Development of Conceptual Change and Understanding in Children

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Abstract: *The study explored conceptual development and understanding in children across different age groups from a developmental psychology perspective. The aim was to investigate developmental change in children's understanding of two different yet overlapping concepts of 'earth' across the three different age groups. The children in the successive age groups of 6 years, 8 years and 10 years were studied using the specific concepts of mother earth and planet earth. The participants were asked to draw and describe their representations of the respective concepts of earth. The results indicate that conceptual development in children varies with age in a developmental manner. It has been substantiated by the results of the study, which indicate that the participants aged 6 years had no concept formation of the specific concepts investigated in the study. However, the participants aged 8 years depicted conceptual change and formation, compounded by ambiguity and overlap between the two concepts and for participants aged 10 years, the results displayed stark distinctions between the two concepts. The study suggests that conceptual change develop with the increasing cognitive ability to learn and the significant role played by school related factors on children's conceptual understanding.*

Key words: *Conceptual Development, Cognitive Understanding, Conceptual Change, Developmental Psychology*

I. INTRODUCTION

Conceptual development in children has traditionally been treated in terms of inductive learning and categorization. Generalizing on the basis of a known example is one of the most common forms of inductive reasoning, and it is the basis of categorization. Because generalizing on the basis of an object is easiest to study empirically, the majority of studies in conceptual development concern children's knowledge about objects in the world. The ability to reason by induction is widely accepted to be present very early in development. Because inductive reasoning is assumed, the focus of research has been on the extent and organization of the knowledge that determines the ability to categorize entities as instances of the same concept. These core principles that determine induction have been referred to as innate 'constraints on learning' (Gelman, 1990).

Categorization is thought of as a cognitive activity because inductive inferences depend on more than purely perceptual similarity. Historically, concepts have been thought to be internalized representations that are relatively abstract. Concepts are described as mental structures that are more than sensory perceptual representation (Quinn, 2002, Gelman, 1988). However, Neisser (1987) defines categorization as the ability "to treat a set of things as somehow equivalent, to put them in the same pile, or call them by the same name, or respond to them in the same way'. Categorization is an essential cognitive activity because the world consists of an infinite number of discriminately different stimuli and each object or event cannot be treated as unique. Recognizing novel objects or events cannot be treated as unique. Recognizing novel objects or events as familiar because they belong to an unknown category enables us to know more about those objects than is possible just from looking (Mervis & Pani, 1980).

Categorizing is thus more than another form of perceiving, even though perceptual and conceptual processes are intertwined. They are intertwined due to the intimate connections between perceptual information and cognition because categories involve beliefs about the world. The perceptual structure of the world must be an important source of information for the development of these beliefs. Perception of the attribute structure of the world provides a reasonable basis for the assignment of objects to particular categories. This point was elaborated by Rosch (1978), who argued that the world comes naturally bundled into sets of attributes, and that this attribute structure is most accessible at the so-called "basic level". The "basic level" involves both seeing directly what things are, and having a theory that tells us how they should be classified which is known as prototype theory.

There is a large amount of evidence indicating that young children have rich conceptual structures that they have abstracted from their everyday experience of the world. However, this does not mean that they never experience conceptual change. The level of knowledge that can be abstracted from perceptual causal information about different entities has in many cases been transcended by modern physics and biology. By and large, this knowledge must be taught. It seems likely that conceptual change in such instances (for example, from medieval theories of motion to Newtonian theories; Kaiser, Proffitt & McCloskey, 1985) depends on motion.

However, it is unclear whether taught knowledge really causes conceptual change. Some developmental psychologists have argued that children do experience spontaneous conceptual change, without direct tuition. When such conceptual change occurs, the new principles are said to emerge that 'carve the world at different joints' (Carey & Spelke, 1994). However, such apparent change may result from incremental knowledge acquisition. This could change the relative activation strength of various core features of particular concepts, suggesting to the external observer that new principles have emerged.

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Carey has argued that conceptual change in childhood (and in science) depends on children and scientists *mappings* between different domains. Such mappings entail relating objects in one system to objects in another system (e.g. plants). If such a mapping is created, then the principles that govern children's understanding of people can be applied to their understanding of plants. Children use analogical mappings from people to decide whether animals and plants can be kept small and cute forever or whether they would like to feel pain if pricked by a needle (Inagaki et al, 1993, 1988). Furthermore, there is a growing body of work which demonstrates that analogical mappings are used by children as young as 3 years, in other areas of cognition such as causal reasoning (Goswami & Brown, 1990), physical reasoning (Pauen & Wilkening, 1997) and reasoning about natural kinds and artefacts (Goswami & Pauen, 2006).

Carey (1985) has also argued the case for the importance of analogical mappings to conceptual change using the domain of biology as an example (Kuhn, 1989). Carey has argued that preschool children's understanding of biological phenomena differs radically from that of older children. Her data suggests that younger children base their understanding of animals on their people, projecting behavioural and psychological properties onto other animals according to how similar these animals are to human beings. Only older children showed a coalescence of the concepts animal and plant into the new concept, *living thing.* Carey thus argued that children's understanding of biology emerged out of their understanding of people. It is unclear that whether this coalescence should be termed conceptual change. The tendency to attribute physiological and mental properties to other objects on the basis of their similarity to people has also been termed a 'personification analogy' (Inagaki & Hatano, 1993; Inagaki & Sugiyama, 1988).

There is lack of consensus with Carey's views on biological development (Atran, 1994; Keil; 1989; Kuhn, 1989). A different view of conceiving of conceptual development can be derived from the notion of foundational domains, summarized by Wellman and Gelman (1992) who pointed out that young children are probably developing several alternative conceptual frameworks at the same time. Rather than developing a monolithic understanding of the world, infants and young children are probably developing distinct yet interlinked conceptual frameworks to describe the "foundational domains" of biology, psychology and physics.. Many concepts will of course be represented in more than one of these foundational frameworks. These foundational domains will then engender, shape and constrain other conceptual understandings. At the same time, the children will use at least two levels of analysis within any framework, one that captures surface phenomena (mappings based on attributes) and another that penetrates to deeper levels (mappings based on relations). The need to compare, share, merge and create new conceptions is likely to be encouraged by the assumptions of surrounding children and adults, by the technology of the culture, and by systematic teaching received in school. However, it is not clear that these mechanisms of sharing and merging conceptual understandings across foundational domains were the same as the kind of conceptual change envisaged by Carey and Spelke (1994). These empirical questions can be investigated further by cognitive development studies.

II. METHOD

The purpose of the study was to observe the development of concept formation in children using specific concepts. After considering the three age groups as 6 years, 8 years and 10 years, and the level of familiarity with different concepts, the concept of 'mother earth' and 'planet earth' were selected for the study. The data for the study comprised of a sample of 30 children from three different age groups. The participants were selected using the technique of *Purposive Sampling,* based on the inclusionary criteria that the ten participants should belong to each from the three age groups 6, 8 and 10 years.

It was also suggested that participants should be enrolled in one of the Public schools with English as a medium of teaching-learning instruction. After finalising the concepts to be studied with children, ten participants, each of the three different age groups with the appropriate school background were selected. The participants were asked to draw their representation for the concept of 'mother earth' and 'planet earth', followed by asking them to description and writing, which was done for the three age groups. The participants were provided with plain papers and colours for the task. Relevant instructions were given to each participant. After the data was collected, it was analysed using *Content Analysis Method* to find out the concept formation and making comparisons amongst the different age groups.

III. RESULTS

The drawings and corresponding descriptions provided by the participants were analyzed and certain themes were evolved to understand the development of concepts –'mother earth' and 'planet earth' in children belonging to three different age groups.

Development of the Concept of Mother Earth

In the age-group of 6 years, the participants had no formation of the concepts of 'mother earth' presented to them and most of them did not respond well at both the drawing and description tasks. However, in the age-group of 8 years, the concept of mother earth emerged as a feminine figure: Mother Earth has been conceived as a feminine figure by the participants. The perception of mother earth as feminine figure got support from the children's descriptions as well as drawings. Mother earth was been drawn beautifully by the participants, using vibrant colours and had been referred to as *'lovely'* and *'beautiful'.* There could, thus, be seen beautification of mother earth. The *ecological proximity* emerged as another theme which suggested that the closeness between the children's concept of mother earth and ecology could be observed. Various ecological components were perceived by the participants as part of concept formation of mother earth. Occasionally, the participants' concept of mother earth included sparrows, clouds, trees, grass, plants and so on.

Psychological attachment to the concept of mother earth was also observed in children's descriptions of mother earth.

Notion of abstract utility supported the children's psychological proximity to their concept of mother earth. The children referred to ways in which components of mother earth provide benefit to humans. For instance, there were mention of utility of houses and trees in providing shelter and food to human beings. *Earth as a nurturing figure* evolved as a subsequent theme, with abstract utility being a major component of psychological proximity, mother earth was perceived as a nurturing figure by the participants. Moreover, the benefits that mother earth provide through houses, trees and grass to humans; mother earth was also seen as providing space to children for play. Thus, apart from material utilities, mother earth takes care of happiness and enjoyment of children. Conceptualizing mother earth as a nurturing figure, there could be seen *an absence of the self as a caregiver,* in the participants. The participants mentioned ways through which mother earth provides benefits to humans, ecological proximity and psychological proximity, but there was no mention of ways through which humans can, in turn, help and do something for mother earth.

The description of participants, in the age group of 10 years, included all those characteristics that point towards the role of *earth as nurturing.* The children described earth as comprising of all those amenities that are necessary for people to stay healthy and which helps people remain fit and happy. This description has a close resemblance to the role of the mothers in their own lives. The children's description did not entail any details, depiction or description of nature or the ecological environment which reflects a *lack of ecological* awareness. The children's drawings had a mention of only those things that provide humans some or the other benefits, thus earth acted as a holistic provider for children.

The children's descriptions and drawings reflected the role of *earth as unidirectional* and missed out any mention of their responsibility towards the maintenance of the Mother Earth. Thus, the earth was only seen as a provider of things and children, in turn, had no responsibility towards the earth. The children tended to represent earth as eco-friendly and focused on the very basic things that were necessary for everyday living. There was no mention of modern objects, despite the world's increasing use and production of technologies. It was a close representation to that of environment to be very simple and people friendly.

Development of the Concept of Planet Earth

While analysing data with children in the age group of 6 years, it was found that the participants had no formation of the concept of planet earth In the age group of 8 years, however, the planet earth was *symbolized as a commodity* and not something with life of its own. The pictures were of concrete objects that accommodated air, space, mud, tress, tables and human beings. Children displayed *an apathetic, indifferent and emotionless attitude* towards the planet earth. The term and its association appeared to be impassive and children showed no care. Even though the participants talked about life giving objects or things on earth, such as trees, air, mud but they talked about those *objects as lifeless things* and not as life giving forces. The images were influenced by the pictorial representations that children had seen in their school textbooks and so their understanding was *affected by the academic structures*, rather than emerging from their independent thought processes.

In the age group of 10 years, the concept of planet earth was perceived as *"lifeless" entity* with emphasis on the geographical and structural features of the earth. The participants responded that the image of earth consisted of landscape and water, in the form of continents and oceans. However, in providing written explanations, the children mentioned expectation of life on the earth, there was no glimpse on the existence of living things such as plants, animals and human beings in their drawings. The image on planet earth appeared to be a systematic and scientific projection of earth in the *solar system where the sun occupies a major place.* The emphasis on the sun and other planets reflected their previous knowledge of the solar system as they were able to differentiate between earth and other components of the solar system.

The pictorial representations by the participants evolved the relative *positions and motion of the earth* along with other planets. Although the image of earth has been enlarged to emphasize its significance, the names of other planets and the sun were also provided. Some distinguishing features in other planets such as size and rings have also been highlighted. In some drawings by children, the image of the earth was divided into two equal parts, in which the one of the side was darkened. The side which was facing the sun had been projected as day and the other side which was opposite to the direction of sun projected as night. Thus, the image has highlighted the major *role of sun in causing day and night* on the earth.

The drawings and explanations seemed to be influenced by children's *academic learning in schools*. The participant even mentioned that they had a chapter on solar system in their school textbooks and they had seen similar diagrams in other science books. So, children's previous learning at school must have influenced their much elaborated drawing of the planet earth. The pictorial representation appeared to be typical diagrams of solar system which are found in the textbooks of children studying in school. The children were able to provide a detailed description of the drawing in written form which seemed to be *rote-memorized*. The conceptual explanation of the drawing had more instances of sun and other planets rather than planet earth.

IV. DISCUSSION

As reflected in the results section, all the participants aged 6 years, were not able to produce anything relevant or related to the concepts of 'mother earth' and 'planet earth', reasoning that these concepts have not been taught to them at school level and thus, as such they were not aware of these terms. Moreover, their ignorance of these concepts may also be attributed to the fact that even their home environments had also not been able to expose them to these concepts. Subsequently, for the participants aged 8 years, the concepts of mother earth and planet earth were found to be overlapping as well as distinct from each other. The concept of planet earth, as conceptualized by the children, represented earth as a commodity and a lifeless thing and there was no emotional association between earth as a planet and human beings.

Mother earth, on the other hand, was conceptualized as a life form that further consists of living entities. There was psychological proximity between the mother earth and the child. Besides these differences, some overlaps between the two concepts could also be observed. There was an ecological proximity in conceptualizing mother earth and there was a mention of ecological factors like trees, sun and so on in planet earth, while referring to it as a commodity. So even though planet earth was seen as a commodity, but it was conceptualized as containing ecological factors. Further, in planet earth as well as mother earth, the sense of responsibility towards the earth was missing.

With all these distinctions and overlaps in the concepts of mother earth and planet earth in 8 year olds, the drawing of the two concepts and the conceptualization of components that constitute earth were found to be very similar. The descriptions, however, brought out a difference in approach of perceiving the constituents of mother earth and planet earth. Thus, it can be proposed that the 8 year old participants conceptualized and perceived mother earth and planet earth in a very similar manner.

The demarcations between the two concepts became more clear, precise and evident with increasing age, as it can be observed in the drawings and descriptions of the participants aged 10 years. For this age group, the development of the two concepts, there was a strong impact of schooling. The exposure of children to the kind of material taught in schools as quite evident from their drawings and descriptions. For the concept of planet earth, the descriptions were very spontaneous and easy for children to represent and it was a clear indicator of rote memorization but the concept of mother earth seemed to be less developed and was produced after lot of probing.

However, for the 8 year old participants, the concept of mother earth was much easier to represent as compared to the planet earth. The kind of description that emerged for the 8 year old participants did not show a very finite distinction between the two concepts. This showed that the concept of earth as mother earth was present in the earlier years, but due to the formal schooling and the rigorous orientation of the children in the educational systems, the concept of earth as a mother could not stay distinct and clear.

V. CONCLUSION

The two concepts 'mother earth' and 'planet earth' are derivatives of a broader concept or an umbrella term 'Earth'. From the initial years, children learn something or the other about the 'earth', and mostly it is about earth as a mother who takes care of human beings. The children, at a very young age, are sometimes told about the planets like sun, earth and other scientific properties of earth as a planet, but this view was not very much prevalent within every child. Thus, most of the children grow up with a better conceptualization of earth as a mother. Thus, it can be assumed that representing mother earth will be much easier for all age groups than planet earth, but this has not been supported by the results of the present study. There could be different reasons for this which will be analyzed below by considering the development of the two concepts across successive age groups. The study showed that the development of concept formation in children varies with age, with 6 year olds exhibiting no concept formation of the selected concepts, with 8 year olds displaying indistinct and ambiguous distinction between the two concepts and with 10 year old demonstrating clear, comprehensible distinction between the two concepts. The study, therefore, highlights that conceptual understanding develop with the increasing cognitive ability to learn and the significant role played by school related factors in children.

VI. REFERENCES

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