Teaching ecology to children of preschool education to instill environmentally-friendly behaviour

Abstract

This qualitative study analyzes the results of a pedagogical and didactic experiment which was focused on the problem of teaching environmentally-friendly behaviours to young kindergarten children. It is essential to awaken children's curiosity and desire to know more about environmental issues in their regions so that children develop their own answers to problems. Our research focus was to understand the potential of practical-experimental activities connected to ecology, in a relaxed and entertaining learning context, promotes the learning of environmentally-friendly behaviours.

The analysis of the results obtained in the pedagogical and didactic experiment was based on the following categories: (a) teaching and learning methodology and teaching resources; (b) children perceptions. The findings revealed that the built teaching resources have enabled these children to understand the importance of having environmentally-friendly behaviours.

Keywords: Environmentally-friendly behaviours, Practical-experimental activities, Preschool children, *kindergarten* educator training

INTRODUCTION

Within the scope of a Master's degree of a Portuguese higher education college in preschool education and elementary education teaching, we have developed, over the years, research in teaching and learning sciences in the kindergarten and primary classroom. Several studies have demonstrated the need to intentionally strengthen science education for children attending kindergarten (Martins, et al., 2009; Ferreira, Caires, Pitarma, 2015).

In the curriculum guidelines for preschool education (OCEPE), in Portugal, we find that "(...) all curricular components should help to foster students' attitudes and values that enable them to become aware and be supportive citizens, empowering them to solve life's problems" (ME, 2009: 51). Preschool education is considered "the first stage of basic education in the education process throughout life, which complements the educational action of the family, with which it works in a close relationship, favoring the formation and the balanced development of the child with a view to her integration in society as an autonomous, free and solidary being" (ME, 2009: 15). In OCEPE, in the curricular area

"Knowledge of the World" it is considered that the teaching and learning must be “rooted in the child's natural curiosity and desire to know and understand why. Curiosity is encouraged and extended in pre-school through opportunities to engage with new situations that are both opportunities for discovery and exploration of the world “(ME, 2009: 79).

The various social, cultural and economic dynamics that the world faces today "require that education becomes a set of renewed missions, that only collective effort can face" (Carneiro, 1994 cited by Monteiro, 2009: 42). It is not enough to experience everyday contexts for the acquisition of scientific knowledge.

According to Thiesen (2008: 8), "the more interdisciplinary the teaching, the higher the conceptual relations between different sciences, the more problematizing, stimulating, challenging and dialectic are teaching methods, the greater the possibility of understanding the subjects they learn".

Activities developed in the kindergarten context should enable children to become autonomous and independent in relation to thought and the acquisition of know-how. The *kindergarten* educator must "promote the autonomy of the child and the group. (...) The acquisition of know-how, necessary for their independence and the need for greater autonomy, is an opportunity for choice and accountability" (ME, 2007: 53). Hence, after checking skills and difficulties, children should be prepared to experience those activities, in order to prepare them for positive interventions in their nearby surroundings. As Tregenza stated, (s / d: 14), “children are the future. It is hoped that they will take these skills with them when they leave preschool, and continue to implement them in their daily lives. We know that they can and do have an impact on their families and the wider community”.

The cultural metabolism of most population does not follow the principles of ecological sustainability. One hopes that science will solve environmental problems related to anthropocentric practices. However, nature needs a sustainable development which necessarily implies the adoption of environmentally-friendly behaviour. If, on the one hand, the relationship between economic development and environmental balance, which should underpin sustainable development, has been consensual between the political community and researchers in these areas, on the other hand the role of education is in most cases very different and controversial, having been the object of a wide range of analysis. Partaking in the ideals of those defending a critical awareness for this educational problem, education for sustainable development, in its multiple and renewed

perplexities, is a truly challenging problem. Jickling (1992) shares the belief that education should give emphasis to autonomy and critical thinking. According to Uzzel (1998), children are powerful environmental change agents. Souza (2009) points out that education should be innovative and critical, showing children that social justice, solidarity and respect for nature are vital to solving our planet's environmental problems.

Teaching science stimulates children's curiosity as well as their cognitive and emotional development (Pereira, 2009a). It is essential to awaken in them the curiosity and desire to know more about environmental issues in their regions so that children develop their own answers to problems. According to Pereira (2009a: 12), "children build explanations, which may not correspond to current scientific knowledge, but are logical for them."

Practical work as a teaching resource, as Hodson (1998) views it, includes all activities in which the child is actively involved in the cognitive level, as well as the affective and psychomotor level. As for experimental work, and supporting Milk's point of view (2001), it covers the practical activities as well as the control and manipulation of variables.

The *kindergarten* educator has the task of organizing activities which give the children an emotional involvement in learning. These education professionals should take care to plan several activities that are both interesting and challenging and to invite, "young children to observe, explore and experiment" (Chaille Britain, 2003 cited by Wilson, R. s / d: 6). According to Martins, (s / d: 6), "if the methods, language and content are applied age-appropriately (...), science teaching will be able to form proactive thinking society members (...) ".

According to Reis et al (2009), activities should be conducted so that the children observe, question, experience, check and decide. Following a recreational and didactic orientation, activities should also encourage curiosity and develop reasoning. According to St. Augustine, (quoted by Enir Fonseca, s / d: 12), "recreation is eminently educational in the sense that it is the driving force for our curiosity about life and the world, it is the beginning of all discovery and all creation."

Following a socio-constructivist orientation with children attending preschool education, the science teaching and learning process should take into consideration that: the learning of scientific concepts should start at this age; children have alternative conceptions that may condition/preclude the (re)construction of scientific concepts, interests, motivations and new learning.

The pedagogical and didactic training of the *kindergarten* educator student assumes in

this setting a crucial role. This research was developed in the context of a supervised teaching practice of a Master's in preschool and primary education, from a higher education Institution of Portugal.

In the context of the curricular area "Knowledge of the World" (including the areas of natural sciences), at a preschool education level in Portugal, the study aims to include ecology knowledge appropriation to instill environmentally-friendly behaviour in young children. In this context, we designed, implemented and validated pedagogical and didactic resources (PDR) with a group of kindergarten children. Accordingly, we have considered the following research questions:

(i) Do we consider ecology knowledge apropriation, designed in an interdisciplinary perspective (integrating mother tongue and art) and set in everyday situations, suitable to instill an environmentally-friendly behaviour in young children?

(ii) Do we consider practical-experimental activities, in a relaxed and entertaining learning context, a pedagogical and didactic resource suitable to instill environmentally-friendly behaviour in young children?

For these questions the following objectives were defined:

(i) To create experimental contexts (activities) using an interdisciplinary perspective (integrating mother tongue and art) and the relationship of interdependence between the practical and the experimental activities and a relaxed and entertaining learning context.

(ii) To demonstrate the relevance of the practical-experimental activities, in a relaxed and entertaining learning context, to instill environmentally-friendly behaviour in young children.

METHODOLOGY

In this research we chose the action-research methodology. This methodology brought to science research a new way to research, putting the researcher and the participants in the same action plan. It is an essentially practical and applied research methodology, which is governed by the need to solve real problems, with the objective to understand, improve and reform practices (Coutinho et al., 2009). According to Arends (2008), action-research begins with a problem, like any other investigative act. However, its big difference is the production of information and knowledge that allows an immediate application in context. The ultimate goal of action-research is to promote changes (Bogdan and Biklen, 1994) and social development (Almeida and Freire, 2003), assessing the specifics of the educational reality and encouraging decision-making of its agents for change. This

attitude will involve an awareness of each of the actors (individually and in groups) from which the construction of knowledge emerges by comparing and contrasting the meanings produced by reflection (Mesquita-Pires, 2010).

This study was configured as pedagogical and didactic experiment. The PDR designing involved ecology content. The following social-subjects were selected: waste/garbage; recycling bins; waste/garbage reutilization; biodegradable/non-biodegradable; decomposition; preservation of nature/environment. It was developed in the context of supervised teaching practice of the master´s degree in preschool and primary education, with the participation of the *kindergarten* educator, the researchers (the *kindergarten* educator student and the teacher supervisor) and the small group of children (n = 10; 5 girls and 5 boys, aged between three and five years) attending the kindergarten classroom. This supervised teaching practice (STP) was developed in a professional context, in a public kindergarten, which belongs to the Portuguese higher education college cooperation net. It took place over six months (February to July).

The first two weeks of STP were dedicated to observing the group of children in the context of teaching and learning with the teacher of the group. The observation of the children/group allowed us to obtain relevant information for each child and also for the whole the group, and to understand how they deal and react to teaching and learning contexts (curriculum content, interaction: child-child, child group, child educator). To observe each child and the group, "is to know their skills, interests and difficulties, to collect information about the family context and environment in which children live, which are necessary practices to better understand the characteristics of children and tailor the educational process to their needs."(ME, 2009: 25).

Over the first three months of SPT, we found that the group of children, despite their age differences, was very participative and interested in the activities. However, it was found that, during the afternoon, some of the children (especially the younger ones) showed tiredness and lack of concentration. Thus, we chose to develop this pedagogical and didactic experiment only in the morning and for a short period (approximately 30 minutes). The research took place after three months of STP and was developed over twenty days. The conceptual scheme design for the pedagogical and didactic experiment was as follows (Figure 1):

[Figure 1]

Through a dialogue, we defined with the children that over the following weeks everyone

would understand why it is important to protect and respect the environment, and agreed that we would find out the answer to the question “Is our behaviour environmentally-friendly?”

Description of teaching and learning contexts of the three practical-experimental activities

***Contextualized situation*:**

For the three experimental and practical activities- exploring the song:

Of the environment we’ll take care/ and pollution we’ll fight / to get everything clean / and so we can live in it

(I) **1st** practical-experimental activitiy- Theatre: "The eco-colorful”

We are going to: promote contact with everyday waste/garbage, by watching and describing; Promote attitudes of environmental preservation; Understand the importance of our behaviour in protecting nature; Encourage socialization; Develop speaking skills.

The *kindergarten* educator, along with the *kindergarten* educator student, performs a play for the group of children on the theme recycling bins (Figure2).

[Figure 2]

At the end of the play, the room goes back to having different waste/garbage scattered on the floor. Half of the group of children is wearing the colored recycling bins (green, blue and yellow) which were built by reusing materials. The other part of the group puts waste/garbage on the appropriate recycling bin. All repeat the play. The *kindergarten* educator and the student challenge the group of children through irregular behaviour (e.g., incorrectly using the recycling bins). Children show that they are always alert and teach adults the right environmentally-friendly behaviour.

In the end, everyone sings the song:

The recycling bins all should use! / See how you can separate! /

You should always use them! / To change the environment!

(II) **2nd** practical-experimental activity: Recycling Train: building toys.

The activity begins with the establishment of a work plan, in which each child initially decides what she wants to build with the material (waste/garbage train). In a second phase,

children check what they have managed to build (reuse) and why.

We are going to: Understand the importance of waste/garbage reutilization; Promote waste/garbage reutilization; Build toys through waste/garbage reutilization; Stimulate creativity; Develop fine motor skills.

Through painting, stamping, collage and creativity children reused some waste/ rubbish and built their toy (Figure 3).

[Figure 3]

(III) **3rd** practical-experimental activitie: What happens to the waste /garbage we throw on the ground?

We are going to: Promote ecological awareness; Understand the environment (-Get to know it;-Get to like it;-Get to respect it; -We must know our rights and duties;-We must have environmentally-friendly behaviours); Develop sustainable behaviours; Observe and record events over time; Develop curiosity and the desire to want to know more; Develop reasoning and critical spirit; Consolidate the knowledge about environmental sustainability.

The following learning process was followed:

1st. Through oriented dialogue on diverse images:

Children say what they think (alternative conceptions) on:

- Leave waste / trash on the floor;
- What will happen to the waste / garbage lying on the floor?

2nd. How will I find out if all the waste/garbage lying on the floor is biodegradable? (Planning)

Let's build little digesters which we will put in the garden of our kindergarten.

3rd. Experimentation (we'll find out if what I know is true ...)

- 1st challenge:

Children put in plastic bottles: organic waste (fruit peel, bread, oils, ..), plastic, paper, polystyrene, ... Now let's call bottles: digesters (figure 4).

[Figure 4]

- 2nd challenge:

When asked if the digester was equal to the garden soil with garbage, they all answered no.

Via oriented dialogue, they came to the conclusion that it may be similar to soil. Then they went to get soil from the garden and mixed it with garbage/waste.

- 3rd challenge:

When questioned if water is important for the garden soil?

All say so ... because of the plants.

And as for the digesters? They say they do not know.

- 4th challenge:

Let's find out ... How?

Children were challenged to put water in one digester and not in another.

Will it happen something different in the digester that has water in relation to the one that doesn't?

- 5th challenge:

When the digesters were closed, there was the problem of the existence of the air as it exists in the garden. When asked about this issue, they said that we should not cover the demijohn.

- 6th challenge:

When asked if the digesters should be in the sun, they all answered yes. They concluded that the sun was important to warm the digester, as the soil warms (Figure 4).

4th. What I observed (record)

For 15 days, the children followed, by observing, the evolution of waste/household waste deposited in digesters. The group sought an explanation for what they were watching.

5th. At the end of the activity they concluded

The recording instruments adopted were: (i) photos, which, according to Bogdan and Biklen (1994:183), "give us strong descriptive data, and are often used to understand the subjective and are often analyzed inductively"; (ii) iconographics, which according to the Portuguese Ministry of Education-ME (2009) is the most common written record in preschool education; (iii) skills table. The notion of skill can be understood as "knowledge in use" as opposed to "inherent" knowledge (Roldão, 2003), which requires the mobilization of knowledge, abilities, attitudes and values. The skill tables, assessing knowledge, abilities, attitudes and values, have been filled through direct observation, since this allows for the observation and analysis of each child's involvement in the realization of practical-experimental activities. These dimensions affect how each

individual engages in problem-solving and decision-making (Perrenoud, 2001). The observation lets us record events, behaviours and attitudes, in their own context and without altering its spontaneity. Martins et al. (2007) argue that the assessment based on observations made by education professionals will be more effective if it occurs during the performance of practical tasks. Keeping track of what was happening in the group, of the exchanges between children, of the way they conducted the activity and the type of support that they requested were aspects also considered in the evaluation.

DATA ANALYSIS AND DISCUSSION

This qualitative study involved an interpretative and naturalistic approach. The following analysis tools and strategies were used: participant observation, collection of materials produced by children, photographs, collection of alternative conceptions of children in collective dialogue, at the beginning and end of each activity.

Based on direct observation held over the three practical-experimental activities we tried to understand if the following skills had been acquired:

(i) In relation to the knowledge and abilities we noticed the usage of ecological terminology (ex: biodegradable, decomposition, preservation, reutilization) and if the children were able to describe, interpret and apply the information supplied to them about environmentally-friendly behaviour.

(ii) In relation to the attitudes and values we paid attention to: autonomy, responsibility, teamwork, commitment, initiative, curiosity, dismay and joy.

The attitude and value dimension is shaped by cognitive, affective and behavioural components.

The analysis of the results obtained with the PDR used in the pedagogical and didactic experiment was based on the following categories: (a) teaching and learning methodology and teaching resources; (b) children perceptions.

(a) Teaching and learning methodology and teaching resources

Based on the direct observation held over the three practical-experimental activities, designed in the context of an interdisciplinary perspective (integrating mother tongue and art), where children learn from everyday situations and in a relaxed and entertaining learning context, the following education methodology was observed:

(i) the whole group was able to observe and perform the activities, as well as describe, interpret and apply the information supplied to them about environmentally-friendly

behaviours.

(ii) this pedagogical and didactic experiment had a globalizing scope and enabled these children to get involved in procedures and ways of thinking that are typical of the construction of scientific knowledge.

(iii) within the framework of song dramatization we promoted the connection between musical expression, dramatic expression and the development of oral communication, which proved to be a context that fostered involvement and curiosity. It also provoked dismay and joy, therefore raising awareness to the importance of solving environmental problems through our behavior.

(iv) theater and toy building fostered the children's autonomy, responsibility, teamwork spirit, involvement, initiative, curiosity, dismay, joy and oral communication skills. It also raised awareness to the importance of solving environmental problems through environmentally-friendly behaviours.

Children's understanding of what attitudes and environmentally-friendly behaviours are was outstanding, particularly when they were challenged to comment on pictures/photos. We came to the conclusion that activities should be conducted so that the children observe, question, experience, check and decide. The recreational and didactic orientation of the activities also developed their oral language, helping the children to consider the waste/garbage in a new way, as well as encouraging curiosity and developing reasoning. Recreation is eminently educational in the sense that it is the driving force for our curiosity about life and the world; it is the beginning of all discoveries and creation.

(b) *Children perceptions*

The group was always enthusiastically involved in observing, experimenting and explaining.

We were able to observe what the children learned (check learn):

(I) In the 1st practical-experimental activity- Theatre: "The eco-colorful"

To use different recycling bins; I learned the importance of recycling bins for the environment; Why you should never throw waste/rubbish to the floor; Waste/garbage are not all the same to the environment; Only some waste/garbage are biodegradable; I will tell my family why recycling bins are important; I always use recycling bins.

(II) In the 2nd practical-experimental activity: recycling Train: building toys.

I learned that I can reuse waste/garbage reutilization; I made a waste/garbage toy that

went to the recycling center; I used the same type of waste/garbage as my friend, but I made a different toy with it; I will teach my family to reuse waste/garbage from our house; I learned the importance of waste/garbage reutilization.

(III) 3rd practical-experimental activity: What happens to the waste / garbage we throw to the ground?

The young children said:

I observed that not all types of waste/garbage decomposes at the same time; There is some waste/garbage that doesn't decompose (non-biodegradable); I learned that there is waste/garbage that destroys our planet; I learned that I should reduce my waste/garbage; I learned that I must keep the environment clean; I learned that one must respect the environment; I learned new words: digester; decomposition, preservation and sustainability of nature/environment.

Thus, the analysis tools used in this pedagogical and didactic experiment showed us that these children: understood the role of recycling bins; Distinguished the different types of recycling bins; Understood why we should use recycling bins; Identified biodegradable and non-biodegradable materials; Understood the importance of reusing waste/garbage; Recognized the importance of their behaviour for the environment; Knew the importance of environmental protection; Were able to work in groups; Developed their speaking skills. In relation to the attitudes and values shown in the course of the practical-experimental activities it was observed in these children: autonomy, responsibility, teamwork, involvement, initiative, curiosity, dismay and joy.

In performing the tasks, we found that these children did not show discouragement at any time, displaying instead joy, responsibility, initiative and curiosity about what was going to happen. The contribution of this pedagogical-didactic resource in adopting environmentally sustainable practices seems clear. The child will gradually establish relationships between ideas, which will form the development basis for more complex and structured ideas: "There is no competence without knowledge, just as no one solves problems with only knowledge" (Martins et al., 2009: 96).

CONCLUSION

Result analysis for this pedagogical and didactic experiment highlighted the need for an assessment of the wider impact of the teaching and learning of ecology knowledge appropriation, designed in an interdisciplinary perspective (integrating mother tongue and art) and set in everyday situations to instill environmentally-friendly behaviour in the

context of preschool education.

That is, it is necessary that other pedagogical and didactic resources of this type are designed, validated and implemented. This study is part of a wider research area, which aims to analyze methodologies of teaching and learning in science with children of pre-school and primary education.

Preschool education is a determining factor for learning and personal, educational and social inclusion, which should be the foundation for a responsible and active citizenship for all children (Martins et al. 2009; ME 2009, Ferreira, Caires and Pitarma 2015). In this study it was concluded that the practical and experimental activities using an interdisciplinary perspective (integrating mother tongue and art) and a relaxed and entertaining learning context, constitute teaching and learning resources which foster learning of the environmentally-friendly behaviour in young children. This PDR focused on interdisciplinarity, life and daily experience of these children and fostered a relaxed and entertaining learning context. Following a recreational and didactic orientation, activities should also encourage curiosity and develop reasoning. Recreation is eminently educational in the sense that it is the driving force for our curiosity about life and the world; it is the beginning of all discoveries and all creation.

The following were always present throughout our study: a reflective and constant questioning attitude, reasoning and critical attitudes, the development of the children's communication skills, the understanding of scientific concepts, attitudes and values to instill the importance of environmentally-friendly behaviour. The activities developed enabled the children to observe, question, experience, check and decide, it developed their autonomy, responsibility, teamwork, involvement, initiative, curiosity, and allowed them to experience dismay and joy. An important aspect of this pedagogical and didactic experiment was to create a pleasant and relaxed environment, where children felt free to express their ideas and weren't afraid of making mistakes. The activity room was structured to develop autonomy, independence, leisure activities and the realization of choices (e.g. reading corner, modeling clay and painting). This room had direct communication with an outdoor space where there were small plants, which contributed to create this environmentally-friendly atmosphere (clean, i.e. no man-made waste).

The PDR developed proved to be very interesting in terms of teaching and learning methodology, introduced the teaching of science to young children as a way to instill environmentally-friendly behaviour.

Over the four weeks in which this educational intervention took place, it was observed

that the adopted teaching and learning methodology was an appropriate educational tool for the development of environmental literacy. Thus, it was observed that these children: Understood the role of recycling bins; Distinguished the different types of recycling bins; Understood why we should use recycling bins; Identified biodegradable and non-biodegradable materials; Understood the importance of reusing waste/garbage; Recognized the importance of their behaviour for the environment; Knew the importance of environmental protection; Were able to work in groups; Developed their speaking skills.

Despite the previously described positive aspects of this study, we would like to point out situations which may constitute limitations to this study. Thus, consideration must be given to the following conditions: (i) the small size of the group of children; (ii) the duration of the intervention (there were no limitations placed); (iii) the classroom had a direct connection to an outdoor space structured according to safety rules.

The results of this study, combined with results of other research that was already developed, allowed us to conclude that the pedagogic and didactic resources developed, based on science education and framed in a socio-constructivist framework, are a favorable context to promote environmental literacy. We believe that behavioral changes are made gradually and should start with small children. We support the idea that the training of the future *kindergarten* educators in ecology teaching is very important to create skills in order to develop environmental literacy in young children, the foundation for a responsible and active citizenship.

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Legends

Figure 1. Conceptual scheme of the pedagogical and didactic experiment.

Figure 2. The eco-colorful.

Figure 3. Recycling Train: building toys.

Figure 4. The little digesters.