

TEACHING ANIMAL CATEGORIZATION IN PRESCHOOLERS USING TYPICAL - NON TYPICAL EDUCATIONAL ENVIRONMENTS *

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Abstract: The aim of this research study is to present the goals, the content and some evaluation elements of a teaching intervention for preschool children concerning animal categorization. The intervention combines typical and non typical educational characteristics and takes place both in the school class and in a zoological museum. More specifically, we will present the cognitive objectives of the intervention which are the following: (a) the familiarization of children with various samples of animals, (b) the movement of children's ideas from using anthropomorphic or functional criteria to the use of morphological criteria for classification of animal samples, (c) the identification of new samples of animals with one of the constructed categories of animals and (d) the creation of a new class of animals in case of the animal sample does not fit in any of the constructed categories. In this study we will focus on the characteristics of teaching activities which take place during the visit to the zoological museum at the University of Patras. Some preliminary results which support the hypothesis that the museum educational activities have a positive impact on the fulfillment of the mentioned didactical objectives will be presented.

Keywords: Preschool education, zoological museum, animal classification, cognitive precursor models

INTRODUCTION

The present study is part of a wider research related to the design and evaluation of a teaching intervention which addresses to preschool children with the cooperation of school and zoological museum. The educational program is one of the forms of active involvement in school activities on science and technology (Koliopoulos, 2009), which promotes a structured scientific knowledge (Martin, 2004; Piqueras et al. 2008) and is regarded as a rich educational activity, which contributes to the achievements of scientific literacy (NRC, 1996). The latter form is usually based to the cooperation of the museum with the school, which, as noted, can combine the advantages of the museum and the school environment in order to achieve its full educational goals for visitors - students (Anderson et al., 2010). Studies have shown that students who have worked on subject before visiting a museum foundation and are prepared for the visit learn more from their experience (Griffin, 1994).

The objective of the teaching intervention is to be constructed by children a precursor model of classification of animals. Children learn about animals in a variety of ways. In zoos and museums, which children have been visiting ever since these establishments opened their doors to the public (Tunnicliffe & Reiss, 2000). The zoological museum of first generation is the oldest and most conventional type of museum where there are exposed collections of animals usually embalmed. This type of museum seems to be a suitable environment because of

an explicit or an implicit way, it gives meaning to its collections through the concept of systematic classification of animals.

In parallel it has also been noted that children of this age can build precursor models of natural sciences through a socio-cognitive teaching approach according to which they are able to form explanatory forms compatible with both the knowledge of science and their own mechanisms for recruiting and processing knowledge (Ravanis, 1996). In this study will be present the goals, the content and some evaluation elements of a teaching intervention for pre-school children concerning animal categorization.

THE DESIGN OF TEACHING INTERVENTION

The principles of the design of the proposed teaching intervention are referring to (a) the structure and content of school knowledge on the subject, (b) the constructive approach of teaching and learning of science in early childhood education and (c) the museological conception on the teaching effectiveness of programs when they are carried out with the cooperation of school and museum environment.

The cognitive field which is the subject of teaching and learning in our case is the field, of the classification of animals. There are different theoretical starting points within which the concept of classification takes a different meaning. The currently accepted theory of evolution has led to the grouping of animals according to their relationships or the affinity of species (phylogenetic approach) and their common origin (genealogical approach). According to this theory the animal species are transformed and evolving entities and the hierarchical clustering result from a careful examination of similarities and differences in order to distinguish between the features which are due to their common origin and not the analog characteristics which are due to similarity in their function (Mayr, 1982; Lecointre, 2007). Is it possible through that, this epistemologically valid knowledge can be the scientific knowledge of reference for the teaching of the subject in preschool education? Our interest focuses of course on micro-classification, a field that is examining the methods and principles with which are identified and described the types of organisms (Mayr, 1982).

It is considered that in our approach it is impossible to introduce the types of living beings (here animals) as a biological species (taxa) in the modern sense of the term. In contrast, we use the concept of typological kind, which it may derive from theoretical framework where the notion of classification is recognized and becomes accepted without resorting to the theory of evolution, but it does not contrast with the concept of biological species). The typological (or morphological) type is considered to be a separate and stable entity, where the species are determined by fixed, key characteristics, usually morphologically. Scientists officially recognized a kind by defining a sample type that was recorded and deposited to a museum in order to represent the ideal form or morphology of the species' (Hickman, Roberts & Larson, 2001). Even today there are scientists who study only preserved specimens-types for which the dominant conception of species remain typological (Mayr, 1982; Hickman, Roberts & Larson, 2001). It is considered that this choice doesn't represent, at first an epistemological rupture between children's conceptions (who use mainly anthropomorphic or functional criteria to classify animals) and the knowledge where the criteria for classification of animals are purely morphological. It is also assumed, that the transition from the empirical criteria to criteria concerning the theory of evolution would be difficult or impossible because of the enormous distance between the two cognitive structures. So, the conceptual component of the proposed school knowledge is established, firstly as a didactic transformation of knowledge of the typological species and secondly, as a simplification of the collections of the Museum of Zoology of the University of Patras used as a museum reference. There are created, simple collections (Lecointre et al, 2007) and were formed four typological species, reptiles, birds,

fish and mammals. As main morphological features of distinction between typological species were considered the anatomical characteristics and the nature of the skin (scales for reptiles, feathers for birds, scales for fish and hair for mammals). Yet they were established collections of samples of animals which form the phenomenological basis of intervention.

As for the methodological dimension of the proposed school knowledge, the emphasis was on the process of systematic observation of animals which responds to specific questions, is used to confirm some assumptions and is based on finding criteria of similarity or comparison (Guichard, 1998; Lecointre et al , 2007).

The constructive approach of teaching and learning of science in early childhood education is the second principle we take under consideration. This approach is based on assumptions according to which preschoolers can build conceptual models of precursor science (Zogza & Papamichael, 2001; Ravanis, 1996). It has been noted that the construction of these models can be possible within the interventions of teaching where the teaching objectives have been based on the cognitive obstacles or the general cognitive abilities of children of this age (Ravanis, 1996, 2005). Thus the teaching activities are designed so as to be used constructively the cognitive capabilities or/and removing the cognitive obstacles that children have (Ravanis, Koliopoulos & Boilevin, 2007; Koliopoulos & Argyropoulou, 2011). As for the construction of the concept of classification by preschool children, researchers note that children of this age use basically the anthropomorphic and the functional criteria (eg, habitat and movement) rather than morphological criteria to classify the different types of animals (Trowbridge & Mintzes, 1988; Kattmann, 1998; Zogza & Papamichael, 2001). The proposed teaching intervention, therefore, emphasized on activities that aim at (a) the ability of the children to distinguish and name samples types of animals and (b) at shifting children's interest to the morphological characteristics of the sample-types through an organized and systematic observation of images and zoological exhibits. Examples of such activities are provided in the following section.

Finally, as for the educational environment in which will be implement the teaching intervention, was chosen to approximate three phases, each of which implemented in a formal (school) or non formal (museum) learning environment (Table 1).

Table 1 here

Each of the three instructional phases corresponds to qualitatively different educational activities (Allard, Boucher & Forest, 1994; Paquin, 1998). In the preparation phase before the visit, which takes place in school, questions are submitted and a discussion is developed concerning the museum object. On the phase during the visit which takes place in the museum, is carried out the data collection and analysis as well as the systematic observation of the museum object. Finally, in the phase after the visit which takes place in school, the aim is the further processing of data obtained in the previous phase, the drawing of conclusions and the evaluation of the constructed knowledge. This approach is based on an inquiry-based teaching and learning method engaging students in identifying relevant evidence and reflecting on its interpretations (<http://fibonacci-project.eu/>).

THE CONTENT OF TEACHING INTERVENTION

The cognitive objectives of teaching intervention which correspond to the desired cognitive progress of children are the following: (a) the familiarization of children with various samples of animals, (b) the movement of children's ideas from using anthropomorphic or functional criteria to the use of morphological criteria for classification of animal samples, (c) the identification of new samples of animals with one of the constructed categories of animals and (d) the creation of a new class of animals in case of the animal sample does not fit in any

of the constructed categories. Then we describe the key features of teaching activities which we assume that will contribute to the achievement of these objectives.

Activities prior to the visit

The activities carried out before the visit included activities where according to the principles of constructivist approach are investigated primarily the initial conceptions of children on the subject of teaching intervention. Within these activities the children are asked to recognize and name the samples of animals which are depicted in a series of cards which constitute the first simple collection of animals. In addition, children are asked to create groups of animals by classifying the various samples of animals which are depicted on the cards and indicate the criteria used. Finally, there are activities aimed at developing children's interest on their visit to a museum of Zoology.

Activities during the visit

These activities are carried out during the visit to the Museum of Zoology of the University of Patras. This particular museum exhibits mainly taxidermies animals placed in showcases that correspond to categories of animals, perfectly compatible with the typological categories of items that we seek to be constructed by children. There were introduced activities where children, through systematic observations, were asked to deconstruct the categories of animals that have been created in school and to compare their own categories with the categories adopted by the museum. Finally, children are asked to reconstitute the animal categories based on their observations and the emergence of common morphological features for each category. An example of an educational activity that took place in this phase is represented in Table 2.

Table 2 here

Activities after the visit

During the activities after the visit, experiences of the visit are invested in the construction of new knowledge from the children and the achievement of learning objectives of the program is assessed. More specifically, children were asked to compare the groups of animals which themselves had built at the beginning of teaching intervention to those created in the museum. They were also asked to include new images of samples of animals to the categories of reptiles, birds and fish, that were already familiar to them, or to suggest a new category (mammals) in case of the appearance of a new morphological feature.

THE COGNITIVE PROGRESS OF CHILDREN

The results of the analysis of perceptions of children's categorizations of animals came mainly from the *Pre – Post test (interview)*, which took place before the beginning and after the completion of the educational program. We use individual semi structured interviews for all the children who participated in this pilot study- educational program. Complementary, the second unit of the results consists of the data which collected through observation of the subjects of the research, during the visit to the zoological museum.

The main conclusions which drawn after the final interview are as follows: Three of the nine children considered to have built a vision classification of animals based on purely morphological criteria, because they were able to identify, name and classify all samples of

animals were given, while to suggest a new class of animals other than those which studied the museum and to justify their presence by using morphological data. Five of the nine children are in the process of building a culture of classification of animals based on morphological criteria. These children fail to nominate at least two categories of animals, but not always using purely morphological criteria (introduced, for example, the criterion of residence). They also recognize a new category of animals without name it. Finally, only one out of nine children who participate in this pilot study seems not to cognitive progress notes remaining on his original ideas.

Some complementary data which obtained during the children's visit the at the museum are indications that the activities of target observation suggested to the children contributed to the final construction of the classification of animals by using morphological criteria. Here are some examples of children's conversations with the researchers during the activity identification of exhibits on display in the zoological museum: "... This is a big peacock ... I have not seen it before" (Spiros). "... Look like a fish ... we see those in the sea during the summer, but here these look bigger" (Androniki). "... all snakes are here ..." (Themis). Infants also through the educational activity which took place during the visit to the museum identified the representative characteristics of each group (birds, reptiles and fish). "Here is the group of birds all have wings ... are all around, in the nearby showcases and small and large" (Francesca).

The next educational activity which took place during the visit to the museum, where the children have to compare samples of animals depicted in these photos of exhibits and trying to assign each exhibit with the photograph, appears to be a suitable environment to move children from the original 'experiential' criteria for the classification of animals on criteria which mobilize mental representations based on the morphology of animals.

Characteristic is the phrase that Ianthi looking at an exhibit in a showcase says: "... This little bird is the same as what we saw in the photo at school ...and in this one ... has many ... colors in the wings ... and small legs as the other." [meaning the exhibit depicting in the photograph], (Ianthi). While Phoebus indicate "... but since that is not the same [pointing to the pairing just made his classmate between photography and the exhibit], a different color in the wings ... we decided to find the same ... this is the same", (Fivos).

CONCLUSIONS

A key finding of the research activity developed during the planning of this educational program described here is that the collections of the Zoology Museum of the University of Patras can be attributed by meaning, which can be potentially appropriate educational materials that will contribute to the cognitive and emotional progress of children of preschool education. These meanings come from both the nature and characteristics of the museum and, mainly, the objectives and content of each educational program. This means that the museums are possible through the model of educational program to upgrade the communications and educational role while simultaneously achieving objectives of the formal education.

The results of the program, in particular the activities undertaken during the visit, using the empirical basis of the museum (the zoology museum's exhibits) may provide an appropriate environment for children of preschool education to create a variety of meanings, to certain networks operating, rules and standards of interpretation, according to which they will 'translated' their experiences and assimilate the information from these intakes (Ravanis, 2005). So, if some of these networks of meanings, as in the case of the proposed program appears to be set up exactly due to the systematic interconnection of the contents of formal (school activities) and informal (museum activities) form of education, then demonstrate the functional re-

relationship between the two forms of education and this is a central hypothesis in our ongoing investigation.

The positive response of the overwhelming majority of children who participated in this program was another finding of this investigation. But this is not an unusual finding itself as the natural history museum with collections of "teaching remains an advantage that will make [visitors] to admire, be surprised and wonder (Van Praet, 1989). The important questions whether this response is and how the cognitive function in a privileged way is introduced in the proposed model of integrated curriculum. This is another interesting idea to be transformed as a research case study and in the future to be further explored.

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Before the visit	School	Preparation	Submit Question	Reflections on the museum object
During the visit	Museum	Completion	Data collection and analysis	Observation of museum objects
After the visit	School	Extension	Analysis and synthesis	Building knowledge through museum objects

Table 1: A three phases' model for the educational use of museum

Educational Activity	Cognitive Objectives
<ul style="list-style-type: none"> - The teacher - researcher asks the children to deconstruct the groups of samples of which were created at school and they are invited to put the cards which depict animal samples in the respective proposed showcases of the museum. - Subsequently the children are asked to construct groups of animals, placing the pictures with samples of animals placed in the same and / or in adjacent showcases in the same group. - Finally, children are invited to make assumptions for the reasons in which specific samples of animals belong in different groups of animals which were formed, turning the debate on the existence of morphological similarity criteria. 	<p>Children have</p> <ul style="list-style-type: none"> - To identify and name images of samples of animals through systematic observation. - To modify the criteria of grouping of animal samples by using morphological criteria.

Table 2: Educational activity during the visit to the museum of Zoology