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THE NATURAL WORLD IN PRESCHOOL EDUCATION

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ABSTRACT

In this paper we attempted to bring to light some issues on the approach of the natural world in preschool education as well as its main prevailing trends concerning science initiation. This work also deals with differences between science education for young and older children and with the diverse teaching strategies used for the initiation of pre-school children to the natural sciences.

Key words: Natural world, science, preschool education

INTRODUCTION

Preschool curricula are not often founded in explicitly expressed theoretical principles. The equilibrium amongst social, affective and cognitive aims does not usually depend on accurate selections that are justified according to psychological, epistemological and pedagogical approaches of child development. As a consequence, the programs tend to gradually strengthen children's spontaneity and their artistic expression and imagination. While ascribing autonomy to child, it is doubtful, whether educational authorities converge or blend educational approaches or whether there are approaches just based on the possibilities a child will soak up (Lurçat, 1985). However, these educational necessities kind of directions only lead to the obfuscation and demise of the nature of preschool because they undervalue the necessity of holistic child development: the domain of logical thought and initiation to the natural world is grossly underestimated.

It is well known that the main psychological and epistemological trends concern the constitution of human thinking, stress the significance of discovery of physical objects and the relations which exist amongst phenomena, concepts of science and children's ways of thinking. In this area, the contribution of science education research has been significant. In this research domain, the significance of preconceptions in children's thinking for the construction of scientific knowledge was emerged (Driver, Guesne & Tiberghien, 1985; Driver, Squires, Rushworth & Wood-Robinson, 1994). The study of children's representations usually concerns children aged 10 and over. However, the reason for this starting point is not clearly justified. On the other hand, there is not an explicit agreement or disagreement on the development of research attempts concerning in pre-school or first school age. This vague situation in science education within the scientific community is probably related to the complexities of research attempts concerning children's thought before the age of ten, when the psychological peculiarities tend to grow.

However, it is possible that the earlier we are concerned with children's naïve ideas, the better we can work with all sides of children's thought. Similarly, at pre-school age, the problem of construction of scientific representations about the natural world that have already been constituted by the children can be probably better illuminated by experienced researchers. Moreover, this approach contributes to developmental research on the evolution of naïve ideas (Ravanis & Boilevin, 2009). Finally, it is difficult to forget that one of the precursors of contemporary preschool science education, Jean Piaget, devoted much of his research to children's conceptions of the natural world (Piaget, 1930, 1973). Within this framework, it is possible, that some of the activities realised in nursery schools have to be devoted to the systematic initiation of science concepts and phenomena.

In this article we shall discuss these issues in order to define frameworks within which possible answers can be drawn.

INITIATION OF SCIENCE IN PRESCHOOL EDUCATION

Attempts to introduce science to preschool children take two directions. They are either directed towards a type of teaching science or towards an attempt at an initial systematic and organised contact with the physical world. These two perspectives have different aims and consequently the instructional procedures which derive from them are also different.

Kamii (1982) and Kamii & De Vries (1978) believe that we should juxtapose the "activities of physical knowledge" and the "learning of science" for pre-schoolers. The teaching of science focuses on the object to be taught, the laws, scientific terminology and research methodology. On the contrary, the activities of physical knowledge focus on the progress of children's activities and discoveries.

These differences are significant. Ordinary science courses are usually addressed to students who are at least ten years of age. They have the possibility of using a series of fundamental reasoning, and moreover, on the basis of concrete models--although these models are not compatible with science models--of representing and interpreting in their thought the physical world. However, in the case of preschool children, the obstacles caused by the incomplete organisation of logical reasoning, and, in addition, by the limited models used by children to interpret the physical world, pose different types of difficulties. For example, in a series of researches in order to study the propagation of the light or the shadows formation have used simple materials such as lamps and simple opaque obstacles. Subsequently, students 10 to 13 year old appear to have a reasoning to explain the transition of the light as autonomous entity and the formation of a shadow due to an obstacle (Guesne, 1985; Dedes & Ravanis, 2007; Ravanis, Zacharos & Vellopoulou, 2010; Castro, 2013; Voutsinos, 2013; Grigorovitch, 2015). However, when the same problem is studied with 5 to 7 year old children there is the basic obstacle that children do not know that light is transmitted independently of the sources and the final receiver and shadow is due to the light being blocked by the objects (Ravanis, 1998; Resta-Schweitzer & Weil-Barais, 2007; Gallegos Cázares, Flores Camacho & Calderón Canales, 2009). Consequently, altered didactical interventions for both cases, 5 to 7 year old (Ravanis, Christidou & Hatzinikita, 2013) and 10 to 13 old children (Galili & Hazan, 2000; Grigorovitch, 2014), have different cognitive obstacles. For the older children, an explanation model is already used. However, in the case of younger children, a model has to be constructed, which up until then was non-existent.

Other differences between preschool and school age are those caused by their different "empirical references" (Martinand, 1986, 1989). Indeed, 5-year old children have significant limitations concerning both knowledge of simple physical qualities of materials and problem solving. This lack serves to direct the science initiation of younger children according to a priority of qualitative approaches to objects and their qualities, as well as, the elementary reactions of objects on the actions exerted on them. In the situation in which children are occupied with problems whose solution requires the use of scientific models of thought or the use of scientific methodology, Kamii (1982) proposes elementary activities for pre-schoolers having as its main objectives, the transposition and transformation of objects. In a similar light Crahay & Delhaxhe (1988), propose initiating preschool children with elementary qualities belonging to certain objects (spirals, magnets, inclined planes etc).

These approaches are limited to a certain extent. They do not explicitly reject the integration of elements from the methods and the basic knowledge of science (wherever this is probable). Indeed, it will probably be possible for researchers as well, to look at the conditions under which we can transcend the detection of the physical qualities of objects for pre-schoolers. The contemporary researches are oriented towards a systematic study of the understanding of simple phenomena, as the state transformation or shadow formation, by the students of nursery school via specific didactical interventions. In these research attempts, it is possible to look for, and also, go beyond the obstacles of logical thought which create difficulties for children's thought. In this way, there are simultaneous conclusions for the constitution of elementary concepts and phenomena and for the transition, from intuitive models of thought to others, which are more compatible with characteristics of science.

SCIENCE AND PRESCHOOL EDUCATION: TOWARDS A CONVERGENCE

If it is accepted that the attempt of initiation of preschool children in science has real meaning, then the questions met at all levels of science teaching are confronted as well. How can appropriate curricula for the preschool level be developed? Which didactical strategies should be used? How should preschool teachers be correctly guided concerning science and what should their in-service training comprise?

It is well known that such questions cannot be answered in the same way for all levels of education. Thus, for nursery schools, specifically elaborated didactical approaches are needed. In this particular case, the development of didactical activities, are very different from other levels of education. Indeed, subjects like physics, chemistry, biology or other unified courses are constituted on the basis of specific curricula. In a nursery school, however, the science activities are more piecemeal/fragmentary and they have close ties with logico-mathematical concepts and problems of social living. The structure of a concept or phenomenon is not clearly separated. In other words, the object of an activity and its function in concrete circumstances is not explored or articulated.

The approaches attempted up until now seem to be mainly influenced by empiricism and Piagetian structuralism. Didactical procedures of an empirical nature emphasize the dominant role of the senses for the understanding of the physical world. Hence activities that focus on sensory stimulation are designed/developed (Hildebrand, 1981). The same trend is not involved in research approaches to students' reasoning. Moreover, the activities' object consists simplifying a science object, without explicitly having any criteria of selection or of simplification.

Piagetian procedures promote the idea that the development of human intelligence is a result of the constitution of intellectual structures through the activity of the subject on objects of the material world, rather than of the shapeless, sensory perception of data of the physical and social environment. It is, therefore, natural that didactic approaches based on Piaget's theory should lead to strategies which provide children with the possibility of manipulating material objects and experimenting. In short, intellectual activity is capable of leading to the assimilation of physical knowledge. In respect to the constitution of physical knowledge, educational procedures have suggested for pre-school children that the above mentioned characteristics should be included. At the centre of these procedures is situated the free but carefully supported initiative of the children along with the nursery-school teachers playing a particular, encouraging and analysing part in the activities (Kamii & De Vries, 1978; Crahay & Delhaxhe, 1988) .

During the last years, contemporary research has attempted to adjust to preschool education experiences from science education and, at the same time, to propose well founded activities concerning effectiveness on the level of conceptual change. This approach is based on the theoretical framework of social constructivism. Its principles foster the idea that cognitive progress is a product of the deliberate intervention of social environment. Its strategies induce conflict, thus making the child confront its own strategies conflicts in order to answer a question (Limón, 2001).

Current research orientations attempt to: (a) detect preschool students' mental representations which concern certain physics concepts and phenomena and (b) develop experimental didactical interventions aiming at the same time, to destabilize the intuitive students' models of thought in order to constitute others which have characteristics compatible with science models. For example, after a study of children's representations with a concrete didactical intervention for the problem of understanding water's gasification of 5-year old children constitute a model in order to face the phenomenon. Based on this model, they predict gasification as a result the heating of water, distinguish the water's transition to air and offer explanations based on the situation's descriptive characteristics (Ravanis & Bagakis, 1998). In another didactical intervention, by means of socio-cognitive conflicts, the constitution of a model for the understanding of the formation of shadows as a result of obstructing light was achieved. Moreover, they predict the position where shadow is projected and also they correspond the number of shadows to the number of light sources (Ravanis, Charalampopoulou, Boilevin & Bagakis, 2005). These types of research attempts--although they are of an experimental nature and need an effectiveness test in class situations--use the science education research tradition. The same attempts also lead to the constitution of activities, which can construct in a systematic way, models of thought facilitating and not obstructing science thought.

But the real cognitive progress of children does not only consist of broadening children's field of experience, but also, comprises the development of cognitive and manual abilities, the possibility of confronting questions which derive from everyday life, and the broadening of possibilities of symbolism and concept formation (Weil-Barais, 2001).

Another significant issue posed is the preschool teachers' seemingly problematic relation with science presents additional obstacles. It is understandable that within their basic formation--either from within universities or from without--some courses are needed to familiarize teachers with selected concepts and phenomena, experimental methodology, the use of simple instruments and the making of experiments. It is also logical to attempt to instruct preschool teachers in the logic of science education (in order that to understand research data probably useful for their work, and be ready to produce new data). During the the last decades, it seems difficult seriously to discuss science teaching without efficiently focusing/concentrating on science teachers.

DISCUSSION

In this paper we attempted to bring to light some issues on the approach of the natural world in preschool education as well as its main prevailing trends concerning science initiation. Moreover, we tried to find links and convergences of existing preschool science teaching with recent findings in science education. Up until now the current research attempts indicate that development of science activities transcends the empirical or Piagetian approaches, yet, at the same time, we shouldn't underestimate them. Indeed, in order to study activities which take into account the limitations of the logical constitution of children's thought, it can be seen that preschool children are able to constitute models of limited range having characteristics compatible with science models. If we assume that one part of the activities of preschool age is devoted to the discovery of the natural world, perhaps one dimension of these activities could be the study of circumstances under which the cognitive constitution of models become possible, so that some regularities could become understandable. In this direction, at least from a methodological point of view, we could draw conclusions from current science education.

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