International Journal of Innovation and Research in Educational Sciences
Volume 2, Issue 6, ISSN (Online): 2349–5219

Children Ideas for "Animal" Compared to Teachers' Conceptions

Penelope Papadopoulou, Kyriacos Athanasiou

Abstract – **The study described in this paper is a part of a cross-sectional study which focuses on Greek children in preschool and middle school age and to primary school teachers' concepts and classifications regarding animals and the associated values attached in concepts and classifications; i.e. which entities categorize as animals and which are the categorization criteria they use and if they differ with the course of age. The research was conducted with group and individual interviews and proper modifications of Interview about Instances (IaI) technique. Various groups of children and primary school teachers as a representative group of adults were interviewed for the meaning of the concept "animal", and the constant comparative method was employed to analyze data. Key findings in children ideas are the recording of a limited range of entities, which are categorized as animals, the use of sensory criteria mainly for deciding about the categorization, and especially the human-oriented course of perceptions. Findings indicate that the meaning of the concept of "animal" that both, children and teachers possess is restricted and anthropocentric, as it appears a universal denial of human categorization in animal kingdom. Nonetheless, it seems that the anthropocentric ideas of school children and adults differs qualitatively, as school children, besides taking more anthropocentric stands compared to adults, they are not led so much by ideological and ethical motives in their decisions, a fact that seems to be developed in lateral stages of life.**

Keywords – **Preschool Children, Primary School Pupils, Primary School Teachers, Ideas, Conceptions, Animal**.

I. INTRODUCTION

A lot of research has been conducted on the concepts and classifications children use about animals (Bell, 1981; Trowbridge & Mintzes, 1985; Tema, 1989; Braud, 1991; 1998; Villabi & Lucas, 1991; Barman et al., 2000; Papadopoulou & Athanasiou, 1998; Tunnicliffe & Reiss, 1999; Kattman, 2000; 2001). On the other hand, teachers' concepts and classifications remain relatively unexplored, with the exception of Mak's et al. (1998) research on the concept of "amphibians", although Bybee (1993) maintained that teachers are the "change agents" of educational reform and that teachers' conceptions and beliefs must not be ignored.

It has been suggested in the past (Atran et al., 2004) that it is important to understand (a) how ordinary people think about the organic world and (b) how scientific concepts emerged in industrial societies for several reasons. Studies have pointed-out that first of all, humans of different ages use different criteria to decide what life is: The first characteristic is that, children and often adults, consider "life" as a sole characteristic attributed only to animals and humans. They cannot perceive the fact that living things are characterized by multiple characteristics like: 1) a need to obtain matter energy from the environment to stay alive and to do so they have mechanisms that allow them to find out what goes on around them. 2) Living beings continuously change by reconstructing themselves and they modify the environment in which they live. 3) Living beings perpetuate themselves (Martinez-Losada, Garcia-Barros & Garrido, 2013).

Children normally establish an ontological difference between living things and inanimate objects, like dolls, from a very young age. Both children and adults living in a society that being imbued with Christian- Judaic ideas, are unable to conceive that both plants and animals, and of course, humans, belong to a single entity that is the world of living organisms. They cannot think that animals and plants are evolved from early life forms, and humans from other animal forms. As it is now, well known, often children of various ages and teachers, as well, repeat the ideas of scientists or the philosophers in earlier ages; i.e. they repeat Aristotelian ideas as they further were elaborated by Descartes and as they were portrayed in the Judeo-Christian tradition: That is to say 1) Aristotelian Typology, and 2) Hierarchical and pyramidal assignment of organisms, where the base is possessed by the plants, follows the level of animals and in the top are humans. This has as a result the explicit segregation in the minds of children, and often adults, between plants and animals, in one hand, and between humans and animals, on the other. So, children have problems in including plants in the category of living things, because they consider their basic characteristics to be different from those of animals. In the same way, other authors point out that even though children recognize that animals and plants share certain qualities, this fact does not usually lead them to conclude that plants are living things just like animals (Tamir, et al. 1981; Leddon, Waxman and Medin, 2011; Martinez, 2014).

The survival of the Cartesian dichotomy "man- anima"' or otherwise, the anthropocentric perceptions, have been recorded in surveys concerning to animal-related perceptions of school-aged children (Tema, 1989; Barman et al., 2000), and indeed, as is the case with the alternative conceptions, it is maintained after the completion of the first two levels of education among non-experts adults (Athanasiou & Papadopoulou, 2005). The anthropocentrism which is recorded in the afore-mentioned surveys consists partly of a non-inclusion of humans in the scope of the concept of "animal", and partly on the existence of an anthropocentric reference-framework for the same concept. Confirming the position of Villani & Lucas (1991) that someone should not make generalizations from such findings when dealing with unlike cultural contexts, the anthropocentrism of perceptions is not mentioned as a finding in another series of surveys (Bell, 1981; Villabi & Lucas, 1991; Bell &

Freyberg, 1985; Trowbridge & Mintzes, 1985; Lowe, 1997; Yen et al., 2007), although the inclusion of humans in the range of concept does not seem to be acceptable.

The findings of surveys which were mainly English-speaking cultural contexts, such as New Zealand and the U.S. (Bell, 1981; Bell & Freyberg, 1985; Trowbridge & Mintzes, 1985; Barman et al., 2000) record usage of the word "animal" as synonym with the word "mammal". The above findings do not converge with the findings of other cultural contexts (Villabi & Lucas, 1991; Lowe, 1997; Papadopoulou and Athanasiou, 1998; Yen & Mintzes, 2007). Where all the investigations converge noteworthy, despite the different cultural contexts, are the findings as to the criteria for classification decisions. The criteria that constitute the depth of the concept 'animal' are primarily, but not exclusively, sensory-type criteria i.e. morphological characteristics, apparent behavior (e.g. movement) and the type of residence of the entity (Habitat). Of course, there is recorded a diversification in some of the criteria depending on the cultural environment (Lowe, 1997; Papadopoulou & Athanasiou, 1998; Yen & Mintzes, 2007).

At the same time, learners have fundamental ideas i.e. conceptions and beliefs that should be built on, replaced, removed, or ignored. The latter applies to teachers, as well, that often have fundamental ideas about both their subject matter and teaching itself. DeJong et al. (1995) have indicated that teachers' knowledge about their subject matter may function as a source of difficulties in teaching curriculum topics. Furthermore, many prospective elementary teachers need to learn the content of science at the same time as they are learning to teach science.

Educational research is focused more towards the study of the acquisition of scientific knowledge processes in populations of students older than ten years, as confirmed by all of the aforementioned studies with the exception of a few. For example one which was carried out by Zogza et al. (1996), explores, in essence, the concept of live in preschool children. According to this study, a form of autonomous biology is acquired early in childhood, while in later stages conceptual changes take place or simply knowledge is enriched, something that is very likely to apply in the case of basic classification (e.g. discrimination in animals – plants – inanimate. Other studies, while provide evidence that the basic conceptual framework for differentiating living and nonliving things seems to appear earlier than previously thought (Margett and Witherington, 2011). Also there are studies that have suggested that the notion of animacy turns out to develop gradually; firstly granting a "living thing" status to human beings, subsequently to animals and eventually to plants (Yorek, Sahin and Aydin, 2009). Nevertheless, the property of life is often attributed to the same extent to plants and vehicles (Villarroel and Infante, 2014). Despite the given mental and cognitive limitations and the strong deficit in preschool children's knowledge, exploring their concepts associated with animals is extremely interesting, since the role of the animals is vital in the acquisition of vocabulary and the socialization of children from early years.

All these ideas have been studied throughout a series of studies that have been performed within the last few decades throughout the world (Yorek, Sahin and Aydin 2009; Villarroel and Infante 2014; Martinez-Losada, Garcia-Barros and Garrido 2014). This present contribution is a resume of a series of studies we have performed on the subject and were presented scattered mostly in national conferences, meetings and symposia (Papadopoulou and Athanasiou, 1998a, 1998b; 2005; Papadopoulou and Parastatidou, 2009; Lazarou and Papadopoulou, 2011). We thought that a comprehensive retroactive presentation in the form of a scientific journal paper might be of some usefulness, especially in the light of the fact, that the subject seems not to be saturated or solved, and is coming on the surface again and again.

The main research questions that have been considered are:

- What is the meaning that preschool and school children and teachers are paying to the meaning "animal"?
- What criteria are used to classify the various groups of animals? Do these criteria correspond to those used in Biological Taxonomy?
- What values are connected with the meaning "animal", but also with perceptions about the protection and use of animals?

II. Research Methods and Participants

Participants

The research process with the preschool children, a total of six group interviews on the main phase of the survey, conducted in the spring of 2008 and was attended by 24 children which went to 3 kindergartens in neighboring villages of Northern Greece. Kindergartens were selected based on the willingness of teachers and the consensus of the informed parents.

The survey with the school aged children, was attended by 26 children, pupils of the 5th class of primary school, that were attending five different schools, 3 urban and 2 rural, in Northern Greece.

The study with the school-teachers was carried out in two parts: the first part was the concept study and the second was the classification study, results of which have been published somewhere else (Papadopoulou, 2003, Papadopoulou & Athanasiou, 2005). At this stage of research, 10 in service primary school teachers, 3 men and 7 women, with a range of 8 to 21 years of teaching experience, participated. In all studies the number of participants was determined by the achievement of information saturation (Lincoln & Cuba, 1985, p. 202) or theoretical saturation (Glaser & Strauss, 1970, p. 61)

Research technique and materials

The primary school participants were individually interviewed by means of an adapted version of the interview about instances approach (Gilbert, Watts and Osborne, 1985).The choice of group interview for preschool participants, was made mainly for the ease of contact with young children and their eager and active participation.

The research technique was an adapted version of the interview about instances approach (Gilbert et al., 1985). Stimulus materials were used in support of the interviews, a total of 19 - cards represented the entities listed in table 1.

All the interviews were analyzed using the constant comparison method (Glaser & Strauss, 1967) in which the framework for coding the transcripts derived from the data.

III. FINDINGS

The meaning attributed to 'animal' by the participants of the three studies is described both by the entities they include as an instance of the concept or not (Table 1) and the criteria they used.

Part I – The categories/criteria for animal

There were about thirty-eight (38) kinds of classifications as a result of analysis, which were finally included into 8-11 wider categories in our studies. The categories used by the three groups of participants in their decision making are comparatively presented in table 2. For simplicity reasons and in order to make possible a comparison we present our results for all the groups simultaneously for all the groups of participants.

1) Morphology- anatomic elements

A. Preschool children: In this category it was included information contained in the external morphological features of the entities for which it was asked a categorization, such as:

-Seagull... Yes… It has feathers, beak…

-Olive tree...No… because has roots.

Children used a really large and varied number of morphological criteria, some of these we will characterize safe or effective, i.e. always drive to the categorization of the entity of animals. Example of such features is the tail, or four feet for entities recognized as animals, while the hands, the wheels or the lights are leading to the exception of the entity from the animal category.

B. Primary school children: A richness of external features makes the morphology the criterion that is used more often. The same safe or effective morphological features were recorded in this group of participants too Examples of such features are: *-Cow ...Yes ... it has tail..., four feet, -No men ...have hands.*

These are rather attributes critical for children of both groups, as some of them help children to make the distinction between animals and plants (e.g. head, face, teeth), while others to distinguish between other animals and human beings (e.g. tail, four feet, horns).

C. Teachers: They did not adopt morphology as a categorization criterion for "animal".

2) Taxonomy-Biological Classification

A. Preschool children: The decision seems to be taken on the basis of the membership in a category that this group of children seems to regard as mutually exclusive with the category animal. Such accusations seem to be plant-life forms and human. For example: *-No the gull… is not animal, is a bird..., -No…olive-tree...because they are trees… -No man... because they are humans…*

B. School children: Here, again, the decision is often made according to grouping into another subgroup that in turn, is recognized or not as a subgroup of the animal group:

-Butterfly…yes…ash…has of course things other animals don't have…for example the cow or the elephant…but on the other hand is animal because is insect…

C. Teachers: They referred groups with the names: *insects, reptiles, birds, mammals, amphibians, invertebrates, rodents, fishes, mollusks, arthropods, vertebrates.*

3) Behavior

As "behavior" is defined the set of changes in attitude or position of a living being, one observer describes as movements or activities in relation to a given environment. Behavior usually is associated with activities such as walking, eating, search, etc. They all relate mainly to moving (Varela & Maturana, 1992, p. 152 & 156).

A. Preschool children: In this category were included references related to autonomous **movement** in all its expressions, such as: *-Orca...Yes… because it swims. -Mushroom...No…because does not walk.* Some information units related to the **production of sounds** are also included in this category, *-Yes…cat...because meow "cat".*

B. Primary School children: And for this group also, **movement** was an important criterion for their decision to. Categorized as animals were all entities that have the possibility of autonomous movement in all its variations characterizing the various species of animals. *-Yes-Butterfly...can fly...* In contrast they do not consider them to be animals those entities that are not characterized by autonomous movement: *-Fire...No…because the flame does not move, only with the air is moving...* **Sound production** capacity and type of sounds produced is taken also into account for the classification of entities or not in animals. *-Yes... Lion...has voice in his own language...* So animals are entities that have the capacity to produce various sounds, but not the articulated speech.

Movement appears to be the most important criterion of distinction between animals and inanimate for preschool and schoolchildren. Even children of preschool age make this distinction based on the existence of the autonomous movement. Only animals, according to them, exhibit this feature, while for the inanimate it is required the presence of an external factor to move. The criterion of (loco)motion is associated with the criterion of morphology as their reason for animals. Children refer to morphological structures, which enable move, such as: *"has legs"* or *"has four legs"*.

C. Teachers: The "Behavior" criterion is mostly used by teachers too. The majority of the references in this category were related to movement, and in particular to autonomous one. *-Animals can move…plants cannot….*

4) Dietary habits- Heterotrophy

A. Preschool-children: As it is obvious, in preschool children this category consists of simple references to eating. *-Yes – fish...It eats small fish. -Not mushroom…because is not eating.*

B. Primary school children:

In this category included references to eating behaviors as well as the type of diet. As animals are recognized entities that actively seek their food either by motion or by developing other types of behaviors. *-Yes…Lion…. he stops… runs through… looking for food...*

References to the type of nutrition, are limited. As animals, i.e. recognized entities that are heterotrophic, fed on other animals, (*-Yes… Gull... A bird that eats the fish...)* but not fed on plants (

-Not... Butterfly...their food is the flowers...)

C. Teachers: Heterotrophy: Teachers often make references about the kind of nutrition, the occurrence of photosynthetic ability and the meaning of heterotrophy. *- …it makes its food itself, in contrast to animals that take their food ready…*

5) Habitat

A. Preschool children: The decision on whether or not an entity is ranking in animals was obtained based on the type of living or living place and some of their features, such as:

-Yeah…frog … He lives in severely damaged waters.

B. Primary school children: Decision is depending on the type of living conditions and the characteristics of the place. *-The snail, Yes... It cannot leave inside a house; it needs fresh air, for example in a village, or the country…to leave among herbs…*

C. Teachers: The category includes groupings of animals according to their habitat and more specifically**:** Marine animals, aquatic animals, tropical animals, etc.

6) Presence and properties of life: "Development", "Reproduction"- "Viviparity"

A. Preschool children:

Growth and Development was the only property of living which was used in the decision. *-No – mushroom… can grow with the rain water.*

Viviparity was one of the main but not universal features of mammals based on which preschoolers integrate an entity into the category of animals. *-Yes – elephant... gives birth to little elephants...*

B. Primary school children:

Properties of life: The entity is sorted or not in animals, after first recognized as a living organism. *-Yes-cow... Hm... Because if it was not an animal, it wouldn't be alive. It is declared in the word "animal" itself...It is an animal, not human.*

Another criterion was the existence or not of one or more properties which characterize the phenomenon of life, such as breathing:

-Yeah-herring... and that breaths. Yeah 'cause all living organisms in nature breathe... -

C. Teachers: The decision based on claims whether an entity is alive or not. *-Yes it is an animal because it has life…*

7) Relationship with human: utilitarianism, risk, etc.

A. Preschool children: This category was formed by references to a utilitarian human other animals relationship.*-Fish – Yes ... and because we eat.*

But also to type and degree of risk shown by the entity.: *-Worm, yeah ... and if someone would go they sting of...*

B. Primary school children:

The category was formed by references related to utility for humans. *-Yes, cow... Giving milk…*

Also, there were references to the degree and type of risk entitled to the entity with reference to humans. *-Yes, snake…only a touch with its tongue can poison someone...*

C. Teachers: This category includes references to groups according to their relationship with or their use by man and more specifically**:** domestic animals, wild animals, farm animals.

8) The nature of the entity

A. Preschool children: It seems that the preschool children are missing this criterion which seems to develop in latter stages of life.

B. Primary School children: This category refers to essential characteristics of the entity as is it's' nature, such as: *No-car ... cause has electricity that makes it work*.

C. Teachers: This category refers to essential and intrinsic characteristics of the entity such as whether it is human-made or naturally occurring. *[…no] car [is not an animal] is made by human … that has no relation to animals…*

9) Mental ability -Senses

A. Preschool: There were references concerning the existence of the senses, and particularly pain.*-Yes – Elephant... because when gives birth hurts.*

B. School children: Attributing to someone the human capacity of thinking makes a separate category, which primarily distinguishes humans from the animal kingdom. *-No-man … know how to think, Aash…see everything and know…do something better every time....*

An interesting point was the fact that children who classified humans to the animals assigned some intelligence to some animals, as well, especially domestic or pets. .*-Yeah man…cause does not have much difference from all animals… And the animals are very intelligent but they don't know how to show it…*

C. Teachers: This is the main criterion that teachers used to separate human beings from the animal kingdom. The statements of this category contain references to special human abilities like language, reasoning, learning, critical thinking, culture and so on. All these abilities seemed to signal the human superiority over the other species…. *- Animals have [a kind of mental ability] but it is of inferior kind, they are inferior…*

10) Value and ideology

A. Preschool children: This category is directly related to relationship with the criterion "*humans"*, but differs from it in that it includes positive and negative value judgments. *-Yes – worm... it is disgusting, – Orca... It is not a good thing, is bad.*

B. Primary school children: This category is not recorded in this group**.**

C. Teachers: The criterion/category related to values is the most anthropocentric one. In this category there are implicit references to religious influences. *…My*

perception is that human beings constitute the highest rank of creation.

Also there were references to animals like the «*inferior other"*.

In this category we see displayed stereotypical concepts of good and bad animals, which have come a long way over time and perpetuated by a set of narratives (e.g. biblical storytelling, traditional tales) but also the very function of language.

None of the above categories – criteria was used by all children or teachers, nor the same category was used for all entities, as the decision for the categorization each entity usually being taken using multiple criteria. This multiple used criteria suggest that the concept of animal is a set of meanings.

It is obvious that primary school teachers have formulated a concept for "animal", more elaborated than this of children, but still a restricted and anthropocentric one, since many teachers exclude human beings from animals (table 1). They did not classify human beings as animals, although they seemed to be aware of the argumentation of the Evolution Theory concerning the descent of humans. *"... I know that they are not included in animal category ... they are human beings ... although according to a theory, human beings evolved from an ape species...* If this latter approach is combined to the idea that several teachers have in distinguishing animals from plants in reference to the criterion of life, it can be said that many adult members of our societies still endorse Aristotle' ideas.

Part II: Frequencies of category use

Preschool children. Figure 1 shows the frequency that each criterion used by children. As recorded in this figure the decision to include or not the entity into 'animal' is made primarily with invoking morphological characteristics and manifestations of behavior. The presence of the human-centered criterion "relationship with humans" is quite interesting. While the limited presence of category "habitat" compared to other age groups, may be attributed to the limited knowledge and experience of this group of children. Finally, we could say that in this quantitative evaluation of the use of categories, preschool children recorded using mainly sensory type criteria i.e. morphological characteristics, apparent behavior (e.g. movement) and the type of residence of the entity (habitat), a finding that comes in convergence with other previous surveys in the area.

Part II: 2. Frequencies of each category use by Grade 5th Pupils and Teachers.

The categories/criteria teachers employed in order to group entities into the animal category are compared with the categories/criteria used by pupils on a similar task (Papadopoulou & Athanasiou 1998). As shown in Figures 2 and 3, the profile of the individual category use of pupils is more similar to the one of teachers. In both categorizations Taxonomy and Habitat were first in rank, with taxonomy being the first one, with substantial difference to the 2nd criterion (75.2% for teachers and 52% for pupils). A difference was found for the criterion of "Relation to human" which was the 3rd in rank for teachers, noting the 7.5% of preferences compared with the 5% and 6th in rank preference of pupils. In parallel, a noticeable difference was observed to the movement criterion, where the percentage of students was 10 times higher compared with that of teachers (5.61% and 0.5%, respectively).

Teachers' categories are, of course, more sophisticated; although anthropocentric thinking is apparent in both groups. The anthropocentrism of pupils is mainly expressed through the comparison with human beings - the human being as the normative entity - and also by naïve categories such as "Dangerous for man", "Utility for man". On the other hand, anthropocentric criteria of teachers such as "Values - Ideology" and partly "Mental ability" are well-elaborated categories, connected with ideas having a long history in the Western Thought.

IV. DISCUSSION-PEDAGOGICAL CONSEQUENCES

The study presented here is a synthesis we have performed for recording perceptions of preschool and school age children and teachers, as well, about issues related to how they perceive the meaning of the animal, how it differs from that of non-living organisms, and how they perceive man's place in the Animal Kingdom. The subject has been examined in numerous studies in the last 20 years (Johnson et al., 1992; Coley, 1995; Lòpez et al., 1997; Wolff et al., 1999; Coley, 1999; Coley, 2000) both because of its intrinsic importance and as a test case for more general ideas about conceptual development (Ross et al., 2003).

The distinction of Humans from the Animal Kingdom!

Medin & Atran (1999) support the special importance of Folk Biology in the understanding of human thought and behavior, since a great part of human history went by (and still goes by) in close contact with the plants and the animals and it is hard to imagine that the cognitive function of man was not influenced by this coexistence. It has been supported that there is no culture globally, except from those maybe that have not been influenced by Aristotle, essentially the western ones, which regard that humans and the rest of the living organisms belong to the same ontological category (Atran 1991, 1996 p. 677). This claim has been doubted by other findings (Coley, Medin & James 1999, Ross et al., 2003). The findings of our research converge with the results of research that record the ontological distinction between human and the other animals. In addition, the findings support Atran's claim (Atran, 1991, 1996 p. 677) that the teaching of sciences has a limited effect on the folk taxonomic forms and the effect of the teaching of Biology on them is marginal. For most cultures, human is the rule for the comparative identification of other animals, but human himself is not an object of comparison (Atran, 1991, p.32). Teachers make a limited use of the morphological criteria for taking their classification decisions and consequently it is not possible to identify a similar morphological comparison of

man with other animals, as this happens with children (Papadopoulou & Athanasiou, 1998).

The criteria of classification are multiple

The classification criteria used by children for each case are multiple and there doesn't seem to be a sole criterion to categorize all of the examples. On the contrary, the term "animal" in accordance with the scientific standard is a set of meanings and criteria, but which correspond to all living organisms classified in the animal kingdom. So it doesn't seem to be supported a basic assumption of the classical theory of concepts acquisition that from a sample of the width of a category, children make an overall conclusion as to which is the depth of the class, and as they progress in the acquisition of the concept, end-up to form competent and necessary criteria for inclusion in the category (Markman, 1989, p 6).

Summing up we could formulate the position that the anthropocentric intuitive biology, whose existence has been documented in other studies (Zogza, 2006), seem to focus on human needs, desires, and interests reserving special treatment for humans, classifying them separately from other living organisms (Tema, 1989; Papadopoulou & Athanasiou, 1998). In preschool children, while the anthropocentric value in the word animal was obvious, it was not recorded the human as a reference point for classifications, something that has been recorded in children of the same cultural framework but older in age (Papadopoulou & Athanasiou, 1998). This could partly be attributed to the level of development of biological knowledge in preschool children and, secondly, to reinforcement of early childhood ideas by socio-cultural factors and the educational system, as well, which seems to be the case, but obviously warrants further investigation.

The existence of senses, especially pain, is an interesting criterion-category with very limited recording. The cultivation of concepts related to this may prove very useful, not so much in the development of the concept of "animal" per se as for the cultivation of empathy and the development of a network of less anthropocentric values that will govern the relationship of human to other animals. This concept would obviously need to run all levels of education, but primary education and preschool education constitute a privileged field for this. Maybe taking care of some animal, as part of the educational process, and focusing on similarities rather than differences between human and other animals, might constitute a fertile ground for the development of the concept of "animal" but, also, attitudes of responsibility and care the "others".

As to the width of the concept held by school-aged children, we observed that all children with ease recognized as animals the terrestrial quadrupeds. Bell (1981) claims that children use the meaning "animal" as synonymous with the concept mammal, but the fact the unanimous classification by the children who participated in this research of the frog to the animals, shifts the commonly accepted meaning to "quadruped", observation that is further corroborated by the fact that very often children use as categorization criterion, morphological characteristics.

Regarding the groupings of animals and the denominations of categories, a wide use of scientific biological designations is recorded with respect to the categories formed by teachers. It can be said that this finding is in a way the continuation of Kattmann's (2001) findings, who ascertains a greater use of taxonomic categories as the age of pupils increases. Teachers' taxonomies, despite their apparent approach to the scientific biological taxonomy, are essentially closer to the folk biological classification framework (Papadopoulou and Athanasiou 2005).

About the Anthropocentrism of children and teachers

The meaning teachers attribute to the concept of 'animal' is limited and anthropocentric since human is not usually included in the range of the concept. The study of the national biological framework as well as the history of the scientific Biological Taxonomy shows the long road that this perception has traveled through time, as well as its widespread, acceptance in various societies of the planet. This is about the self-placement of human on the world, whose position is determined out of the animal kingdom, and consequently out of nature. Naturally, the conquest of the human condition is regarded, from teachers and children as transcendence from the animal condition and the whole historical course of the human society conduces to that. However, this separation of humans from nature and mostly the sense of superiority and omnipotence it bears have been regarded by environmental thought as a cause for the dominating behavior of human against nature, and in our case against animals.

Teaching Consequences

Cobern (1993, 1998) supports that it is important for the teaching of natural sciences to understand the central, culturally grounded beliefs for the world, which the students and the teachers, we could add, transfer in the classroom and that these beliefs are supported and grounded on their culture. Education in Biology is successful to the extent that Biology can find a place in the cognitive and socio-cultural environment of children and adults (Cobern, 1994).

Regarding the education and the training of teachers on the classification of animals the observation that the basic concepts of Biology, like the concept of "animal", are combined by everyday people with a framework of values, which is both popular enough and it also comes from a long way through time, should not be ignored. Obviously, it is not possible for the total of these beliefs to yield with the appeal of scientific authority only, as far as the content of the concept of "animal", since it is connected with a mesh of values and beliefs. With the above remarks for the deep socio-cultural grounding of some ideas, it is not implied that these beliefs should remain intact from the educational and training procedure. This remark has the sense of understanding the size and the type of the undertaking, which, according to our opinion, does not only consist of the conceptual change that is usually intended by Science Education. This undertaking does not

simply concern the doubt of the pre-existing concept of "animal", but it also concerns values and beliefs, which are connected with the manner in which people perceive of themselves.

The training of teachers on the Scientific Biological Taxonomy, the design of relevant analytic curricula with an evolutionary and ecological orientation, the extensive teaching of the Theory of Evolution itself and the exploitation of examples and cases from the history of Biology and Systematics, could open new paths in the thought of teachers, their knowledge and their pedagogy. The evolutionary orientation of the teaching of Systematics could include, apart from the phylogenetic relevance, the presentation of minor groups of living organisms, with their evolutionary history and the appearance of their characteristic adaptations as a central axis. Last but not least, the biological evolution of human can be a part of the training of teachers, since it seems to form possibly the most central friction point for the recognition of the biological singleness of all living organisms, including human.

REFERENCES

[1] Atran, S., D. Medin, & N. Ross, (2004). "Evolution and devolution of Knowledge: A tale of two biologies". *Journal of Royal Anthropological Institute*, 10 (2): 395-420.

[2] Atran, S. (1990). *Cognitive Foundations of Natural History. Towards Anthropology of Science*, N. York: Cambridge University Press.

[3] Atran, S. (1996). "From Folk Biology to Scientific Biology". In *Education and human development. New models of learning, teaching and Schooling, edited by* D.R. Olson and N. Torrance, 646-682, Cambridge MA: Blackwell Publishers.

[4] Barman, R.C., S.N Barman, M.L.Cox, K. Berglund Newhouse, and J.M.Golston. (2000). "Students' Ideas About Animals". *Science and Children*, 38 (1): 42-47.

[5] Bell, F.B. (1981). 'When an Animal is not an Animal'. *Journal of Biological Education*, 15 (3): 213-218.

[6] Bell, B. and P. Freyberg. (1985). Language in the Science Classroom. In *Learning in Science* editing by R. Osborne and P. Freyberg, 29-40, Auckland, NZ: Heinemann, p.

[7] Bentley, W., and G. Rodriguez. (2001). 'Honduran Folk Entomology'. *Current Anthropology*, 42 (2): 285-301.

[8] Braund, M. (1991). 'Children's ideas in classifying animals'. *Journal of Biological Education*, 25 (2): 103-110.

[9] Braud, M. (1998). 'Trends in children's concepts of vertebrate and invertebrate'. *Journal of Biological Education*, 32 (2): 112-118.

[10] Bybee, R.W. (1993). *Reforming Science Education*. New York: Teachers College Press.

[11] Cobern, W.W. (1993). Contextual Constructivism: The Impact of Culture on the Learning and Teaching of Science. In *The Practice of Constructivism in Science Education* edited by K. G Tobin. Hillsdale, NJ: Lawrence Erlbaum Associates.

[12] Cobern, W.W. (1994). Cultural Constructivist Approach to the Teaching of Evolution, SLCSP Working Paper #112, http://www.wmich.edu/slcsp/slcsp.htm [accessed 13-12-2002].

[13] Cobern, W.W., and G. Aikenhead. (1998). Cultural Aspects of Learning Science. In *International Handbook of Science Education* (39-52) edited by B. Fraser, and K.G. Tobin Dordrecht: Kluwer Academic Publishers..

[14] Coley, J.D. (1995). 'Emerging Differentiation of Folk biology and Folk Psychology: Attributions of Biological and Psychological Properties to Living Things'. *Child Development*, 66 (6): 1856-1874.

[15] Coley, J.D. (2000). 'On the importance of comparative research: The case of Folk biology'. *Child Development*, 71(1): 82-90.

[16] Coley, J.D., D. Medin and L. James (1999). Folk Biological Induction among Native American Children. Paper presented at Biennial Meeting of the Society for Research in Child Development, Albuquerque, New Mexico.

[17] De Jong, O., & F. Brinkman (1999). 'Investigating student teachers' conceptions of how to teach: international network studies from science and mathematics education'. *European Journal of Teacher Education*, 22: 5-10.

[18] Gilbert, J.K, M.D. Watts, and R.J Osborne. (1985). Eliciting Student Views Using an Interview-about-instances Technique. In *Cognitive Structure and Conceptual Change* edited by L.H.T. West, and L.A Pines, 11-27. Orlando: Academic Press Inc.

[19] Glaser, B.G., and A.L Strauss (1967). *The discovery of grounded theory: Strategies for qualitative research*. New York: Aldine Publishing Company.

[20] Johnson, K.E., and J.S. Boster (1992). 'Developmental changes within the structure of mammal domain'. *Developmental Psychology*, 28 (1): 74-83.

[21] Kattman, U. (2001). 'Aquatics, Flyers, Creepers and Terrestrials - Students' Conceptions of Animal Classification'. *Journal of Biological Education*, 35 (3): 141-147.

[22] Lazarou, Th., and P. Papadopoulou, 2011. Preschool children's' conceptions about "plant". In Proceedings of the 7th Pan-Hellenic Conference of Science Education and New Technologies in Education, edited by Papageorgiou, and G. Kountouriotis, pp 431-438. (In Greek).

[23] Leddon, E., Waxman, S.R., & Medin, D.L. (2011). What does it mean to 'live' and 'die'? A cross-linguistic analysis of parent-child conversations in English and Indonesian. *British Journal of Developmental Psychology*, 29 (3): 375-395.

[24] López, A., S., Atran, J.D., Coley, D.L., Medin, and E. Smith (1997). The tree of life: Universal and cultural features of folk biological taxonomies and inductions. *Cognitive Psychology*, 32 (3): 251-295.

[25] Lincoln, Y.S., and E.G. Cuba. (1985). Naturalistic Inquiry. West Hillcrest Drive Newbury Park, Ca, Sage publications.

[26] Lopez, A., S., Atran, J.D., Coley, D.L., Medin, and E.E. Smith (1997). The tree of life: Universals of folk-biological taxonomies and inductions. *Cognitive Psychology*, 32 (3): 251–295.

[27] Lowe, J. (1997). 'Scientific concept development in Solomon Island students: a comparative analysis'. *International Journal of Science Education*, 19 (7): 743-759.

[28] Targett T.E., and D.C.Witherington (2011). 'The nature of preschoolers' concept of living and artificial objects'. *Child Development*, 82 (6): 2067-82.

[29] Mak, S.Y., D.Y., Yip, and C.M. Chung (1998). 'Alternative Conceptions in Biology-Related Topics of Integrated Science Teachers and Implications for Teacher Education'. *Journal of Science Education and Technology*, 8 (2): 161-170.

[30] Markman, E.M. (1989). *Categorization and Naming in Children: Problems of Induction*, Cambridge Massachusetts: MIT Press.

[31] Martínez-Losada, C., García-Barros, S. and Garrido, M. (2013). 'How children haracterize living beings and the activities in which they engage'. *Journal of Biological Education*, 48(4), 201-210.

[32] Maturana, H., & Varela, F. (1992). *The tree of knowledge*. Translated and edited by S. Manouselis). Athens: Katoptro . (in Greek).

[33] Medin, D., and S. Atran, (1999). Introduction. In *Folk biology*, edited by Medin, D., and S. Atran (3-15). Cambridge, MA: MIT Press, p. 3-15.

[34] Papadopoulou, P., & Athanasiou K. (1998). Primary school pupil's meaning for "animal". Paper presented at the 2nd Conference of European Researchers in Didactic of Biology, Universtry of Götegorg, 18 - 22 November 1998.

[35] Papadopoulou, P., & Athanasiou, K. (1998).The concept of animal according to elementary school children. In: Koumaras, P., Seroglou, F. and Skordoulis, K. (Eds.). The contribution of History and Philosophy of Science to Science Teaching. Symposium Proceedings. Christodoulidis Eds, Thessaloniki, Greece. pp 251-263, (Greek Edition).

[36] Papadopoulou, P., & Athanasiou, K. (2005). Primary school teachers' categories for "animal": biology or folkbiology? In M. Ergazaki, J. Lewis, & V. Zogza (Eds.), Trends in Biology Education Research In the New Biology Era, pp. 43-58. Patras University Press.

[37] Papadopoulou, P., & Parastatidou, D. (2009). Preschool children's' conceptions about "animal". *Issues of Science and Technology in Education*, 2 (1-2), 127-139. (Journal in Greek).
[38] Papadopoulou, P., & Athanasiou, K. (1998). The concept of animal according to elementary school children. In: P. Koumaras, P. Kariotoglou, V. Tselfes, & D. Psillos (Eds.). Proceedings of the 1st Panhellenic Conference on Science Education and Application of New Technologies in Education. Christodoulidis Eds, Thessaloniki, Greece, pp 130-137. (Greek Edition).
[39] Ross, N., D., Medin, J., Coley, and S. Atran. (2003). 'Cultural and experiential differences in the development of folk-biological induction'. *Cognitive Development*, 18 (1): 25-47.
[40] Strauss, A., and J. Corbin. (1990). *Basics of qualitative research. Grounded theory. Procedures and techniques*. Newbury Park, CA: Sage.
[41] Tamir, P., R., Gal-Choppin, and R. Nussinovitz.(1981). 'How do intermediate and junior high school students conceptualize living and nonliving?'. *Journal of Research in Science Teaching*, 18 (3): 241-248.
[42] Tema, B.O. (1989). 'Rural and Urban African Pupils' Alternative Conceptions of Animal'. *Journal of Biological Education*, 23 (3): 189-207.
[43] Trowbridge, J.E., and J.J. Mintzes. (1985). 'Students' Alternative Conceptions of Animal Classification'. *School Science and Mathematics*, 85 (4): 304-316.
[44] Tunnicliffe, S.D., and M.J. Reiss. (1999). 'Building a Model of the Environment: how do Children See Animals?' *Journal of Biological Education*, 33(3), 142-148.
[45] Villani, M.R. and Lucas, A.M. (1991). 'When an Animal is not an Animal? When it Speaks English'. *Journal of Biological Education*, 25 (3): 184-186.
[46] Villarroel, J.D.,and G. Infante. 2014. 'Early understanding of the concept of living things: an examination of young children's drawings of plant life'. *Journal of Biological Education*, 48 (3): 119-126.
[47] Wolff, P., D., Medin, and C. Pankratz. 1999. Evolution and devolution of folk biological knowledge. *Cognition*, 73(2): 177-204.
[48] Yen, C-F., T-W., Yao, and Y-C. Chiu. (2004). 'Alternative conceptions on animal classification focusing on amphibians and reptiles: A cross-age study'. *International Journal of Science and Mathematics Education*, 2 (2): 159–174.
[49] Yen, C-F., T-W., Yao, and J.J. Mintzes. 2007. 'Taiwanese students' alternative conceptions of animal biodiversity'. *International Journal of Science Education*, 29 (4): 535–553.
[50] Zogza, V. 2006. *The biological knowledge in childhood*. Athens: Metaixmio . (Greek Edition).
[51] Zogza, V., M., Sarmonika, and P. Oikonomopoulou, (1996). Mental representations of living and nonliving as well as plant-animal: Which are the distinction criteria in use in preschool children? Paper presented in the 5th Greek National Conference of Psychological Research, Patras, Greece, 23-26 of May 1996 (in Greek).

AUTHOR'S PROFILE

Penelope Papadopoulou
is an Assistant Professor of Biological Education at the University of Western Macedonia, Florina, Greece. She received her Ph.D. from the Department of Elementary Education-The Aristotle University of Thessaloniki, Greece. Her teaching and research interests are in the area of Biological and Environmental Education.
Email: ppapadopoulou@uowm.gr

Kyriacos Athanasiou
is an Emeritus Professor of the National and Kapodestrian University of Athens. He has been Professor of Biological and Health Education at the Department of Elementary Education-The Aristotle University of Thessaloniki, Greece and the Faculty of Pre-School Education, The National and Kapodestrian University of Athens-Greece. He is teaching now at the Graduate School of the Department of Biology of the University of Athens and the Open University of Greece.
Email: kathanas@ecd.uoa.gr

Table 1: Categorization of the stimulus material entities in 'animal'

	Preschool children *n=24*	Primary school children *n=26*	Teachers *n=10*
	Yes %	Yes %	Yes %
		Instances	
Cow	100	100	100
Elephant	100	100	100
Orca	100	100	100
Herring	100	100	100
Frog	87.5	100	100
Cat	87.5	100	100
Lion	87.5	100	100
Snail	87.5	92.3	100
Spider	83.3	84.6	100
Earthworm	70.8	92.3	100
Snake	70.8	92.3	100
Butterfly	66.7	84.6	100
Seagull	45.8	92.3	100
Human	**0**	**15.4**	**30**
		Non instances	
Dandelion	16.7	0	0
Car	4.2	0	0
Olive tree	0	0	0
Mushroom	0	0	0
Fire	0	0	0

Table 2: Comparative representation of pupils' and teachers' criteria regarding the concept of "animal".

Preschool children	**Primary school Pupils**	**Teachers**
Morphology	*Morphology*	*Morphology*
Biological classification	*Taxonomy*	*Taxonomy*
Behavior	*Behavior*	*Behavior*
Development	*Properties of life*	*Existence and properties of life*
Viviparity		
	Anatomic Elements	
Existence of senses	*Senses*	
Habitat	*Habitat*	*(Habitat)*
Composition	*The nature of the entity*	*The nature of the entity*
	Reason	*Mental Ability (including reason)*
Value- judgment	*Dangerous for human*	
Relationship with humans	*Utility for human*	
		Heterotrophy
		Values - Ideology

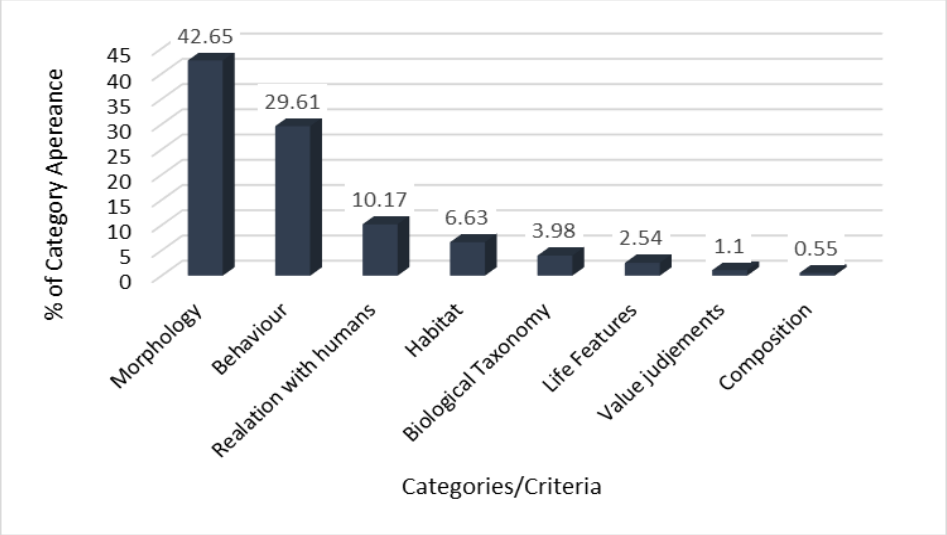

Fig.1. Use frequency of the categories used by preschool children for classifying or not an entity as animal. From the chart there were removed a 2.21% of "unclassified" and 0.88% of "no-answer".

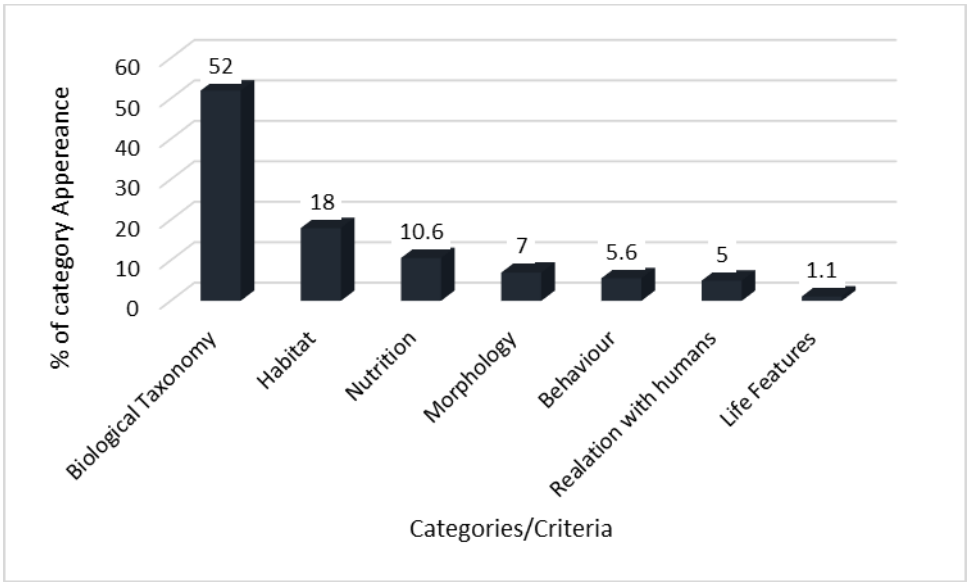

Fig.2. Frequency of use of each one of the categories for include or not an entity as animal by the grade 5th primary pupils.

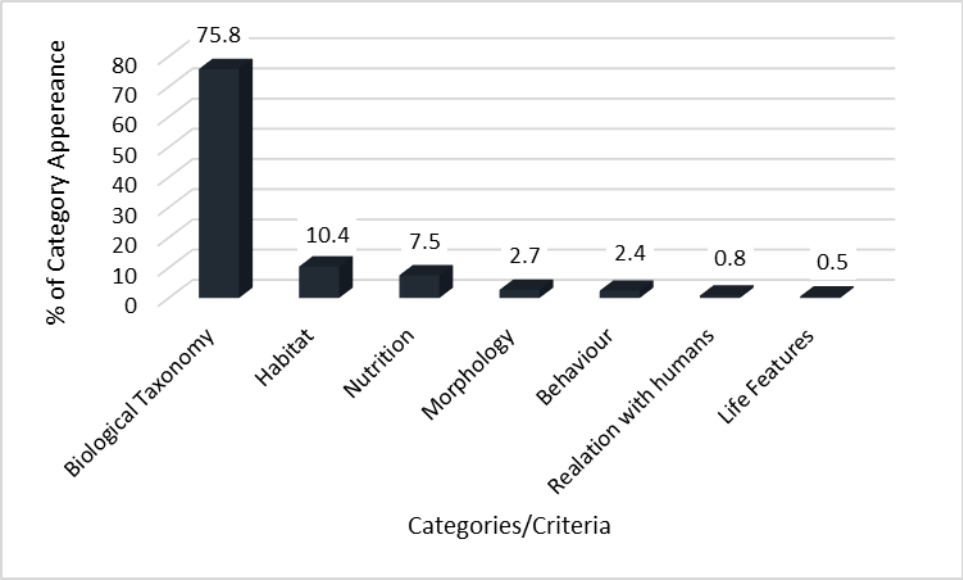

Fig.3. Frequency of the categories used for classifying or not an entity as animal by the primary school teachers.