartons.
No. 5 Behavior of woodlice in front of humidity	This activity is intended for children to design an experiment, formulate predictions, make observations, and draw conclusions. It is about learning the behavior of woodlice in humidity. The teacher asks questions such as: "Do they prefer dry or humid places?" "How can we know?" First, they design the experience, recording predictions in tables. Afterwards, they place the woodlice in places with different humidity conditions and wait a few minutes. Then the children write down the observations and draw their own conclusions. Materials: Cardboard boxes, kitchen paper, and a spray bottle with water.
No. 6 Mock-up	This activity is intended for students to apply ideas about the parts of a woodlouse. In a group, they build a cardboard woodlouse. Materials: Cardboard and pencils.
No. 7 Building a terrarium for pill bugs	This activity is intended for students to apply ideas about the behavior of woodlice in certain environmental factors. The teacher asks questions to check what the children learned during the teaching intervention and gives them the opportunity to apply these ideas to design a habitat for the woodlice.

2.3. Data Collection and Data Analysis

In this paper, information was collected, in the form of a classroom diary, from the observations of each session, and the most significant contributions of the participants were written down. In addition, two sessions (session 1 and session 5) were audio and

video recorded, and later transcribed. Only sessions for which we had informed consent to capture audio and video were recorded. We have selected the sessions that could provide us with the most valuable information to answer the research questions. The transcriptions were written verbatim to preserve the essence of the speech. The excerpts that are included in the Results and Discussion section have been translated from Spanish and Galician. The students speak both languages fluently. To analyze the discourse, conventional turns were taken as a unit of analysis. A turn began when a person took the floor in a conversation and ended when another person took the floor.

In order to ensure the reliability and validity of this interpretive study, the triangulation of both data and researchers was used [36,37]. Data triangulation refers to the confrontation of different sources of data from the study. In this case, the information collected was a classroom diary and the transcriptions of the audio and video recordings. In relation to the triangulation of research, the transcripts were analyzed individually by the authors and, subsequently, a common reflective analysis of the analysis of all these records was carried out.

3. Results and Discussion

In the following lines, significant events of the discursive interactions between the teacher and the children are presented. Similar to other works [38,39], the communicative interactions are presented in three columns, which refer to the speaking turns, the transcribed dialogue, and the analysis of the interventions in order to describe the intentionality or meaning of each intervention.

3.1. Session 1

In Session 1, the teacher divided the participants into two groups. Group 1 was made up of Casto (5 years old), Bea (4 years old), Brais (4 years old), Alex (3 years old), and Ana (3 years old). Group 2 was made up of Carmen (5 years old), Carlos (5 years old), Breogán (4 years old), Ara (3 years old), and Antón (3 years old).

As shown in Table 2, during this session, the teacher asked questions to find out the children's ideas about woodlice. Since woodlice are familiar creatures for some children, some children were already able to express their ideas and comment on experiences.

3.1.1. Discourse Analysis in Group 1

In Group 1, a total of 128 contributions were made during Session 1 and 61 contributions were made by the teacher. Casto (5 years old) made 24 contributions. Bea (4 years old) made 13 contributions, Brais (4 years old) intervened 10 times, Alex (3 years old) intervened 18 times, and Ana (3 years old) barely participated; she only spoke on two occasions.

When the teacher asked the children what they thought the living beings that appear in the photo were, Casto (5 years old) said that they were larvae, that they live in oak trees and in holes, and that they eat leaves and soil.

Turn	Speaker	Statement	Analysis of Interaction
1	Teacher	What do you think they are?	The teacher tries to encourage the children to make their ideas explicit.
2	Casto	Bugs.	Casto identifies woodlice with insects.
3	Teacher	Ah! And do they have another name?	The teacher tries to encourage the children to make their ideas explicit.
4	Casto	(. . .) Larvae.	Casto relates the activity to one they previously completed with the ants.

Bea (4 years old) stated she does not like woodlice. At another point, she said that woodlice eat logs. She believed that they live in logs and that at night, they run away and curl up in a ball. In another comment, she said: "They walk and then they turn into little balls and we think it's a ball to hit (. . .) And then we catch them, we throw them and that hurts them, and they get hurt and we have to take them to their mummy bug".

Brais (4 years old) said that woodlice live in a small house that is not colored. Later, he said: "They are strong (. . .) because they eat a lot of food".

Alex (3 years old) commented that he saw the bugs in the cinema, because they were on the screen, and pointed out that the bugs are first big, and then small, and then a ball.

Ana (3 years old) barely participated. She spoke twice, although the teacher tried to encourage all the children to engage in the conversation. At the end of the session, the teacher insisted that Ana participate. Casto intervened to explain the intention of the questions to Ana.

Turn	Speaker	Statement	Analysis of Interaction
110	Teacher	Only you remain. Tell me something Ana. What do you think they are? What do you think they eat?	The teacher tries to encourage Ana to participate.
111	Casto	What do you think. It's not what it is.	Casto realizes the importance of how questions are phrased to encourage participation.
113	Teacher	(. . .) Aren't you telling me anything, sweetheart? You tell me later.	The teacher tries to encourage Ana to participate.
114	Ana		She nods.

3.1.2. Discourse Analysis in Group 2

In Group 2, a total of 82 contributions were made during Session 1 and 38 were made by the teacher. Carmen (5 years old) made 20 contributions, Carlos (5 years old) did not speak, Breogán (4 years old) intervened 7 times, Ara (3 years old) intervened 8 times, and Antón (3 years old) intervened 9 times.

When the teacher asked the children what they thought the living beings that appear in the photo were, Carmen (5 years old) mentioned that she did not know what woodlice are. She said she had never seen them. She believed they live in a hole or a cave. She thought they can eat dirt and water. She stated she did not know anything about woodlice.

Turn	Speaker	Statement	Analysis of Interaction
1	Teacher	Let's talk a little about these bugs. Do you know what they are?	The teacher tries to encourage the children to make their ideas explicit.
2	Carmen	I don't know.	She claims not to recognize woodlice.
3	Ara	I do.	She claims to recognize woodlice.
4	Carmen	Worms?	She identifies woodlice with worms.
5	Ara	They are bugs.	She identifies woodlice with insects.

Breogán (4 years old) pointed out that he did see woodlice on the road and that they are great. He does not believe they eat dirt, but they do eat stones. He said they are small, and he likes them. Ara (3 years old) thought woodlice are bugs. She believed they eat dirt, but not stones. Antón (3 years old) said that pill bugs are called snails and that they are bugs. According to him, woodlice live on the soil, they are called snails, they eat stones, sand, and dirt, and also toys and mats, and they are small.

Turn	Speaker	Statement	Analysis of Interaction
68	Teacher	(. . .) Where do you think they live? Have you ever see them?	The teacher tries to encourage the children to make their ideas explicit.
71	Antón	(. . .) I think they eat stone and sand and dirt, and also toys, and also mats.	He lists what he thinks woodlice eat.

3.1.3. Discussion

In the first session of the teaching sequence, the children showed great enthusiasm for working with living beings in the classroom. To obtain an idea of the participation of the children and the teacher, we counted all the contributions that took place. In Table 3 we can see the number of contributions by each participant in each session. As shown in Table 3, the number of children's contributions was more than 50% of the total interventions in each session, although not all participated equally. In Group 1, a total of 128 contributions were made during Session 1 and 61 contributions were made by the teacher. In Group 2, a total of 82 contributions were made during Session 2, 38 of which were made by the teacher.

Table 3. Participant contributions in each working group during the development of Session 1 and Session 5. N_{GX} = Total number of contributions in group X.

Participants	Session No. 1 $N_{G1} = 128$ $N_{G2} = 82$	%	Session No. 5 $N_{G1} = 111$ $N_{G2} = 199$ $N_{G3} = 187$	%
Teacher G1	61 (128)	47.60	54 (111)	48.64
Teacher G2	38 (82)	46.34	95 (199)	47.73
Teacher G3			83 (187)	44.38
Casto (5 years old)	24 (128)	18.75	20 (111)	18.01
Carmen (5 years old)	20 (82)	24.30	61 (187)	32.62
Carlos (5 years old)	0 (82)	0	9 (199)	4.52
Bea (4 years old)	13 (128)	10.15	21 (187)	11.22
Brais (4 years old)	10 (128)	7.81	15 (111)	13.51
Breogán (4 years old)	7 (82)	8.53	51 (199)	25.63
Alex (3 years old)	18 (128)	14.06	40 (199)	20.10
Ana (3 years old)	2 (128)	1.56	22 (187)	11.76
Ara (3 years old)	8 (82)	9.75	10 (111)	9.00
Antón (3 years old)	9 (82)	10.97	12 (111)	10.81

The teacher's spoken interactions were primarily in the form of questions and, in some cases, to correct the behavior of a child or to encourage them to participate. The questions fulfilled different functions, such as starting the conversation: "What do you think these little bugs are?" They were also used to encourage the children to pay attention to the characteristics of woodlice: "Are they all the same?" On other occasions the questions were intended to connect with their experiences: "Have you ever see them?" They also tried to connect with the preschoolers' emotions: "Do you like them?" The questions also fulfilled the function of activating the children's knowledge: "Do you know where they live?" "And what will they eat?" Also, so that they could express themselves more effectively: "And do they have another name?"

As shown in Table 3, the children who participated the most were the five-year-old children, Casto, from Group 1, and Carmen, from Group 2. Furthermore, in relation to the children's contributions, we can say that they differ quite a bit in their commentary. The children were not very clear about what woodlice were called, and used terms such as bugs (the older ones), snails, and worms (the smaller ones) to refer to woodlice. When asked where woodlice live, the children responded that they think they live in oak trees, on logs, in the grass, in the dirt, and in holes. We could consider these statements to be synthetic or naturalistic explanations [40]. As for food, they believed that they can eat dirt, logs, and grass.

Some of the 4-year-old children used anthropomorphic expressions. For example, Bea said: "And then we catch them, we throw them and that hurts them, and they get hurt and we have to take them to their mummy bug". Another 4-year-old child, Brais, mentioned: "They live in a little red house." These anthropomorphic expressions are characteristics of the preoperational stage according to Piaget [41]. When a young child is said to have anthropomorphic reasoning, it means that he or she tends to attribute human characteristics to objects, animals, or phenomena that do not possess them.

The three-year-old children tended to establish syncretic explanations, also characteristic of the preoperational stage. For example, Alex said the following about woodlice: "First it's big, then it's small, and then it's a ball". Syncretism is closely related to the way in which children relate events and objects in their environment, tending to group objects or events based on superficial characteristics or emotional associations rather than on logical or rational criteria. This means that they can make connections between events that have no real logical connection [41].

3.2. Sessions 2–4

In Session 2, the children were highly involved in observation activities. The only difficulty regarding terminology was the term uropods, although some children learned

it right away. The older children had no difficulty writing the names of the parts of the woodlouse. The little ones needed the help of the older ones.

In Session 3, symmetry was worked on, as had occurred in previous proposals about ants and ladybugs. This activity gave the children the opportunity to apply the terminology that had been introduced in the previous session. Three-year-old pupils needed more help than older students.

In Session 4, a large group activity was carried out where they had to design an experiment to find out if pill bugs prefer light or darkness. In this activity everyone was very excited to do an experiment. This activity was led by the older children who proposed the experimental design. Although the planning was led by the five-year-old children, the teacher considered that the three- and four-year-old children understood the purpose of the research. There are doubts as to whether the little ones understood the result of the experiment. One girl did not understand that woodlice like the dark better since there were two in the light and eight in the dark. She said: "Eight like the light better, but two like the dark better". She understood the results as concrete and literal data and this may be due to a lack of probabilistic thinking [15]. These aspects will be discussed in greater depth later.

3.3. Session 5

In the fifth session, an activity was implemented where children had to design an experiment to find out the behavior of woodlice in humidity.

In this session the teacher divided the participants into three groups. Group 1 was made up of Casto (5 years old), Brais (4 years old), Ara (3 years old), and Antón (3 years old). Group 2 was made up of Carlos (5 years old), Breogán (4 years old), and Alex (3 years old). Group 3 was made up of Carmen (5 years old), Bea (4 years old), and Ana (3 years old).

3.3.1. Discourse Analysis in Group 1

In Group 1, a total of 111 contributions were made during Session 5 and 54 were made by the teacher. Casto (5 years old) made 20 contributions, Brais (4 years old) made 15 contributions, Ara (3 years old) made 10 interventions, and Antón (3 years old) commented 12 times.

First, they completed a recapitulation of the experiment they had carried out as a whole class about the behavior of woodlice in front of light.

Turn	Speaker	Statement	Analysis of Interaction
1	Teacher	What experiments did we do yesterday?	The teacher asks the children about what they did in the previous experiment.
2	Casto	Whether or not they like the darkness.	Casto remembers the purpose of the experiment.
6	Teacher	Do they like light or darkness?	The teacher asks the children about the conclusions of the experiment they completed in the previous session.
8	Antón	The light.	He mentions, as a conclusion of the experiment, that woodlice prefer light.
9	Casto	The darkness.	He mentions, as a conclusion of the experiment, that woodlice prefer darkness.
10	Teacher	But what happened yesterday in the experiment?	The teacher asks the children about the result of the experiment they completed in the previous session.
11	Antón	Many in the dark part and two in the light part.	Antón remembers the result, but is not able to reach a conclusion.

Subsequently, the teacher suggests doing research to find out if woodlice prefer humid or dry environments.

Turn	Speaker	Statement	Analysis of Interaction
29	Teacher	What will they like more, being in a dry or humid area?	The teacher asks the children to express their ideas.
30	Antón	Be wet.	He makes a prediction.
34	Ara	Entourages.	She makes a prediction.
35	Teacher	(. . .) We have to mark what we think they will like on the chart.	The teacher instructs each child to cover the prediction on the sheet.
38	Teacher	Casto, that's to cover later when we do the experiment. Now, we may think one thing, but another may happen. We have to check if the predictions come true.	The teacher focuses attention on the task they have to perform, indicating what to cover the predictions and explains the role of the experiment that will allow the ideas to be tested.

Then, the teacher encouraged the children to think about how to design the experiment.

Turn	Speaker	Statement	Analysis of Interaction
56	Teacher	Anton, what idea do you have? How can we tell if they like it moister or dryer?	The teacher tries to encourage Antón to participate in the planning of the experiment.
57	Antón	We put everything wet.	He makes a proposal.
58	Teacher	And so how do we know?	The teacher questions Antón's idea.
59	Brais	No! No!	He disagrees with Antón's idea.
60	Casto	Maybe they like it dry.	Casto intervenes to question Antón's idea.
61	Ara	No, wet, wet.	Ara intervenes to question Casto's idea.
62	Maestra	How do we do it, Ara?	The teacher tries to encourage Ara to participate in the planning of the experiment.
63	Ara	Wet and dry.	Ara modifies Antón's proposal by pointing out the need to put both a dry and a humid area in.

Afterwards, the children placed the woodlice in places with different humidity conditions. They continued talking and after a few minutes, they returned to look at where the woodlice were.

Turn	Speaker	Statement	Analysis of Interaction
86	Teacher	Let's see where they are placed. Where are they?	The teacher directs the conversation so that the children focus their attention.
87	Casto	It seems that in the wet part.	Casto makes an observation.
91	Teacher	How many are there in the wet part?	The teacher asks Casto to give more details about his observation.
92	Antón	Three.	Brais and Ara also count three woodlice.
93	Teacher	Well, we point out in the observation chart that there are three in the wet part. If in total we had four and in the wet zone there are three, how many will there be in the dry zone?	The teacher gives instructions for collecting observation data and challenges the children with a new question.
109	Teacher	So, what did they like more. humid or dry?	The teacher asks the children to draw conclusions from the experiment.
110	Brais	The wet!	He draws a conclusion from the experiment.
111	Antón	The wet!	Antón shares Brais' conclusion.

The following lines summarize the development of the session for this group. Casto (5 years old) and Antón (3 years old) considered that the woodlice would like to be in the wet area more, but there was no agreement since Ara (3 years old) and Brais (4 years old) believed that they would like to be in the dry area better. The participants covered the prediction sheet according to their hypotheses with the teacher's help. At this point

we consider it relevant to clarify that in this study, when we refer to predictions, this refers to when children make statements about what will happen when performing the experiment. Prediction often derives from a hypothesis, from an idea to be tested, describing an observable result that must occur if the hypothesis is correct. The teacher showed them the material: a cardboard box, paper, and a spray bottle with water. To test their hypotheses through experimentation, Casto (5 years old) proposed moistening the box so that the woodlice would survive. The teacher reminded him that the purpose of the experiment was to find out if they prefer a humid or dry environment. Casto (5 years old) did not seem to understand the purpose of the experiment and insisted on moistening the entire box so that the woodlice would survive. Other children, Ara and Antón, also wanted to put all the wet paper in the box. They also did not seem to understand the purpose of the experiment. However, when the teacher asked them again, they said that they had to put one part wet and the other dry.

Afterwards, they discussed how many woodlice to place and decided to put four woodlice. After waiting a few minutes, they made the observations. They counted three pill bugs in the wet part and one in the dry part. Casto (5 years old), without the teacher's help, understood the result of the experiment and concluded that they prefer humidity. Brais (4 years old) and Ara (3 years old) described the result indicating that there were more woodlice on the wet side. Antón said there were more woodlice on the dry side. When the teacher asked what the woodlice prefer, a humid or dry environment, Brais and Ara answered that they like the humid area better. However, we are not sure that they would have reached the same conclusion on their own.

3.3.2. Discourse Analysis in Group 2

In Group 2, a total of 199 contributions were made during Session 5 and 89 were made by the teacher. Carlos (5 years old) made nine contributions, Breogán (4 years old) made 51 contributions, and Alex (3 years old) commented 40 times, but many of his contributions were off-task. At one point in this session, Alex required the presence of another teacher who intervened to keep Alex's attention. There were six interventions from the other teacher. In total, both teachers made 95 utterances.

A few moments before the activity, Breogán (4 years old) started a conversation with the teacher while observing the woodlice. Alex and Carlos also participated.

In the following episode, Breogán (4 years old) discovered how the woodlice move and how they form a ball. The teacher told the children how to pick up woodlice so as not to hurt them.

Turn	Speaker	Statement	Analysis of Interaction
1	Breogán	Hey! They can walk around here. They are very fast.	He makes an observation about the movement of woodlice.
2	Teacher	They are very fast, yes.	The teacher shares Breogán's observation.
3	Breogán	Hey! This is where they are trying to escape!	He makes an observation about the movement of woodlice.
6	Teacher	Yes, they like to be free more. When we finish, we'll release them in the patio.	The teacher makes a comment about the behavior of the woodlice.
7	Breogán	(. . .) Hey! There's a ball inside here. Did they ball up?	Breogán observes how a woodlouse takes the shape of a ball.
8	Teacher	They would be scared! You have to handle them carefully!	The teacher guides Breogán on how to handle the woodlice.
9	Alex	Now I'm going to take them carefully.	Alex indicates that he is going to follow the teacher's instructions regarding handling the woodlice.

Then, the teacher took advantage of Breogán's (4 years old) contributions to make a brief recapitulation of what the children had learned.

Turn	Speaker	Statement	Analysis of Interaction
11	Breogán	Look how big! Hey! This one tickles me. Hey! There is a bigger one! I hadn't realized there was a bigger one!	He shows amazement at the size of the woodlice.
12	Alex	Look teacher! Look at it!	Alex shows amazement when he observes the legs of the woodlice.
13	Teacher	Yes. It has legs. Look how well we can see its legs. What parts does the woodlouse have?	The teacher takes the opportunity to review the body parts of a woodlouse.
14	Alex	Antennae!	Alex indicates a part of the body of woodlice.
21	Teacher	What else do they have?	The teacher asks the children about the body parts of a woodlouse.
22	Breogán	Eyes!	He indicates a part of the body of woodlice.
23	Teacher	Okay, the he...	The teacher helps children remember the parts of a woodlice.
24	Breogán	Head!	He indicates a part of the body of woodlice.
25	Teacher	Very good! The tho...	The teacher helps children remember the parts of a woodlice.
26	Breogán	Thorax!	He indicates a part of the body of woodlice.
28	Teacher	Very good! Ab...	The teacher helps children remember the parts of a woodlice.
29	Breogán	Abdomen!	He indicates a part of the body of woodlice.
32	Teacher	Very good! What were the names of the peaks below them?	The teacher helps children remember the parts of a woodlice.
33	Breogán	Uropods!	He indicates a part of the body of woodlice.
35	Alex	Uropods.	Alex indicates a part of the body of woodlice.
37	Breogán	And they have stripes down the back.	He indicates a part of the body of woodlice.

Afterwards, the teacher asked the children what they had learned from the previous experiment they had completed regarding the behavior of woodlice in front of light.

Turn	Speaker	Statement	Analysis of Interaction
41	Teacher	What did we learn from the experience we did yesterday?	The teacher asks the children what they learned in the previous experiment.
47	Alex	Some went to the light and many remained in darkness.	Alex describes what he observed regarding the behavior of woodlice in front of light.
48	Teacher	What did they like most?	The teacher asks the children to remember the conclusions of the experiment.
49	Breogán	Darkness.	He draws, as a conclusion of the experiment, that woodlice prefer darkness.
40	Teacher	Carlos, what did the woodlice like the most?	The teacher asks Carlos to remember the conclusions of the experiment.
51	Carlos	Mmmm... Eat.	He gives an answer unrelated to the conclusions of the experiment.
52	Teacher	Carlos, what did they like more, darkness or light?	The teacher rephrases the question to help Carlos draw a conclusion.
53	Carlos	Darkness.	He draws, as a conclusion of the experiment, that woodlice prefer darkness.

The teacher continued the session by asking the children questions about the places where the woodlice live, and whether they prefer wet or dry soil. The children presented their ideas as hypotheses and began to cover the prediction sheet with the help of the teacher.

Turn	Speaker	Statement	Analysis of Interaction
66	Teacher	(. . .) How do you think they will like the soil? When it rains and is wet, or when it doesn't have any water?	The teacher asks the children to express their ideas.
67	Breogán	When it doesn't have any water.	He makes a prediction.
68	Teacher	Alex, how do you think they will like it?	The teacher encourages Alex to make a prediction.
69	Alex	Mmmm. . .Wet.	Alex makes a prediction.
70	Teacher	Carlos, dry or wet? How will the woodlice like it best?	The teacher encourages Carlos to make a prediction.
71	Carlos	Dry.	He makes a prediction.
72	Breogán	I'm going to mark. . . this one.	Breogán refers to what he is going to record on the prediction sheet.
73	Teacher	This is dry and this is wet. What do you think?	The teacher gives information to Breogán about how to cover the sheet and encourages him to make a prediction.
74	Breogán	Dry.	He makes a prediction.
75	Teacher	Well, mark here.	The teacher explains to Breogán how to cover his prediction on the sheet.
76	Alex	To me, wet.	Alex makes a prediction.

The children believed that when they finished the prediction sheet, they finished the activity and began to get up. The teacher asked them if they remember the experiment they performed in the previous session. Breogán remembers that they carried out an experiment to find out if woodlice prefer light or darkness.

Turn	Speaker	Statement	Analysis of Interaction
81	Teacher	Let's do an experiment.	The teacher presents the activity.
91	Teacher	What experiment can we do to find out if they like it wet or dry? (. . .) Let's see Alex, what experiment can we do?	The teacher tries to encourage Alex to participate in the planning of the experiment.
92	Alex	Wet.	Alex seems to suggest moistening the cardboard box.
93	Teacher	But how can we check it? We have a box, some papers and a spray bottle with water. Think about how we did the experiment yesterday.	The teacher guides the design of the experiment.
94	Breogán	We put a bug here.	Alex suggests putting a woodlouse in the cardboard box.
95	Teacher	Okay, but if we put a bug here, how do we know if it likes it more dry or humid? What do we have to put for it to choose?	The teacher guides the design of the experiment.
96	Alex	Water!	Alex suggests putting water in the cardboard box.
99	Teacher	And where do we put the water?	The teacher encourages Alex to make his experimental design proposal more specific.
100	Alex	Here, here, here.	Alex refers to the cardboard box.
101	Teacher	Throughout?	The teacher encourages Alex to make his experimental design proposal more specific.
102	Alex	Here only.	Alex suggests putting water in just one part of the box.

Alex (3 years old) realized that in order for the woodlice to choose, he had to put water on only one side. Later, the children discussed how to place the paper, how to moisten it, and how many woodlice they were going to use. Alex (3 years old) placed the filter paper at the bottom of the cardboard box, moistened half of it with water and placed the woodlice inside. They took a break and returned to observe the results of the experiment.

Turn	Speaker	Statement	Analysis of Interaction
167	Teacher	Let's count how many there are on the wet side and on the dry side.	The teacher directs the conversation so that the children focus their attention.
168	Carlos	Yeah!	He shows a good attitude towards the task.
169	Teacher	How many are on the wet side?	The teacher asks the children to make observations.
170	Breogán	Two.	Breogán makes an observation.
171	Alex	Two.	Alex makes an observation.
174	Teacher	Look at these, one, two, three... How many are there on the wet side?	The teacher suggests that the children make observations again.
175	Breogán	Dang! I should have marked on the other side.	By comparing his response during the prediction phase with the observations, Breogán realizes that his hypothesis was wrong.
176	Teacher	No, you did very well! You thought woodlice liked the dry side, but doing the experiment you discovered that they like the wet side. Do you see how many things we can learn by doing experiments?	The teacher reminds Breogán that the purpose of experimentation is to test hypotheses.
186	Teacher	Where were there more?	The teacher asks the children to remember their observations.
187	Breogán	On the wet side.	Breogán remembers an observation regarding the behavior of woodlice in humidity.
188	Teacher	Where were there more, Carlos?	The teacher encourages Carlos to participate.
189	Carlos	Wet.	Carlos remembers an observation regarding the behavior of woodlice in humidity.
190	Teacher	What results did we obtain from the experiment?	The teacher asks the children to draw conclusions from the experiment.
191	Breogán	Not dry! Wet!	Breogán draws a conclusion from the experiment.
196	Alex	Wet!	Alex draws a conclusion from the experiment.

The following lines summarize the development of the session for this group. At the beginning of the session, the teacher started a conversation while the children made observations of the woodlice. In this conversation, Carlos (5 years old) greeted the woodlice and mentioned the uropods. He said that eating is what woodlice like the most. Breogán (4 years old) mentioned the eyes, head, thorax, abdomen, and uropods, and as a result of observation, he discovered that they had stripes on their back. Alex (3 years old) mentioned antennae and uropods.

Next, the teacher asked them what they remembered from the previous session. Carlos (5 years old) remembered that the woodlice liked the dark better. Breogán (4 years old) remembered that the purpose of the experiment was to know if they like light, and remembered as a result and conclusion that they preferred darkness. Alex (3 years old) was able to describe the results: "Some went to the light and many stayed in the dark". However, it seems that he was not able to draw a conclusion.

The teacher asked the children a question: "How do you think they will like the soil better?" The question was not very well formulated and the children gave arbitrary answers. The teacher asked the question again: "How do you think they will like the soil? When is it raining and wet, or when is there no water at all?" They then began to formulate hypotheses about which woodlice like more, dry or moist soil. Carlos (5 years old) and Breogán (4 years old) indicated that they would prefer the dry soil more, and Alex (3 years old) indicated that they would prefer the wet soil. The teacher then told them that they were going to do an experiment. The teacher showed them the material: a cardboard box, paper, and a spray bottle with water. She mentioned the experiment they carried out in the previous session and asked them to think about what experiment they could do to find out if woodlice preferred wet or dry soil. Alex (3 years old) said they like it wetter, so the teacher asked how she could check it. She pointed out the material they had prepared. Breogán (4 years old) pointed out that they needed a bug. The teacher continued asking questions. Alex (3 years old) pointed out that they needed water and that they should put water only on one side. In relation to the design of the experiment, Carlos (5 years old) commented only to say that he was going to give the woodlice a kiss. Breogán (4 years old) understood that there needed to be a dry part and a wet part, and thought that many woodlice should be put in the box, not just one. Alex (3 years old) considered it enough to put a single woodlouse in the box. After Breogán's correction (4 years), he preferred adding multiple. Regarding the results, Carlos (5 years old) was able to indicate the result by pointing out that there were more woodlice in the wet area. Breogán (4 years old) realized that his hypothesis was wrong: "Dang! I should have marked on the other side." He pointed out that there were more pill bugs on the wet side. The teacher took the opportunity to explain to Breogán that he did it very well, and that by doing the experiment, he discovered what the woodlice like the most. Alex (age 3) also pointed out that there were more woodlice on the wet side. In this session, everyone seemed to have come to the conclusion that the woodlice preferred the wet side.

3.3.3. Discourse Analysis in Group 3

In Group 3, a total of 187 contributions were made during the Session 5 and 83 were made by the teacher. Carmen (5 years old) made 61 contributions, Bea (4 years old) made 21 contributions, and Ana (3 years old) intervened 22 times.

The teacher began the session by asking what the children learned from the experiment they had carried out in the previous activity.

Turn	Speaker	Statement	Analysis of Interaction
1	Carmen	Teacher, what do we have to do?	She requests information about the task.
2	Teacher	We are going to do an experiment like yesterday's. Did you like yesterday's experiment?	The teacher introduces the activity and ask the children to remember what happened in the experiment they had carried out to study the behavior of woodlice in front of light.
3	Carmen	Yeah!	She shows a good attitude towards the task.
4	Ana	Yeah!	She shows a good attitude towards the task.
6	Carmen	Look, teacher, what happens is that it likes both, the sun and also black.	Carmen points out that woodlice prefer dark and light environments equally.
7	Teacher	Well, I think they liked one of the two more, because they were almost all on one side of the box.	The teacher reminds the children of the result of the experiment they had carried out to study the behavior of woodlice in front of light.

Turn	Speaker	Statement	Analysis of Interaction
8	Carmen	In black, but they like everything the same.	She remembers that there were more woodlice in the darkness, but she does not seem to be able to draw a conclusion.
9	Bea	But one liked the sun.	She remembers that one woodlouse preferred the light environment.
10	Teacher	One yes, but almost all of them on which side were they?	The teacher asks the children to remember what happened in the experiment they had completed to study the behavior of woodlice in front of light.
11	Carmen	In the sun. . .	Carmen points out that woodlice prefer light environments.
12	Teacher	Where, Carmen?	The teacher encourages Carmen to think again about her answer.
13	Carmen	In the dark, now give me that sheet. . .	Carmen points out that woodlice prefer darkness.

Subsequently, the teacher began a brief conversation that served as a recapitulation of what was learned about the morphology thus far.

Turn	Speaker	Statement	Analysis of Interaction
14	Teacher	First let's go over the parts. What parts did the woodlice have?	The teacher takes the opportunity to review the body parts of a woodlouse.
15	Carmen	The horns! Oh no. . .	She tries to remember the body parts of a woodlouse.
16	Bea	The antennas!	She rectifies Carmen's response.
17	Teacher	What do they have there? The he. . .	The teacher helps children remember the parts of a woodlice.
18	Bea	Head!	She indicates a part of the body of woodlice.
19	Carmen	And the eyes!	She indicates a part of the body of woodlice.
20	Bea	The eyes!	She indicates a part of the body of woodlice.
21	Teacher	What did they are here big?	The teacher helps children remember the parts of a woodlouse.
24	Carmen	The thorax and. . .	She indicates a part of the body of woodlice.
25	Teacher	Lower and smaller?	The teacher helps the children remember the parts of a woodlouse.
26	Carmen	The abdomen.	She indicates a part of the body of woodlice.
27	Teacher	Very good! Phenomenal! Now more difficult. Two little beaks below that started with u.	The teacher helps children remember the parts of a woodlouse.

Afterwards, the teacher introduced the activity that they were going to carry out in this session, which consisted of designing an experiment to study the behavior of woodlice in humidity.

Turn	Speaker	Statement	Analysis of Interaction
55	Teacher	(. . .) What else can we know about the place where the woodlice live? We know they like the dark.	The teacher asks the children about the behavior of woodlice.
58	Bea	In the darkness and in the light one.	She states that woodlice like light and darkness equally.
66	Teacher	(. . .) What would you like more, that the soil is wet or that it is dry?	The teacher encourages child to express her ideas about the behavior of woodlice in humidity.
67	Carmen	Wet!	She makes a prediction.
68	Teacher	What do you think Ana?	The teacher encourages Ana to express her ideas.
70	Ana	Dry.	She makes a prediction.
71	Teacher	Ana thinks it likes it drier. What do you think, Bea?	The teacher encourages Bea to express her ideas.
72	Bea	Wet.	She makes a prediction.
73	Teacher	Okay, Bea thinks she likes it wetter. Carmen, what do you think?	The teacher encourages Carmen to express her ideas.
74	Carmen	Mmmm, wet.	She makes a prediction.
75	Teacher	Okay Carmen, well we mark wet. Where do we mark wet?	The teacher instructs the children on how to cover the prediction sheet.
82	Carmen	I have a clue, when it's sunny, it's dry, and when it's rainy and it gets dark, it's wet. Wet.	She relates rain to darkness because she mentions that woodlice will like wet things because it will be dark. She makes a prediction.

After formulating and writing down the hypotheses, they began to plan the experimental design.

Turn	Speaker	Statement	Analysis of Interaction
96	Teacher	So how are we going to know if they like it more? Wet or dry? What do you think we can do?	The teacher tries to encourage the children to participate in the planning of the experiment.
97	Carmen	Well, we put wet here, and dry here.	She participates in the design of the experiment.
98	Teacher	Ana, I like the idea. Do you think it will work?	The teacher tries to encourage Ana to participate in the planning of the experiment.
99	Ana	Yeah.	She agrees with Carmen's suggestion.
102	Carmen	Yes, but we have a doubt. Because if the wet has drops. . .	Carmen thinks they have a problem with the design of the experiment.
104	Carmen	And how do we do it then?	She shows doubts about how to design the experiment to test their ideas.
105	Teacher	But what about the drops.	The teacher asks the children to clarify what the problem is with the design of the experiment.
106	Carmen	Well, they are going to the dry side. . .	She makes a prediction about the behavior of woodlice against humidity.
107	Teacher	I don't know. We try. Place the filter papers well because the woodlice previously escaped underneath.	The teacher gives instructions on how to place the materials to be used in the experiment to prevent the pill bugs from escaping.
108	Carmen	Like this?	She requests approval from the teacher.
109	Teacher	Yes, perfect.	The teacher approves Carmen's action.
110	Bea	Me too?	She requests to participate in the placement of the materials.
111	Teacher	Help Carmen place. Well, now what do we have to do?	The teacher suggests Bea collaborate with Carmen.

Next, the teacher asked the children to make predictions about what they thought was going to happen.

Turn	Speaker	Statement	Analysis of Interaction
150	Teacher	What do you think is going to happen?	The teacher asks the children to think about what is going to happen.
151	Ana	In the dry.	She makes a prediction about the behavior of woodlice against humidity.
152	Teacher	Okay later we check. Bea and you?	The teacher asks the children to think about what is going to happen.
153	Bea	In the wet.	She makes a prediction about the behavior of woodlice against humidity.
154	Carmen	And I also. Let's see when they choose.	She makes a prediction about the behavior of woodlice against humidity and suggests carrying out observations.

Finally, the teacher then encouraged the children to look to see what happened.

Turn	Speaker	Statement	Analysis of Interaction
155	Teacher	I think we can now look.	The teacher encourages the children to make observations.
156	Ana	Be careful, they are going to climb.	She suggests carrying out observations carefully to prevent the woodlice from escaping.
158	Carmen	They're still choosing, I think.	She suggests waiting to make observations.
160	Carmen	That's why they go that way. They are not calm.	She believes that woodlice are not calm.
161	Bea	I think they like the wet one better. The dry, only one.	She observes how a greater number of woodlice prefer a humid environment.
163	Carmen	One, two, three, four, five and, in the dry, zero.	She counts the number of woodlice in the humid and dry environment.
167	Carmen	One, two, three, four and five.	She counts the number of woodlice in the humid environment.
168	Teacher	Ah! Look, it's in the dry. Five in the wet and one in the...	The teacher encourages children to make observations.
169	Carmen	In the dry.	She observes that there is only one woodlouse in the dry environment.
170	Teacher	So, which one do they like more?	The teacher asks the children to draw conclusions from the experiment.
171	Carmen	The wet.	She draws a conclusion from the experiment.
172	Bea	The wet.	She draws a conclusion from the experiment.
173	Teacher	Well, we put on the dry side how many there were. We draw one on the dry side.	The teacher gives instructions on how to cover the sheet.
178	Carmen	Teacher, I'm done.	She provides information about the status of the task.
179	Teacher	Okay, which one did they like the most, Ana?	The teacher asks Ana to draw conclusions from the experiment.
180	Ana	The humid one.	She draws a conclusion from the experiment.

The following lines summarize the development of the session for this group. At the beginning of the session, the teacher started a conversation pointing out that they were going to do an experiment similar to the one they had completed the previous day. The teacher asked the children if they remembered the experiment. Carmen (5 years old) remembered the results of the experiment, but did not agree with the conclusions they drew: "Look, teacher, what happens is that it likes both, the sun and also black (...). There

was more in the black but they like everything the same". Bea (4 years old) agreed with Carmen (5 years old) and said "one likes the sun".

Later, the teacher prepared to review the parts of the woodlice. The first thing Carmen (5 years old) said was "the horns", but her answer was immediately rectified by Bea who said "antennas". Bea (4 years old) and Carmen (5 years old) pointed to the head and eyes. Carmen (5 years old) pointed to the thorax and abdomen. With the teacher's help, they remembered the term "uropods". Ana (3 years old) said that woodlice had hands. The teacher corrected her and then she named the legs. Ana and Bea said woodlice have four legs. With the teacher's help, they said fourteen.

Then, the teacher asked them where woodlice live. Bea (4 years old) believed that they live in darkness and light. The teacher asked: "What will the place where they live be like? Will they like the ground to be there? Dry or wet?" Carmen (5 years old) thought woodlice like the night better. Ana (3 years old) said darkness. They marked possible hypotheses. Bea (4 years old) and Carmen (5 years old) thought they would prefer wet soil and Ana (3 years old) thought they would like dry soil. Carmen (5 years old) pointed out a clue: "when it's sunny, it's dry, and when it's rainy and it gets dark, it's wet". Next, the teacher showed them the material: a cardboard box, paper, and a spray bottle with water. She mentioned the experiment they carried out in the previous session and asked them to think about what experiment they could do to find out what woodlice preferred, when the soil was wet or dry. Carmen (5 years old) suggested how to design the experiment by putting a wet part and a dry part in the box. Ana (3 years old) and Bea (4 years old) thought it would work. Carmen (5 years old) suggested that each of them pick up three woodlice, but Ana (3 years old) did not want to pick them up with her hands. They placed in six woodlice and waited. After a while, they went to look, but Carmen (5 years old) pointed out that the woodlice were still choosing. The children waited a little longer and returned to count the number of woodlice in each part. There were five woodlice on the wet side and one on the dry side. They were all able to point out the results and they all seemed to conclude that woodlice preferred humidity.

3.3.4. Discussion

In the fifth session of the teaching sequence, a group activity was carried out where the children had to design an experiment to find out the behavior of woodlice against humidity. The children found the two sessions where they had to design experiments very interesting and they were a topic of conversation for several days.

To get an idea of the participation of the children and the teacher, we have counted the contributions. In Table 3, we can see the number of contributions by each participant in each session. The number of children's contributions was more than 50% of the total, although not all participated equally. As shown in Table 3, almost all the children spoke more in this session than in the first session. In Group 1, a total of 111 contributions were made during Session 5, 54 of which (48.64%) were made by the teacher. In Group 2, a total of 199 contributions were made during this session, 95 of which (47.73%) were made by the teachers. In Group 3, a total of 187 contributions were made during the Session 5, 83 of which (44.83%) were made by the teacher.

The teacher's statements were generally in the form of questions. Sometimes the teacher's contributions were to direct the activity: "First let's review the parts". At some moments, she gave them instructions on the procedure to follow or how to treat the woodlice with care. In some interactions she encouraged the children when they responded correctly: "Wow, Breogán! Shake my hand, champion! Very good!". The questions fulfilled different functions, such as starting the conversation: "What experiment did we do yesterday?" Through questions, the teacher encouraged the children to remember the experiment they did in the previous session: "Did they like the light or the dark?" It also encouraged thinking: "We have to think first". Contributions such as "But how can we check it?" or "Now we have to think about how we can do it" encourage children to articulate their thoughts and clearly specify what they needed to do. In the experimental

design, the teacher helped the children, but following the ideas that they were proposing: "Shall we put the water in everything? Let's look at where they are placed!". The teacher encouraged the children to look at the results and draw conclusions for themselves: "So what do you like best?".

As shown in Table 3, the children who participated the most were Carmen (5 years old) in Group 3 and Breogán (4 years old) in Group 2.

In the fifth session, Casto (5 years old) and Breogán (4 years old) remembered the purpose of the experiment they had carried out in the previous session and the conclusion they had reached. They remembered that the conclusion was that woodlice like darkness. At first, other participants, among which were Brais (4 years old), Ara (3 years old), Antón (3 years old), and Alex (3 years old), did not remember the conclusion. Carmen (5 years old) remembered the experiment, but was not at all convinced of the conclusion and she said: "Look, teacher, what happens is that they both like the sun and also black". The same thing happened to Bea (4 years old) who said: "But someone likes the sun".

Children were able to formulate hypotheses and make predictions about the behavior of woodlice towards humidity and the preference for a wet or dry habitat. Casto (5 years old), Carmen (5 years old), Bea (4 years old), and Alex (3 years old) indicated that woodlice would like moist soil more, while Brais (4 years old), Ara (3 years old), and Carlos (5 years old) predicted that they would like dry soil better.

In relation to the experimental design, Casto initially did not seem to understand the purpose of the experiment because he believed that the objective was for the woodlice to survive, which is why he wanted to moisten the entire box. The same thing happened to Antón (3 years old) and Ara (3 years old) who wanted to get everything wet. They did not seem to understand the purpose of the experiment. Carmen (5 years old) and Brais (4 years old) understood that there needed to be a dry part and a wet part, and they suggested how to do it. Bea (4 years old) and Breogán (4 years old), Alex (3 years old), and Ana (3 years old) also understood that they needed both a dry part and a wet part.

All the children agreed that the result of the experiment was that there were more woodlice on the wet side, except Antón (3 years old), who said that there were more on the dry side. Breogán (4 years old) realized that his hypothesis was wrong. For Bea, the result was that five woodlice liked the humidity, and only one liked dry environments. In general, all of them seemed to come to the conclusion that woodlice like humidity.

According to these results, the children presented certain difficulties in understanding the purpose of the experiment and how to reach conclusions from the experimental results, as observed when they were asked about the experiment they carried out in the previous session with the aim of finding out if the woodlice prefer the light or the darkness. Lorch et al. noted out that students show a better understanding of variable control if only one variable at a time is offered [42]. In this work, we see how children were able to formulate hypotheses and make predictions about the behavior of woodlice in the face of humidity. Children, in general, recognize the variable that needs to be investigated and how to do it. This is in line with the results of Cook et al. who consider that preschool children already recognize how to isolate variables in a simple context with few variables to investigate [16]. In general, they were able to recognize the results of the experiment and, furthermore, they were able to contrast their predictions with observations. Some difficulties were also observed in reaching conclusions from the experimental results. These results would be in agreement with the results of Piekny et al. who have shown that preschool children already have a basic ability to evaluate evidence and a basic understanding of experimentation [43]. The findings showed that the ability to evaluate evidence is already well developed at the age of four, and increases steadily and significantly over time as long as the covariation pattern is perfect.

3.4. Sessions 6–7

In the sixth session, the children made a model of a woodlouse, enhancing fine motor skills and the artistic field. This activity also gave children the opportunity to use terms

referring to the morphology and apply ideas and terms that they had learned in the observation activities.

The seventh session was a recapitulation activity of what was learned. It consisted of a conversation with the children where they were given the opportunity to apply the ideas they had learned about the morphology and habitat of woodlice to the construction of a terrarium.

4. Conclusions

This paper describes how children (aged 3 to 5) and the teacher dealt with work in the classroom. They built ideas and practiced scientific skills through empirical experience and dialogue with others by engaging in inquiry activities with woodlice. The first session, in which an exploration activity for activating ideas was implemented, and the fifth session, in which an inquiry activity was performed, were analyzed in more depth.

At the beginning of the teaching sequence, the children had the opportunity to express their knowledge about woodlice, making reference to their name, habitat, food, etc. The teacher's interactions were mainly in the form of questions to activate the children's knowledge. We can say that, in general, the children were involved in the activity, although not all participated to the same extent. In relation to the children's ideas about woodlice, it should be noted that the children did not know their proper name. They referred to them as bugs, and the younger children referred to them as snails or worms. Despite not knowing their name, the children did express correct ideas about the food and habitat of the woodlice. As has been pointed out in other papers, explanations that refer to certain aspects of children's approaches to living beings often reflect anthropomorphic reasoning [44]. Some of the 4-year-old children used anthropomorphic expressions attributing human characteristics to objects, animals, or phenomena that do not possess them. On the other hand, the three-year-old children tended to establish syncretic explanations, tending to group objects or events based on superficial characteristics or emotional associations instead of on logical or rational criteria [41]. In addition, the children were involved in the observation activities and showed interest in learning the names of the parts of the woodlice such as the head, the antennae, the eyes, the legs, or the uropods, in addition to learning more ideas about the habitat and the feeding. These last ideas could help the construction of a precursor model about living beings [45].

The children were involved in inquiry activities in which they had to make predictions, plan an experiment, obtain results, and draw conclusions about the behavior of the pill bugs. In this paper, the fifth session was analyzed in more detail, where they carried out an inquiry activity on the behavior of woodlice against humidity. The teacher interacted with the children by asking questions and encouraging them to express and record their ideas and predictions, encouraging them to think about the experimental design to test ideas, and to record the results and draw conclusions for themselves. In the activity where they have to make predictions about the behavior of the woodlice in relation to humidity, the children presented certain difficulties in understanding the experimental design and the purpose of the experiment and how to reach conclusions from the experimental results. The children were able to formulate hypotheses and make predictions about the behavior of pill bugs against humidity and record the predictions with the help of the teacher. In general, they were able to recognize the results of the experiment. Furthermore, they were able to contrast their predictions with observations.

As seen in this paper, children are involved in inquiry activities. Children can make predictions, formulate hypotheses, and, with the teacher's help, are able to plan a simple experiment to test their ideas. Furthermore, in simple experiments with a single variable, they are able to understand the results and draw conclusions. On the other hand, these types of activities allow children to learn to find answers to scientific questions through experimentation.

In this paper, information was collected through a classroom diary, in which the observations of each session were noted down, and video and audio recordings of two

sessions (Session 1 and Session 5). The analysis of the discourse from the first session and the classroom diary allowed us to answer the question about the children's ideas about woodlice. The analysis of the speech and the classroom diary of three groups from the fifth session allowed us to answer the questions related to the children's participation in the inquiry-based activities. A limitation of the study is the lack of data for the discourse analysis of all activities in the sequence, which would have provided a more robust and complete view of the implementation of the teaching sequence.

Educational Implications

As noted by Lazonder et al., in any early-childhood education classroom, there must be time for free play and exploratory activities, but we must not lose sight of the importance of implementing more structured and more demanding inquiry-based activities for children and also for teachers [46]. Furthermore, carrying out these types of activities with woodlice allows children to become familiar with these small living beings and can help fear, repulsion, and biophobia disappear. In this study, only some children showed some rejection of woodlice at the beginning of the activity. This may be due to the rural context in which the participants of this study live. On the other hand, the teacher's role is essential in providing opportunities for all children to participate in inquiry-based activities. In this study, interaction in a heterogeneous group (3–5 years) was beneficial for all children and this was due, in part, to the skill of the teacher who encouraged the participation of all children.

Author Contributions: Conceptualization, S.B., I.G.-R. and V.S.; methodology, S.B. and I.G.-R.; validation, I.G.-R., V.S. and S.B.; formal analysis, I.G.-R. and S.B.; investigation, S.B. and I.G.-R.; resources, S.B. and I.G.-R.; data curation, S.B.; writing—original draft preparation, S.B. and I.G.-R.; writing—review and editing, V.S.; visualization, V.S.; supervision, I.G.-R. project administration, I.G.-R.; funding acquisition, I.G.-R. All authors have read and agreed to the published version of the manuscript.

Funding: This research was developed within RODA (Ref. ED431C2021/05) research group and was funded by the Spanish Ministry of Science, Innovation and Universities, partly funded by the European Regional Development Fund (ERDF). Grant code PID2022-138166NB-C21.

Institutional Review Board Statement: This study was conducted in accordance with the Declaration of Helsinki. The data for the research were gathered in accordance with the guidelines of Code of Good Practices in Research (USC)(CBPI).

Informed Consent Statement: Informed consent was obtained from all subjects involved in this study.

Data Availability Statement: Data are unavailable due to privacy or ethical restrictions.

Conflicts of Interest: The authors declare no conflicts of interest.

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