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EXPERIMENTAL ACTIVITIES IN SCIENCE TEACHING OF CHILDREN WITH SPECIAL EDUCATIONAL NEEDS IN PRESCHOOL

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Abstract

The study developed fits science education area, designated in Portuguese Preschool Education by Environment Knowledge. In particular, we explored the theme of physical states of water. We build learning pathways by using practical-experimental activities as methodology. The problem of this research study is to understand whether the practices and experimental activities in science contribute to learning of children with special educational needs. As methodology we applied research-action to work with a group of children, aged 4 years, of a kindergarten in Guarda, a small town of Beira Interior, Portugal. The referred group included a child with permanent Special Educational Needs regarding motor and speech competences.

We can conclude that, in the course of practice and experimental activities, children with special educational needs showed a similar involvement of other children in the group and at the end of such activities, they presented significant learning achievements. It was also verified that the use of practical and experimental activities for science teaching in preschool education are an excellent means of inclusion of children with special educational needs.

Keywords: Science Teaching, experimental activities, physical states of water, Preschool Education, Special Educational Needs, Inclusive Education.

1 INTRODUCTION

Considering science teaching as a construction process that involves dialectic between theory and practice, so that knowledge production is integrated in the educational activity, learning cannot be characterized either by studying the content or the processes, but by their dynamic interaction in learning situations ([1]). Bearing in mind that "each person should have scientific and-technological knowledge which enables him to understand some important phenomena of the world he lives in and to take informed democratic decisions, in a shared social responsibility perspective" ([2], p.16), experimental science activities can be excellent promoters of learning in children. For there to be an inclusion of the child it is necessary that the same happens in the trilogy family, school and society. This trilogy has to work together, because if there is a failure in one of the three components, the web is broken and inclusion no longer exists. Therefore, strategies must take into account the student's full inclusion. Vayer and Roncin ([3]) argue that quality of the child's relationships with adults (parents and educators / teachers) will be crucial in discovering abilities and possibilities, in her attempts at social interaction.

This study is part of an action research developed for a month in a kindergarten in Pinhel, a small town of Beira Interior, Portugal, with a group of 4 year-old children. The group consisted of fifteen children, of whom nine females and six males, in which four children had Special Educational Needs (SEN), benefiting from special education. Within the scope of our action research, for this study we selected those with more severe SENs, documented by health professionals.

The research problem in this study was to understand whether practical/experimental activities in science contribute to the learning of children with special educational needs. In this context, we developed, within a curriculum framework, a proposal for pedagogical practices in order to promote inclusive learning. The construction of scientific knowledge in preschool teaching is obtained from fostering science awareness in a suitable way for children of these ages and with great scientific rigor. Such awareness may be related to near surroundings and point to the introduction of various fields of human knowledge: history, sociology, geography, physics, chemistry, biology, among others. Thus, following the Preschool Teaching Curriculum Guidelines (PTCG), favouring blending of different curricular areas, we designed and implemented didactic resources related to *World Knowledge* (within

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the natural sciences). By understanding the physical changes that water undergoes when subjected to different temperatures, the child is able to understand natural phenomena that occur and the factors that influence them. According to PTCG "knowledge of meteorology (wind, rain, etc.) is an aspect of interest to children" ([4], p.81). Aiming to facilitate the classification of materials as solid or liquid, we assume as a classification criterion, for the macroscopic liquid state, that the material is likely to form droplets ([5]).

Planned practical/experimental activities were contextualized within the *physical states of water* content. Water is the primary constituent of living matter and a familiar substance to children. Changes in the physical state of water are phenomena that occur in the children's everyday life and with which they contact very early. According to Martins et al. ([5]), "water is, for various reasons, an example of excellence, being one of the few substances which can exist in all three physical states on Earth's current environmental conditions" (p.11). To Carapeto ([6]) "Water has always been seen by Man as one of the most versatile resources for his activities" (p.169).

2 THEORETICAL FRAMEWORK

It is generally agreed that there is the need for formation-oriented early science education, directed to effectively overcome citizen challenges and needs. According to Cachapuz, Praia and Jorge ([7]), early science education responds and feeds children's curiosity, fostering a sense of wonder, enthusiasm and interest in science and the activity of scientists. In Tenreiro-Vieira's perspective [8], it promotes the capacity for creative, critical, and reflective thinking - useful in other content areas - and in different contexts and situations, such as in solving personal and professional social problems. Blough, Schwartz and Huggett [9] consider that the study of science should help children develop the ability to solve problems efficiently, because as Tenreiro-Vieira and Vieira ([10]) state "so that today's students may be active citizens and social actors (education for citizenship), it is essential they use their scientific knowledge and thinking skills, or, in other words, that they are scientifically literate "(p.51).

Sciences in preschool teaching, according to PTCG, are part of the World Knowledge curricular area. "The World Knowledge area should allow contact with the attitude and methodology of science itself and foster an experimental and scientific attitude in children" ([4], p.82). According to Martins ([11]), PTCGs are a reference in the development of educational practices in the first stage of basic education, i.e. in preschool teaching. In this curriculum area, children can explore their natural curiosity and seek answers for their questions/issues, and it is also conducive to the promotion of active learning in the activities room, encouraging the child to explore and make decisions for herself. Tavares and Alarcão ([12]) reported that children learning takes place through tasks either offered to her or that she chooses. In other words, it is a personal construct built from an experiential process, which results in a relatively stable behaviour modification.

In the opinion of Máximo-Esteves ([13]), strategies oriented towards discovery learning, in addition to stimulating children's logical thinking, also stimulate creative thinking, essential to the child's formation as a human being. Thus, it is the kindergarten teacher's role to promote strategies for peer, adult and material interaction, because these interactions allow for knowledge sharing and lead to the child's increasing knowledge.

According to McGuire (1997), quoted by Máximo-Esteves ([13]), the World Knowledge curriculum area allows the child to acquire new conceptual learning in a blending and meaningful way, valuing her real and imaginary experiences as well as her prior knowledge, which are a reflex of the familiar culture that surrounds her. In addition, this area promotes the development of the child's spirit of acceptance, collaboration and civic competence, so that she is later able to take an active role in society. In preschool teaching, practical activities should be globalizing, developing procedures and ways of thinking that lead to the structuring of scientific knowledge ([4]).

2.1 Practical/experimental activities in preschool teaching

Máximo-Esteves ([13]) advocates that the realization of practical / experimental activities in preschool teaching allows the child to know and deepen, in an integrated manner, subjects of different content areas, as well as being the active agent in her own learning by completing tasks individually or in group. According to Sá et al. ([14]) "Children are able to evolve from a purely manipulative and sensory knowledge to establishing causal relationships of type and even an interpretation of such relationships, based on explanatory models" (p.24).

As in all the activities planned, you have to take into account the ages and abilities of the group with which you are working. "The choice of experiments to be held, as well as the greater or lesser complexity of their development, stems from age, interests, children abilities and also the support given to them by their teacher" ([4], p.83) .

It is necessary that the insertion of practical/experimental activities in school is made consciously and that it proposes an approach to education aimed at bonding the child with the world, acting as a facilitator of learning mechanisms in their different pedagogical dimensions. According to Beviá(1994), referred by Praia ([15]), over the conduct of practical /experimental activities, children can and should be guided/directed by the teacher, enabling the perception of the same varieties of processes implicated in its various stages. This type of activity should not be disconnected from the theoretical content of the discussion groups and other forms of learning. In other words, the contents which are worked with the group and the results obtained with the practical/experimental activities performed should be complementary.

Practical /experimental activities emphasize the child's initiative, because they give her the opportunity to defend her ideas safely and to learn to respect her classmates' ideas. They also give her the opportunity to develop various types of actions, such as handling, observation, reflection, discussion and registration. According to Blough, Schwartz and Huggett ([9]): "Conducting experiments, manipulating, displaying curiosity, asking questions and seeking answers are trends which characterize children and foster science, therefore justifying their need to be taught as an integral part of education "(p.7).

2.2 Inclusive education

It is considered that a child with Special Educational Needs (SEN) is a child who has trouble learning during the course of her schooling process, requiring specific attention and greater educational resources ([16]). According to the UNESCO ([17]), "the term 'special educational needs' refers to all children and young people whose needs are related to learning disabilities or difficulties" (p.6). In Portugal, the SEN designation emerged in the 60s. Until then, it was considered that these children were not allowed to attend school.

Teaching the child, as soon as she enters preschool teaching, to respect others is a good start, so that in the future she leads a happy and successful adult life. Kindergarten/School "is possibly a place where we learn to live, to participate in activities with others, to better understand the community in which it is inserted, to live with different people" ([18], p.13).

Inclusion is the commitment to produce culture, to understand expressive capabilities that were not foreseen and perform humanist actions by accepting the other without prejudice. According to Ladeira and Amaral ([18]), it is a "process that unfolds over the life of an individual, and which aims at improving his quality of life" (p.7). Inclusion is therefore to promote coexistence within human diversity. The kindergarten teacher must meet the interests, needs, abilities, and pace of learning of each child, in order to achieve increasingly effective results. From the perspective of Ladeira and Amaral ([18]), strategies that promote inclusion are: including the reorganization of the activity room according to children's needs and teaching strategies; continuity considered under three aspects: tasks, transition processes and outside preschool; preparation of activities so that all children can participate, taking into account: the definition of contexts, planning of activity and on-going evaluation; peer learning, where teamwork is essential for the development and interaction of children with SEN, but also for the other children. Living with the difference is beneficial for the social and emotional growth of children, youths and adults.

Special education, under the Education Act ([19], art.19th), is one of the special arrangements for school education, governed by special provisions. It aims to recover and socially integrate children with special educational needs due to physical and mental disabilities. The objectives of this modality are: developing physical and intellectual potential; helping in acquiring emotional stability; developing communication possibilities; reducing limitations caused by the disability; supporting family, school and the social inclusion of children and young people with disabilities; developing independence /autonomy; and preparing for vocational training and integration in active life.

Specialized support is aimed at helping the SEN child, who has a significant level of activity and participation limitations, resulting in continued difficulties in communication, learning, mobility, autonomy, interpersonal relationships and social participation. A child with SEN has a needs statement that specifies the required support and interventions and, on this basis, an individual

educational program is developed by a multidisciplinary team that responds to the educational, social and health needs of the student, ensuring equal education. It places responsibility on the kindergarten/ school and family for the implementation of educational measures.

3 PEDAGOGICAL INTERVENTION

Nowadays it is essential to create new attitudes that help children in the understanding and appreciation of scientific knowledge. Only then will they be able to integrate it into everyday life and understand ever better the world around them ([15]).

3.1 Problems and objectives

Our study was based on the following problem: Do practical/experimental activities in science contribute to the learning of children with SEN in preschool teaching?

Thus, we set the following objectives:

(i) To develop and implement educational resources for learning the physical states of water which will allow us to realize whether the practical /experimental activities are promoting knowledge, skills and attitudes;

(ii) To determine the importance of learning records before and after the realization of practical/ experimental activities;

(iii) To establish the acquisition of skills associated with the practical/ experimental activities developed.

3.2 The group of children

We conducted our study in a kindergarten, in a small town of Beira Interior, Portugal. It is a public establishment belonging to the Portuguese Ministry of Education and Science, which welcomes 3 to 5 year-olds and is part of the Pinhel's School Cluster.

The group consisted of fifteen four year olds, nine female and six male. The group profile is homogeneous. They are expansive and communicative children who gladly cooperate and adhere to learning experiences, but also reveal the need to develop attention and concentration skills, as well as respect for others. In terms of interests and preferences, the vast majority of children like games and constructions as well as motor and outdoor activities. There is still great interest in story books.

The children in the group showed some difficulty in complying with rules, requiring frequent adult support in carrying out some tasks. According to Gesell [20], "the explanation for the 4 year-old child psychology lies in his intense energy coupled with a mental organization of great fluidity" (p. 200). This is an absolute growth phase, in which the child tells amazing stories, praises himself, is very talkative, invents justifications, and performs a set of actions, where numerous talent shows. Basically, the child, through these impulses, seeks an identification of himself with his culture, and is trying to figure out what he still ignores about himself.

The group included four children with SEN, receiving special education under Article 16 of Decree-Law 3/2008, of January 7 [21] (as amended by Law No. 21/2008, [22]) with the following educational measures: personalized educational support - by the head kindergarten teacher - for reinforcement, encouragement and anticipation strategies, skills and learning, and the special education teacher to reinforce and develop specific skills; Support technologies - speech therapy and psychomotricity intervention materials and equipment.

Our study will pay particular attention to one of the four children with SEN. This option is due to the fact that this child had the greatest support. This child, whom we will identify as "PC", is the youngest child, and her older brother also benefits from special education. Since she was a baby, PC resides with her godparents, visiting her parents at the weekend. This child always attended kindergarten and was supported in the area of early intervention. Considering the medical and technical information available, this child has permanent SEN - it was verified that: in terms of activity and participation, in relation to learning and application of knowledge, she presents severe impairment in language acquisition and language development; in the acquisition of concepts and skills she has moderate impairment in focusing attention; in terms of communication she presents severe impairment in speech and conversation; in relation to mobility, she displays severe impairment in the hand's fine motor skills; preschool life and related activities are moderately impaired; as concerns global mental

functions, she reveals moderate functionality in temperament and personality; at the level of specific mental functions, she shows serious deficiencies in the mental functions of language and moderate functionality in psychomotor functions; regarding sensory functions and pain, there is evidence of a slight functionality in auditory function; regarding voice and speech functions, there is a severe deficiency in articulation functions and moderate in the fluency and rhythm of speech functions. Finally, in terms of neuro-musculoskeletal functions and duties related to movement, she has slight functionality in functions related to gait pattern. Currently, PC benefits from special education, speech therapy and physiotherapy.

In our one-month study, we randomly selected one child without SEN, of the same sex and the same age as PC, whom we will identify as "EG", so that we have a reference for the analysis of records made during the practical/experimental activities. The first two weeks of our study were for observation and interaction with the group and the last two weeks were intended for three practical /experimental activities.

3.3 Methodology

Given the characteristics of the study we set out to accomplish, we adopted the action research methodology, as it is an essentially practical and applied research, which is governed by the need to solve real problems ([23]).

Action research is, first and foremost, a methodology that tries to overcome the usual dualism between theory and practice ([24]) - part of a process based on experience and daily practice, following the inductive method, going beyond simply describing or understanding phenomena. According to Arends ([25]), action-research begins with a problem, like any other investigative act, yet the major difference is the production of information and knowledge, which generates an immediate application in context. For Coutinho et al. ([23]), action research can be described as a family of research methodologies that include both action (or change) and research (or understanding), based on a cyclic or spiral process, which alternates between action and critical reflection, and that in subsequent cycles, methods, data and interpretation are improved in the light of experience (knowledge) obtained in the previous cycle. The ultimate goal of action research is to promote change ([26]) and social development ([27]). According to Coutinho et al. ([23]), we may also consider that action research aims to understand, improve and reshape practices, in addition to making a small-scale intervention in the functioning of real entities and presenting a detailed analysis of the effects of this intervention.

According to Coutinho ([28]), action research has given science research a new way to investigate, putting the researcher and the participants in the same intervention plan.

In summary, in the education field, action research seeks to fundamentally analyse the specific educational reality and encourage decision-making of its agents for educational change. Such an attitude will involve an awareness of each stakeholder (individually and in groups) that emerges from the construction of knowledge by comparing and contrasting through reflection ([29]).

3.4 Pedagogical approach

Doing research involves planning, acting, observing and reflecting more carefully than is usual in our daily lives, in order to provide practical knowledge on practices ([23]). In order to implement this action research study, three practical/experimental activities to explore the physical states of water (solid, liquid and gas) were performed. All activities were properly planned, taking into consideration the age and characteristics of the group. As Zabala and Arnau ([30]) argue, it is a function of the kindergarten teacher to plan activities which promote scientific literacy, with a view to developing more competent citizens in their personal, interpersonal, social and professional dimensions.

The recording instruments we adopted for all children, irrespective of whether they had SENs, were: Photos, which according to Bogdan and Biklen ([26]), "give us strong descriptive data, are often used to understand what is frequently subjective and analysed inductively "(p.183); iconography, which according to the Portuguese Ministry of Education ([4]) is the most common written record in preschool teaching; skill grids. The notion of skill can be understood as "knowledge in use" as opposed to "inherent" knowledge ([31]), which requires the mobilization of knowledge, abilities, attitudes and values. These three dimensions influence how each person acts in problem- solving and decision-making ([32]). The child's skill grid, assessing skills, attitudes, values and knowledge, was prepared by direct observation, since this allows us to observe and analyse each child's involvement

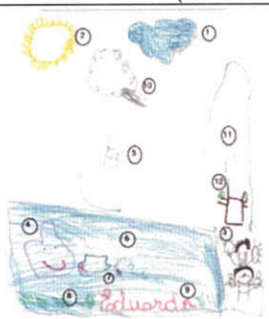
in doing the practical/experimental activities. Citing Sousa ([33]), "observation permits the records of events, behaviours and attitudes, in their own context and without changing its spontaneity" (p.109).

The assessment of the learning that we intended to promote in children, by conducting practical/experimental activities, occurred during the course of the same, i.e., through formative assessment. Formative assessment is part of the teaching and learning process, and is essential for the teacher to decide, at each moment, how to proceed. Martins et al. ([2]) mentions that the assessment based on the observations of the education professional may be more beneficial on children during the performance of practical tasks. Monitoring what is happening in the group, the exchanges between the children, the way they conduct the activity and the type of support they request, are assessment features to take into account.

3.4.1 Discussion of results

Through the story "The Water Droplet Girl" by Papiniano Carlos ([34]), told with the aid of an illustrated cardboard, we created a contextualized situation to begin our didactic exploration. With this, we wanted the children to understand the importance water has in our lives, the water cycle and the physical states in which it can be found. After the story was explored, the children retold the story through individual drawings and described it to the group (Table 1).

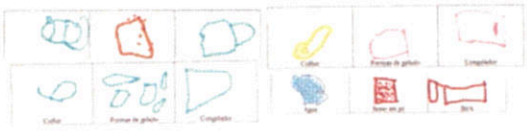
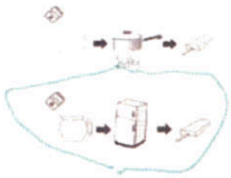
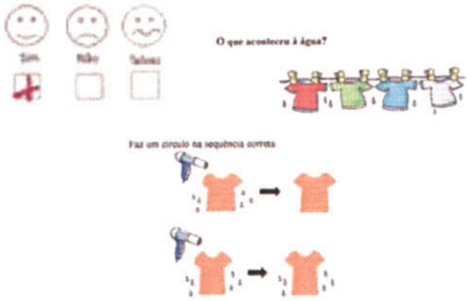
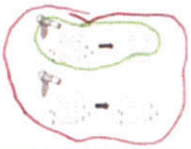
Table 1- "The Water Droplet Girl" story record.

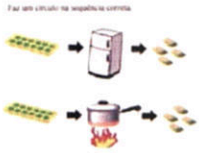
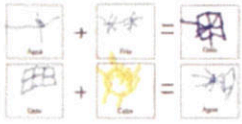
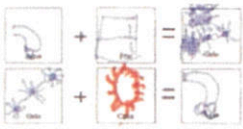
PC (child with SEN)		**EG** (child without SEN)	
	1- "They are clouds"; 2 - "It is the sun"; 3 - "It is the mother" (drew the mother, because the theme of Mother's Day had been addressed in previous weeks); 4 - "It is the water droplet girl" (she is pink because she is a girl); 5- "It is the big boat"; 6- "It is the sea"; 7- "They are fish"; 8 - "They are sea plants"; 9 - Name.		1- "It is the cloud"; 2 - "It is the sun"; 3 -"They are the thirsty boys"; 4 - "It is the water droplet girl"; 5 - "It is the boat"; 6 - "It is the sea"; 7 - "They are tiny fish"; 8- "They are algae"; 9- Name; 10- "It is the wind"; 11- "It is the mountain"; 12- "It is the tree".

As we can see in Table 1, "PC" drew only some of the elements that appear in the story and, furthermore, some of those are difficult to identify. With regard to the human figure, "PC" drew only the head and limbs (two lines for the arms and two for the legs). However, he correctly draws the number of fingers, eyes, mouth and feet. "EG" draws a more complete human figure (except for the feet), and adds details such as hair and members drawn from the trunk.

Then, and following this story, the children recorded, on the learning script, Water Droplet's journey, until she returned to the sea, and painted the schematic illustration. We observed that all children correctly traced Water Droplet's path, which shows they were generally able to understand the water cycle. Regarding the painting of the illustration, "PC" reveals difficulties in following the outlines of the figures, with visible random lines throughout the drawing.

Table 2 - Learning scripts for the three practical /experimental activities

QUESTION-PROBLEM	WE WILL DISCOVER ...	I UNDERSTOOD (systematization)
1st practical-experimental activity: "Can I make ice-cream from juice?" Observations on the records of "PC" and "EG": 1) Both have the same conceptions: they select "yes" and draw a circle around the correct sequence. ((2) "There is obvious difficulty in identifying the necessary materials "PC" drew as opposed to "EG", who is able to draw details, such as the jar handle.	**I think (previous conceptions) that**  **Planning (How will I find out)** - by drawing the necessary materials and explaining the different steps:  "PC" "EG" **Experiment (we will find out if what I know is true...):** **What I noticed (record) - tick the correct sequence:** 	The solidification phenomenon. 
2nd practical-experimental activity: "Does water disappear with heat?" Observations on "PC" and "EG" records: (1) Both have the same conceptions: they select "yes" and draw a circle around the correct sequence. (2) Once again, "PC" draws random lines, as in the case of the second sequence around the circumference. That happened due to the fact that the painting materials were not removed at the end of the task. Once more, "EG" draws details such as the lines to simulate the air that comes out of the hair dryer.	**I think (previous conceptions) that:**  **Planning (How will I find out)**  "PC" "EG" **Experiment (we will find out if what I know is true...):**  **What I noticed (record) - tick the correct sequence:** 	The evaporation phenomenon.  "PC"  "EG" 

3rd practical-experimental activity: : "Can I paint with colored ice cubes?" Observations on "PC" and "EG" records: (1) Both have the same conceptions: they select "yes" and draw a circle around the correct sequence. (2) Once again, in relation to the drawings of the materials needed for the realization of the practical-experimental activity, "PC" displayed more difficulty in identifying them than "EG". Once more, "EG" draws details, such as the faucet where the water was taken, taking for example the notion that the paper is rectangular. It should be noted that both the children drew the right number of used cups and food dyes and the respective colours (yellow, blue, red and green). (3) Both children could freely handle the colored ice cubes, watching what happened to the colours when mixed. "PC" had a little more difficulty in handling the ice than "EG", and drew beyond the line forming the header, we assume that is due to the less developed motor coordination and fine motor skills.	**I think (previous conceptions) that** : But ... How can I make colored ice cubes?   **Planning (How will I find out)** **"PC"** **"EG"** **Experiment (we will find out if what I know is true...):**  **Experiment (we will find out if what I know is true...):** 	The phenomena of: solidification, melting and evaporation  "PC"  "EG"  "PC" identifies her drawing as "It's a rainbow."  "EG" identifies her drawing as "It is a colored wall."

Throughout the practical and experimental activity the group proved to be very motivated and curious to discover whether it was really possible to make ice-cream (solid state) from juice (liquid state). After observing the results, children said they would ask parents to repeat the experiment at home, since they had already learned to make delicious ice cream. Learning requires, therefore, a coordination made by the child between the new and the already known, consequently the call on his knowledge and his own learning strategies ([1]).

The records analysed allow us to conclude that the two children do not have equal graphical development, despite being the same age.

On the basis of direct observation, carried out over the three practical/experimental activities, we checked the level of acquired skills: (i) "PC", in the 3rd practical/experimental activity, was able to describe the activity as well as interpret it and apply the information provided. However, she was still unable to predict or assess the activity. But she was always enthusiastically involved in observing, experimenting and recording. In the view of Martins et al. ([11]) observation, classification, recording and manipulation are examples of abilities needed for an approach to the concepts and knowledge building; (ii) in relation to the attitudes and values shown in the course of the practical/experimental activities we paid attention to: autonomy, responsibility, teamwork, involvement, initiative, curiosity, dismay and joy. The attitudes and value dimension is shaped by cognitive, affective and behavioural components. In various contexts and in different situations, our values are not always reflected in our attitudes, due to various reasons. At the level of science education it matters, above all, to provide an early awakening, fostering interest and enthusiasm for science, establishing cooperative relationships among peers, and developing autonomy and responsibility ([11]). We noted that none of the children felt dismay over the practical/experimental activities. We found that only at the 3rd practical-experimental activity did "PC" show responsibility, initiative and curiosity as to what would happen at each stage of the activity. However, she still didn't achieve an independent attitude. The contribution of this type of methodology seems clear in this evolution. (iii) The child will gradually establish relationships between ideas, constituting the basis for the development of more complex and structured thoughts. "There is no knowledge without jurisdiction, the same way that nobody solves problems only with knowledge" ([11], p.96).

Therefore, regarding the knowledge acquired on the topic "The physical states of water", through practical/experimental activities, we considered: Recognizing the vital value of water; Identifying atmospheric phenomena (clouds, rain, snow); Distinguishing physical states (liquid, solid, gas); Raising awareness of environmental issues. We found that both children showed knowledge of the three atmospheric phenomena mentioned (clouds, rain and snow) as well as expressed knowledge that allow us to conclude that they acquired knowledge concerning the whole water cycle, as well as the cause, the phenomenon and the state that characterizes each stage of the same. This study also shows that the realization of practical/experimental activities is an excellent means of including SEN children in the group, because they actively participate in the same activities as other children.

4 CONCLUDING REMARKS

Throughout the four weeks of permanence in the four-year-old kindergarten classroom, we could observe that when conducting practical / experimental activities, children with SEN participate equally, with the same commitment and dedication than the others, and acquire the same learning experiences.

The need for early science education has been increasingly called for, oriented towards the formation of citizens capable of dealing with the challenges and needs of contemporary society ([11]) The practical-experimental activities have always been considered important for the learning of children, particularly the younger ones, in order to maximize their physical involvement with the outside world, crucial for the development of their thought processes. However, it is not the simple manipulation of objects and tools that generates knowledge. Martins et al. ([2]) states that "it is necessary to question, reflect, interact with other children and the teacher, answering questions, planning ways to test previous ideas, confronting opinions, so you can create a practical activity that is intellectually challenging for the child, so that he keeps wanting to understand phenomena, relate situations, develop interpretations and make forecasts "(p.38) According to Ferreira and Nogueira [35] "through experiments, children manipulate, question, understand the resistance offered by reality, seek solutions, adapt and invent, eventually appropriating the models, progressively accessing new concepts and transforming their way of thinking about the world "(p.7) These activities are closely linked to children's daily life; they promote a reflective and constant questioning attitude; the activities related to reasoning, oral and written communication, development of scientific concepts and drawing all blend; they give rise to the expression of children's "hidden" sides and potential; and finally they solve many problems of indiscipline or lack of interest in school.

The kindergarten teacher has the role of providing discovery situations and developing an attitude of interest, appreciation and fondness for practical-experimental activities. It is important she puts forward problem situations and allows children to find their own solutions through dialogue and

practical activities, making sure that all children have the opportunity to participate in them ([4]). There is consensus among preschool education researchers and practitioners that quality teaching is a determining factor for learning and personal, educational and social inclusion of all children. Thus, a school for all children is an inclusive education system that ensures effective conditions of access to the curriculum and to academic and social success, or a school "aimed at all individuals" ([36], p.21).

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