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ECO-SUSTAINABLE KIDS

MIÚDOS ECO-SUSTENTÁVEIS

NIÑOS ECO-SOSTENIBLES

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ABSTRACT | Promoting Environmental Education stimulates a pleasured learning of science subjects. The present study is based on the outcomes of an educational project implemented with Portuguese children from 3 to 5 years old. It included 9 activities, exploring some concepts related to Environmental Education. The effectiveness of this project was assessed via children's interactions, quality of interactions and the resulting products. This project increased children's knowledge about environmental education, stimulated creativity, and promoted practical and field work as well as the link between solidarity and environment. Children's considered that the project provided exciting and valuable experiences, and helped them to improve their understanding and interest on the subject. Concluding, this study highlights the importance of raising children's awareness to Environmental Sciences.

KEYWORDS: Environmental Education, Autochthone forest, Fire prevention, 3Rs policy, Practical and outdoor work.

RESUMO | Promover a educação Ambiental constitui uma via para estimular as crianças a aprenderem a Ciência com prazer. Este estudo baseia-se nos resultados de um Projeto Educativo implementado com crianças portuguesas com idades compreendidas entre os 3 e 5 anos. Este projeto consistiu na implementação de diversas atividades, explorando conceitos relacionados com a Educação Ambiental. A eficácia do projeto foi avaliada através da interação das crianças e produtos resultantes. Esse projeto promoveu a melhoria do conhecimento no que respeita a educação ambiental, promoveu o trabalho prático/campo, estimulou a criatividade e promoveu a ligação entre Solidariedade e Meio Ambiente. As crianças consideraram esta experiência emocionante e valiosa e acreditam que este projeto ajudou a melhorar sua compreensão e interesse por esses assuntos. Concluindo, este estudo destaca a importância de conscientizar as crianças sobre a importância da Educação Ambiental.

PALAVRAS-CHAVE: Educação Ambiental, Floresta autóctone, Prevenção de incêndios, Política dos 3Rs, Trabalho prático e de campo.

RESUMEN Promover la educación ambiental es una forma de estimular a los niños a aprender ciencias con placer. Este estudio se basa en los resultados de un Proyecto Educativo implementado con niños portugueses entre las edades de 3 y 5 años. Este proyecto consistió en la implementación de varias actividades, explorando algunos conceptos relacionados con la Educación Ambiental. La efectividad de este proyecto se evaluó a través de la participación de los niños en términos de interacción y los productos resultantes. Este proyecto aumentó el conocimiento de los niños sobre educación ambiental, promovió el trabajo práctico/ de campo, estimuló la creatividad y promovió el vínculo entre Solidaridad y Medio Ambiente. Los niños consideraron sus experiencias como emocionantes y valiosas y creyeron que este proyecto ayudó a mejorar su comprensión e interés en estas materias. Concluyendo, este estudio destaca la importancia de sensibilizar a los niños sobre la educación ambiental.

PALABRAS CLAVE: Educación ambiental, Bosque autóctono, Prevención de fuego, Política de los 3Rs, Trabajo práctico y de campo.

1. INTRODUCTION

Nature and environmental education play critical roles in early childhood education. This is due to the increased preschool and transitional kindergarten worldwide, and to the awareness for subjects concerning planetary sustainability (Meier et al., 2017). Environmental education within Schools is common and fundamental for intellectual growth; however, its implementation at kindergarten level in Portugal is still at its first steps (Ferreira et al., 2015, Ferreira et al, 2016).

One of kindergartens' educational aims is the familiarization with environmental issues and the promotion of interest about nature and its preservation (Maleki 2003 & Maleki 2007). Several authors advocate that modelling of attitude/values of preserving and protecting environment begins at an early age (Basile, 2000; Bier, 2001; Aini & Laily, 2010). Another study revealed that, early experiences with science/nature incite children's future interest in the sciences (Maltese & Tai, 2010). Consequently, kindergartens are the ideal place to teach environmental education since children spend a lot of time during a day in these places and their age correspond to the ideal time to explore these contents (Hossein, et al., 2011). At this stage, informal methodologies are advised to teach environmental issues, with a focus on participation, communication, problem-solving and critical thinking (Sobel, 2008, Davis, 2010; Pramling-Samuelsson, 2011). The Foundation for Environmental Education (Romania) runs an Educational Program in kindergartens applying these methodologies with positive results. It was observed an increase in these students' knowledge/awareness about the key role of forests in sustaining life (UNESCO Green Cities, 2019)

In order to develop children's knowledge/awareness about environmental issues, a project entitled "Eco-Sustainable Kids" was designed and implemented in a Portuguese Kindergarten.

The objectives of this educational project are: (a) promote environmental awareness; (b) encourage creativity; (c) increase children's scientific curiosity and develop critical thinking and attitudes; (d) promote solidarity; (e) instigate collective actions through the involvement of the School Community.

The activities carried out in this project include, mini-lectures, workshops, experimental and field work. The assessment of the activities was performed in qualitative terms and mainly focussed on the processes, rather than in the products.

2. FUNDAMENTATION AND CONTEXT

The United Nations Organization defined "17 Sustainable Development Goals", to be accomplished until 2030, to eradicate poverty, promote prosperity and well-being, protect the environment and combat the climate change. The present project is in line with the objectives 4 and 12 - "Quality in Education" and "Sustainable Production and Consumption" (Rieckmann, Mindt, & Gardiner, 2017).

Environmental education within the schools can be fundamental for intellectual growth. By presenting social alternatives and exposing their pros & cons, environmental education ultimately enhances awareness to environmental problems, promoting a change in students' attitudes (Steg & Vlek, 2009), and this should start very early (Drewa & Zorena, 2017).

The present project made the connection between science and children's daily life and reflected on a new model of scientific, innovative, creative and entrepreneurial culture. The

increase waste production and the decrease of natural resources was one of the topics addressed. According to some research the exhaustion of natural resources, and the increasing waste production, has been linked to unsustainable human attitudes and behaviors (Oke,2015; Stern, 2000). In this context, it is urgent to raise awareness and work with children about these problematics. In this project children were asked to plant autochthonous species from the Portuguese forest in the kindergarten garden to raise their awareness of the importance to protect living beings. Literature revision showed that educational gardens can be themed towards different subjects, including awareness to the loss of biodiversity, the proliferation of invasive plant species and of the interdependence of people and plants (Vergou, 2010). Planting trees within the school area in collaboration with experts may have a significant impact on student understanding of the role of plants in nature, building positive attitudes towards plants (Fančovičová &Prokop, 2011).

This project was in line with the Portuguese "Curricular Guidelines for Preschool Education" (Silva, Marques, Mata & Rosa, 2016). At this level the educator is the builder, the manager of the curriculum. This should be built with a pedagogical team, giving voice to the children, their families and the educational community and in line with requests from other educational levels. This educational activity must be based on the educator's reflection, on the purposes and meanings of his/her practices, and on the ways in which he/she organizes the action and adapts it to the needs of the kids.

In a social interaction context, the children are recognized for its ability to build his development and learning. Children are the subject and agent of the educational process. The integrated and globalizing approach of the pre-school curriculum highlights the importance of the different content areas that have been developed in this project, including Personal and Social Education Area, Expression and Communication Area and Knowledge about the World Area. The Personal and Social Training Area is considered a transversal area because it focuses on the attitude development, dispositions and values. The Expression Area and Communication, encompasses the different forms of language indispensable for children to interact with others, to make sense and to represent the world that surrounds them. This area includes mastery of: 1. Oral language and approach to writing, 2. Mathematics, 3. Physical education, 4. Artistic education, contemplating the visual arts, dramatic play, music and dance. The understanding of the World Area is considered to be an integrating area of different knowledges, in which children are solicited to adopt questioning attitudes and organize the search for knowledge in accordance with the scientific method, thus promoting a better understanding of the physical, social and technological world (Silva, Marques, Mata & Rosa, 2016). In this project, we highlight how relevant these areas are, and we applied activities that allow to develop those areas of the curriculum. In this work were emphasized aspects related to cognitive, affective and psychomotor domains.

3. DESCRIPTION OF THE EDUCATIONAL PRACTICE AND CONTEXT

The school plays a fundamental role in the children's continuous development, on a personal and social level. An improvement in pedagogical practice is therefore required to guarantee a qualified education for all, capable of providing a solid basis for future learning and, at the same time, to develop the skills considered fundamental to active and democratic

participation in society. In this perspective, teaching should be seen as a process and not as a product.

The Educational Project of the School Cluster where this project was implemented was aligned with this work. The School Cluster assumes as priority objectives of its action: 1. To promote school success through intervention strategies favorable to an improvement of the teaching-learning process. 2. Make the School a quality, welcoming and well-being training time and space. 3. Encourage the participation of stakeholders in the educational process / relationship with the community.

This project was designed and implemented by the author of this manuscript. However, it was implemented with the collaboration of 2 kindergarten teachers, teachers of Arts, Moral, Dance, Physicochemical, researchers from the University of Minho, a specialist in Science Communication, a Firemen Commander, parents of children and City Council.

3.1 Participants

The activities of this study were developed between December 2017 and June 2018. This research involved a kindergarten. The participants' (n=40) age varies between 3 and 5 years old. The study was approved by the School Board, after hearing the Pedagogical Council since an Ethics Committee does not exist at this School Cluster. Informed consent to participate in the project was obtained verbally from the children's tutors on behalf of the children enrolled in this project. This consent was obtained during a regular meeting, in which the kindergarten teacher explained the aims of the project and requested authorization. Written informed consent was obtained from the children's guardians for the pictures shown in this manuscript. This is a collaborative project between kids, teachers, parents and School Community.

3.2 Activities Implemented

Activity 0: Kick off- Logo Creation

The objective of this activity was to create a logo and a flag for the project. In this phase, we aimed to draw children's attention to the importance of creating a brand as a strategy to promote a product or activity. We gave several examples of brands that the children identified, such as chocolate, ice cream and cereal brands. This activity continued with a mini-lecture about the logo creation story. To motivate the children, a review of the logos success stories such as those related to the automotive industry was made. Afterwards children, with help and guidance, started to create the project logo in the school garden. This activity consisted in the execution of a mural painting in the school garden with all the children proposals. The best representation related to environmental education was selected and became the project logo. The criteria of the logo execution were provided to the children (size, colors, proportions, shapes, division in space and themes) and clues were given on aspects of nature / environment to inspire children. Their artistic productions allowed them to develop competences related to environmental awareness and creativity (Fig 1A).

***Figure 1A*.** Execution of a great mural in the school garden

Figure 2A. Construction of the flag.

Subsequently children were asked to create a flag with recyclable materials (Fig 2A). Figures 2B and 2C illustrated the ultimate logo and flag.

***Figure 2B*.** Final Logo

Figure 2C. Final Flag

Activity 1: Recyclable campaign/Cleaning brigade

Beforehand, children were made aware of the fact that many products they use every day will have future uses if these are recycled. With help, they identified some of these substances as scraps of paper, cans, cardboard, scraps of fabric, etc. After this approach, the recyclable campaign was created. Aspects related to the storage of these materials were also explored and, with the help of the children, a location at the school was selected for this purpose. Different paper boxes were identified with different colors to store the different products.

This activity was conducted with the help of the children's guardians. Plastic containers, tin cans, glass, stoppers, cork stoppers, cardboard fabrics, trunks, colored paper, magazines and textile waste were collected. Some of these materials were collected by the kids cleaning brigade in a forest near the kindergarten. In this phase, besides the importance of the involvement of kids and guardians, it was pointed out the importance of recycling materials and of reuse to reduce environmental impacts and increase sustainability. These materials were used in later stages of the project (Figs 3A, 3B).

Figure 3A Cleaning brigade working in the forest

Figure 3B. Recyclable campaign: Ecopoints construction

Activity 2: Lecture" What to do to protect the forest and prevent fires" /Practical work

The objectives of this activity were: (a) characterize some functions of trees, (b) identify the differences between deciduous leaf and persistent leaf, (c) know trees' products, (d) Identify trees from the Portuguese forests, (e) understand measures for tree conservation and forest protection against fires. This phase was developed by a Biologist and expert in Science Communication (Fig 4A). The interaction with the scientific community, even premature in this age is very important to open children horizons and motivate the childhood educators. The theoretical part was conducted by the Biology expert who questioned children about concepts related to trees, their constitution, shape, functions and protection. This expert gave drawings with incomplete trees to the children and asked them to complete those with roots, leaves, fruits and nests, among others. This part was free, allowing stimulating children's creativity (Fig 4B).

Figure 4A. Lecture" What to do to protect the forest and prevent fires"

Figure 4B. Practical work: Trees design

Activity 3: Visit to the Headquarters/Firemen's Museum

This activity was developed in the headquarters and was conducted by the Fire Commander. Initially, the Commander showed a video about the Fire Department, showing different firefighter's functions, namely: combat fire and other natural disasters, wounded transport and other ludic activities. The Commander also spoke about Forest Fires stressing the main causes and care for their protection. In the second part of this activity the Commander showed the vehicles used in firefighting, the specific clothes used by firefighters such as suits, gloves, helmets and vehicles used to transport injured persons. Children were also informed about the numbers, 112 and 117, in order to contact firefighters. To finalize children visited the Firemen's Museum (Figs 5A and 5B).

Figure 5A. Visit to the Headquarters of V.N. Famalicão

Figure 5B. Visit to Firemen's Museum

When children arrived to the kindergarten constructed objects using recyclable and natural materials alluding to this visit (fig 5C).

Figure 5C. Object creation using recyclable material alluding to the firemen's visit

Activity 4: Recycling workshop/Listening Science

This activity was invigorated by a group of researchers from Minho University, located at Braga, Portugal. It initiated with a small interactive lecture adapted to children's age. The objective of this activity was to explore some contents such as 3Rs policy: To Reduce, To Reuse and To Recycle. Several examples of recyclable materials were presented. Afterwards, 3 sheets were distributed to the children with the Rs drawn. Children decorated the Rs distributed with recyclable materials, namely colored paper pieces, small pieces of straw, scraps of fabric, buttons, paper, caps, newspaper clippings, traces of fabric and plastic (Fig 6). In this activity, creativity was also explored.

Figure 6. Recycling workshop promoted by the Scientific Team from the University of Minho

With these materials and glue children covered the 1st R, whereas the 2nd R was covered with paper of different colors and the 3rd R covered with little pieces of plastic. Concluding, this research team made a final synthesis on the importance of the 3Rs' policy for the Earth sustainability, ending with a slide that represented a humanity cuddle to planet Earth that was much applauded by the kids.

Activity 5: Garden improvement

The objective of this activity was to plant autochthonous species from the Portuguese forest in the kindergarten garden to enhance respect, protection and conservation of our autochthonous forest. This activity was made in collaboration with experts. Some species were selected such as: *Quercus robur, Quercus pyrenaica, Acer pseudoplatanus, Prunus lusitanica ssp* and *Arbutus unedo*. The soil was previously prepared and children with teacher guidance planted the previously mentioned species (Fig 7). Wooden plaques with the scientific names were placed next to each plant. The children showed clear pleasure during this activity.

Figure 7. Kids and Garden improvement

Activity 6: Lecture "Importance of the forest and solidarity in face of fires

In this activity, we selected a book about environmental veneration entitled "The Generous Tree", by Shel Silverstein. We read the history to the children, and after, we discussed about book messages, such as tree protection and environmental solidarity. Another book was chosen "The Lizard History" and the different personage's messages were discussed, including the importance of solidarity between living beings. We extrapolated these messages to human beings (Fig 8A and 8B). Later children made drawings to illustrate "The Generous Tree" history (Fig. 8B). A careful analysis of these drawings showed that the children understood the notion of solidarity well. The drawings illustrate examples of human and environmental solidarity.

Figure 8A. *Mini-Lecture:* "Natural and Social importance of the forest and solidarity in the face of fires"

Figure 8B. *Mini-Lecture:* "Natural and Social importance of the forest and solidarity in the face of fires"

Activity 7: clothes' design alluding to the forest

In this activity, children with parents and teachers were asked to make pieces of cloth allusive to forest themes (clouds, wind, snails, worms, butterflies, birds and wolves) with recyclable materials in order to perform a choreography (Fig.9).

Figure 9. Clothes design alluding to the forest

Activity 8: Public presentation of the project and Environmental Dance performance

This activity was realized in one Parish Council. The project Coordinator presented to the School Community the different phases of this project and after children performed a choreography created by the Dance Teacher for the music “Somewhere Over the Rainbow” of Israel Kamakawiwo'ole. This activity was open to all members of the School Community.

The Educational Community followed the project, given the effort that was made in its dissemination using several channels such as the school website, Facebook page, Educational Bulletin of the region and Regional Newspapers.

4. AVALIATION OF THE PRACTICAL IMPLEMENTATION AND MAIN RESULTS

The integrated and globalizing approach of the pre-school curriculum lead us to the different content areas developed in this project, namely: Personal and Social Training Area, the Knowledge Area of the World and Expression Area and Communication. In the next section a short summary of the activities implemented on each area is presented:

1. Personal and Social Training Area: visit to the forest and consequent observation of nature (flora and fauna), creation of the "Environmental Brigade", organization of lectures/workshop that included aspects of environmental education (reducing, reuse and recycling, forest preservation) and solidarity.

2. Knowledge about the World Area: Internet research on flora and fauna, classification of the flora found in the forest, exploration of the main constituents of trees, planting native trees, visit with firefighters, learning 3Rs' police.

3. Expression and Communication Area: Logo and flag conception and design, stories exploitation (highlighting the history of the "Generous Tree"), choreography, performance, recording different activities, painting, drawing, building Eco points, object creation with recyclable materials (fire engines, butterflies, caterpillars and owls). Finally, leaflet elaboration resulting from the participation in this project.

The activities implement fulfilled the delineated objectives**:**

Objective (a) Promote environmental awareness, standing out the role of the cleaning brigade and the activities 2, 3, 4, 5 and 7. When finished the activity 2 children made some comments, expressing their concerns about the forest with a focus on forest fires and the image of the firefighter emerged as being of vital importance in the actual society. They also called attention to the cleanliness of the forests and the importance of recycling, by making the following comments:
"I saw firefighters in the summer to put out fires and save people"; "Bad people make fires"; "Forests give us very good things, like air and wood"; "We are a cleaning brigade to clear forests."
In the activity 3, children became aware of many practical aspects related to the work of firefighters. They said: "The firefighters do many good things"; "I have fear of fire"; "I like very much of the firefighters because they save the forest". "Firefighters drive ambulances to save people animals and forests";
During the activity 4, 3Rs' policy, was explored through a theoretical/ practical activity appealing to natural resources' economy, children were very motivated and committed. They understand the nomenclature and the meaning of the 3Rs' policy and gave some examples of reuse and recycling materials.
In the activity 5, children lived a very enriching experience, getting to know native plants, their common and scientific names and reminding the importance of native flora. They said: "Let's bring the Portuguese forest to school"; "Let's play in our school forest", "Why can trees have 2 different names?"; "The water is very important to our forest".

Objective (b) Potential to encourage creativity, stands out the Kick-Off: Logo Creation and the activities 2 and 8.

Objective (c) Potential to increase children's scientific curiosity and develop critical thinking.
All the activities contributed to reach this objective. Children along the project adopted attitudes of questioning and argumentation.

Objective (d) Promote solidarity, the activity 6 besides consolidating the contents explored in the activities 3, 4 and 5 also explored essential aspects related to human solidarity. Children mentioned that they have already perform acts of solidarity such as: "I help the little ones in kindergarten", "I sing for the old people", "I visit relatives when they are sick" and "I participated in solidarity campaigns".

Objective (e) Instigate collective actions through the involvement of the School Community, Recyclable campaign and activities 7 and 8. These activities included parents and teacher's participation. The construction of forest-inspired clothes with recyclable/organic materials have the potential to develop creativity and initiative, and once again, to draw the attention to the reuse of materials allowing the close involvement of the parents. Parents commented this project activity and the project as a whole. They said: "Our children were very happy with our involvement in the project"; "After each activity my son came home very happy and reported everything that had happened"; "During this project I was forced by my daughter to separate the domestic waste"; "The construction of the clothes with natural materials was very interesting". The activity 8 oriented by physical education teachers worked the psycho-motor skills, and imagination that are crucial aspects in children of this age group. The parents were also involved in this activity.

The observations made throughout this project suggest that these activities have the potential to motivate students. Besides the evidence collected to support the achievement of the educational goals previously described, this project may also have contributed to develop children' creativity (explored in activities 0, 2, 4, 6 and 8), critical thinking and curiosity (all the activities). In fact, along all the project, children adopted attitudes of questioning and argumentation. The assessment is only qualitative and mainly focussed on the processes, rather than in the products. Nevertheless, in future works it is necessary to evaluate these learnings gains quantitively.

The objectives outlined in this project were fulfilled and even exceeded. The enthusiasm showed by the Eco-Sustainable children was constant and contagious. The project allowed children a) to become actively involved in making this whole process more dynamic, b) found pleasure in knowledge, c) awake to the practical meaning of Science, d) work values of solidarity, creativity and imagination, and e) develop psycho-motor aspects.

Eco-sustainable children developed skills linked to environmental knowledge, awareness, reasoning and citizenship. It was observed that children were always very proactive.

Throughout the project hands-on work, fieldwork, psychomotor activity, knowledge, awareness, creativity and imagination, discussion, critical thinking, dialogue were encouraged. Cognitive, affective and psycho-motor aspects were strengthened. The Educational Community followed the project given the effort that was made in its dissemination and observed with great satisfaction the choreography.

5. CONCLUSION AND IMPLICATIONS

With the engagement of children in this project they have developed cognitive, affective skills. In addition, children become more aware of the importance of environmental issues. The project also promoted the interaction and experiences exchange between several educational partners, involving teachers from different educational levels, with different know-how and professional skills, researchers and parents, being deeply enriching and rewarding. Parent's engagement in school is central to parent–teacher communication and the school climate was more welcoming (Rattenborg et al., 2019).

Through the activities developed in this project children become aware of environmental and economic issues related to the forest. It was emphasized the role of native flora in fire prevention and environmentally friendly practices in order to prevent this catastrophic problem. The issue of recycling was explored whenever appropriated. Values related to sharing and solidarity were also explored, which will certainly be reflected in the future in terms of active citizenship of the Eco-Sustainable kids and the entire Educational Community. Environmental education and active citizenship are a priority and can have implications for the success of biodiversity conservation and human well-being as well as colossal economic impacts on the societies at medium long term.

Due to the wide acceptance and involvement of various actors in this project, we believe that children need to have more opportunities like this, so it is recommended to repeat such interventions in kindergartens.

Nevertheless, this work presents some limitations such as the fact that this intervention was carried out with a small group of children in a particular context.

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