A Study of Malaysian Children's Understanding of the Concepts of "Living Things" and "Animals"

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Beberapa konsep asasi sains lazimnya dibentuk secara intuitif melalui pengalaman serta pemerhatian seseorang kanak-kanak. Kadangkala konsep-konsep intuitif ini adalah berbeza dan bercanggah dengan konsep-konsep sains sebenarnya. Oleh itu adalah penting dalam pendidikan sains serta juga semasa memperkembangkan kurikulum sains untuk mengetahui dengan tepat:

* apakah bentuk serta ciri konsep-konsep intuitif ini?
* bagaimana konsep-konsep ini dibentuk?
* apakah perbezaan di antara konsep-konsep yang dibina secara intuitif dengan konsep sains sebenarnya?

Dalam kajian yang dilaporkan di sini persoalan-persoalan di atas adalah mengenai konsep-konsep 'hidup' dan 'binatang' sepertimana yang diertikan secara intuitif oleh sekumpulan kanak-kanak berumur 4 – 6 tahun. Cara yang digunakan untuk menyiasat persoalan-persoalan ini adalah melalui temuduga secara individu berdasarkan kepada dua jenis kegiatan yang diberi kepada kanak-kanak ini. Kegiatan-kegiatan ini melibatkan mereka mengasingkan gambar-gambar benda 'hidup' dan 'binatang' daripada benda-benda 'bukan hidup'.

Daripada penganalisaan maklumat yang diperolehi melalui temuduga ini, didapati:

1) sebahagian besar kanak-kanak tidak menganggap tumbuh-tumbuhan atau binatang-binatang laut sebagai benda hidup.

2) sebilangan kecil kanak-kanak juga masih menganggap benda-benda seperti kereta, bas, bola dan sebagainya sebagai benda hidup.

3) bagi konsep binatang pula, sebahagian besar tidak menganggap manusia sebagai binatang.

Kriteria yang digunakan oleh kanak-kanak untuk membina konsep-konsep asasi secara intuitif ini mempunyai perhubungan dengan sifat kemanusiaan. Apa yang menarik sekali ialah kanak-kanak menggunakan kriteria kemanusiaan ini untuk mengkelaskan benda-benda seperti bas, bola dan sebagainya kepada benda-benda 'hidup' dan 'binatang'. Namun demikian mereka mengkelaskan 'manusia' dalam kumpulan 'bukan binatang' walaupun kriteria yang digunakan adalah sama.

Introduction

Concepts are formed through experiences. The attributes of a concept are learnt intuitively through the everyday repetitive experience of the different examplars of the concept. These attributes later become criteria for the inclusion of new examplars of the concept.

As we are all aware, children use word, such as; living, animals, plants, force ("The Force be with You"), energy, etc. from an early age. As they are able to use the words and ascribe meaning to them, it can be said that they have formed the concepts represented by these words. However, these concepts as held by children are intuitively formed and are probably very different from the scientific conceptions. As concepts such as those mentioned

above are some of the basic concepts in science, it is of crucial importance that these intuitively formed concepts be studied. Especially as they may be part of an alternative conceptual framework which could hinder the understanding of the scientific conceptions of these basic concepts, both in relation to the effective instruction and curriculum development in science.

In recent years there have been an increasing number of research interest in this area of study. Much of which originated from studies of childrens' use of language and alternative linguistic frameworks in science (Driver and Easley, 1978). Much of the recent work have however focussed on what is now termed as "Children Science" which seen as an conceptual framework which exists in children's mind built up through experiences (Gilbert, et al., 1982), and have been carried in relation to the learning in Science Project in New Zealand (Freyberg and Osborne, et al., 1982). Some of the concepts studied were concepts such as plants, animals and living things (Bell, 1981a, Bell 1981b, Osborne, 1980, Stead, 1980). Some of the findings of these studies showed that children do develop a set of criteria for these concepts, and the concepts formed are different from the scientific conceptions. Further there is evidence to show that these intuitively formed concepts persist until maturity (Freyberg and Osborne, 1980).

It would seem then, based on the studies reported, some of the fundamental questions in science education which needs to be answered are:

(i) How are these intuitive concepts formed?

(ii) What are the attributes of these intuitive concepts?

(iii) In what ways are they different from the science concepts?

(iv) When are they formed chronologically?

(v) How long do these concepts persist?

(vi) How can they be changed so as to become more scientific?

Objectives of the Study

The study reported here is a small scale attempt to investigate into some of the questions mentioned above with regards to the concepts "living things" and "animals". It attempts to record these concepts as held by young Malaysian (Pre-school) children. It is hoped that this study will provide some direction for a large scale survey of these intuitively held concepts spread over a wider age range. The research questions addressed in this study are:

(1) How extensively are these intuitively formed concepts of "living things" and "animals" being held by young Malaysian children?

  (a) When chronologically are they formed?

  (b) What are some factors (such as age, sex, ethnicity) which may have influenced the formation of these intuitive concepts?

(2) What are some of the attributes of these concepts?

Subjects

The sample is drawn from two classes of children at a local kindergarten. There was a total of 44 children with equitable distribution of age, sex and ethnicity. These distributions are presented in Table 1 below:

	Characteristics	N = 42 No. of children
I	Age : 4 years +	12
	5 years +	18
	6 years +	12
II	Sex : Male	22
	Female	20
III	Ethnicity : Malay	15
	Chinese	18
	Others	9

TABLE 1: **Characteristics of Subjects In Sample**

Method

All the subjects were intrviewed individually and in the interviews they were asked to complete two tasks based on a set of picture cards. This set of picture cards consisted of 20 colour picture cards of various familiar objects. They were:

A. Animate Objects

1. Human figures	(female/children)	2 cards
2. Large mammals	(cow/elephant)	2 cards
3. Marine animals	(fish/crab)	2 cards
4. Insects	(bees/butterfly)	2 cards
5. Birds	(hen/seagull)	2 cards
6. Plants	(flower/tree)	2 cards

B. In-animate Objects

1. Toys	(ball/spinning top)	2 cards
2. Food	(cake/biscuits)	2 cards
3. Vehicle	(car/bus)	2 cards
4. Sea		1 card
5. Book		1 card

The interview protocol involved initially asking the children whether they know the words "living things". They were asked to suggest two examples of what they considered as "living things". Children who were not able to do so were excluded from the first task of the interview.

This first task involved the following sequence:

1. Children were told that they were going to play a sorting game.

2. They were shown the randomly shuffled set of picture cards and were asked to name all the objects pictured in these cards.

3. They were then asked to sort these cards in two lots; one for "living things" and the other for "non-living things".

4. As they were engaged in the task, they were asked to explain why different pictures were being sorted in a particular pile.

5. After the completion of this task, the children were again asked to provide further explanations regarding the process of selection that they had, used, both for the "living" and "non-living" things.

After this task, the cards are then reshuffled and the children are to complete the second task which involved the following sequence:

1. The children were asked to give some examples of "animals".

2. Then they were asked to extract the pictures of all the animals to be found in the pack of cards.

3. They were asked to provide some explanations for selecting a particular picture.

4. After completion of the task they are asked to provide explanations as to why some of these pictures were not selected.

Results and Discussions

In this part of the paper I propose to present the findings and discuss them simultaneously for each of the questions posed earlier. The two concepts "living things" and "animals" will be treated separately.

What are the attributes of the intuitively held concepts?

The analyses carried out for these concepts are simple tabulation of frequency counts (both absolute percentage) of the different "mistakes" made by the children in classifying the objects into "living things" or "animals" categories, and also the reasons that they had given to explain their classification.

Concept "Living Things"

Table 4 shows the frequency of these mistakes that the children have made for the different objects found in the picture cards.

	Objects n = 36	Frequency selected as living things	Percentage
I	Animate		
	Tree	17	43%
	Flowers	16	46%
	Fish	33	94%
	Crab	34	96%
II	In-Animate		
	Car	12	33%
	Bus	10	27%
	Ball	10	27%
	Spinning Top	9	25%
	Cake/Biscuits	5	13%
	Sea	3	8%
	Book	2	6%

TABLE 4: **Frequency of inclusion of objects as "Living Things"***

*1. This table is based on n = 36 as 6 subjects were excluded from this task as they indicated that they did not know the word "living".

2. Objects which are selected by all subjects either as "living" or "non living" things are not included.

The most striking finding is the large number of children who have **not** classified plants as living things. Based on a sample (36) of those who indicated that they knew what living things are, only 48% had classified plants as living. The main and obvious reasons they gave for not classifying plants as living is related to the lack of motion by the plants, suggesting movement as being the main criteria used. Some of the responses are:

"Plants have no legs and hands"

"They can't walk"

"They can't move"

A few children (3) also did not include marine animals as living. One of them tried to differentiate "swimming" from "walking". However, this indicates that once again the criteria used is movement. Another reason given was that since these animals live in the sea that they are not living things, suggesting that location forms another set of criteria. This is confirmed as 18 children also used this reasoning to classify objects as "living things" based on this comment; "animals which live on land are living things". Some of the children also seem to use another criteria to separate plants and marine animals from the "living things" category. They (6) use what seems to be criteria of **sound production,** that is, living things produce some sort of sound, and since plants and marine animals do not, they cannot be **living things.**

For the in-animate objects, the criteria of movement was also used by some children (about 10) to include objects such as car, bus, ball, spinning top and sea. Some children also used as a criteria, the relationship that the objects have with themselves indirectly or human beings in general. For example, some children include the above mentioned objects together with other objects such as cakes, biscuits and books as living things because they are things which they use or have in their possession. This type of ego-centric criteria is very interesting in that it seems to be present over the entire age range investigated. Some of the explanations given by the children are:

"They (the in-animate objects) have homes"

"..... I play with them"

"I eat them (cakes, biscuits) so they are living"

All the criteria used by the children in classifying objects in the "living" and "non living" criteria and presented in **Table 5** with the frequency by which that have occurred.

	Criteria Used	Frequency
1.	Movement	29
2.	Location (live on land and live in the sea)	18
3.	Relationship to human characteristics	12
4.	Production of Sound	8
5.	Supportive of human life	5

TABLE 5: **Frequency of Criteria used for selection of "Living Things"**

As can be seen from the table, the main criteria (attribute) used by children for the concept of "living things" is movement. The type of movement which is implied is locomotive movement (self-propelled) and are related to human movement. The second criteria used is location. It would seem that for some children this is quite an important criteria, especially when they have to decide on the picture of marine animals found in the picture cards.

Relationship to human characteristics as mentioned earlier was used for both in animate and in-animate objects. Some children seems to associate the concept of living to things which in their words "have homes", "have babies", "have hair, hands and legs", etc.. Related to this criteria is the one in which living things are seen as supportive of human life, such as "they are food for human", and "can be used by human".

As one 5 years old puts it, "They are living things because I eat them".

Concepts of "Animals"

Table 6 reports the frequency of "mistakes" in the classification of objects as animals.

	Objects	Frequency (n = 42)
1.	Human	42
2.	Fish	7
3.	Crab	3
4.	Insects	2

TABLE 6: **Frequency of animate objects not being classified "animals"**

The finding which stands out is that all children in the sample **do not** regard man as an animal. Although this was to be expected, the extent of this perception was not. If all the children including 6 year old do not see human as animal, then how about children in the primary schools? Obviously this criteria is related socio-cultural background of the children. The crucial question, with respect to science education, is to be asked here is how persistent is this perception within the Malaysian society.

With the other animate objects such as fish, crab and insects, the main criteria used by a small number of children is that of size. According to some of them, in the words of one child;

"Animals must be big things"

Another criteria used is production of sound. This is similar as the criteria used for "living things", but with one difference, human talk is not seen as "sound".

"man talk, animals make noise"

The last criteria used is location. Again some children seem to differentiate between aquatic and terrestrial organisms, and in their minds, only animals live on land.

These criteria with the frequency count is presented below in Table 7.

	Criteria	Frequency
1.	Physical appendages such as "have legs, hands"	16
2.	Production of sound	8
3.	Size	7
4.	Location	5

TABLE 7: **Criteria Used to classify "animals"**

How extensively are these concepts being held by Malaysian children?

In an attempt to provide some indications the data were categorised into different categories of responses and these were then tabulated for the different independent variables, such as age, sex and ethnicity.

Concept of "Living Things"

The first table below (Table 8) reports the frequency of the different types of responses.

	Types of Responses n = 42	No.	%*
1.	Do not know what living things are	6	14*
2.	Classified correctly	5	12%
3.	Included Plants as non living	22	52%
4.	Included Marine Animals as non living	2	04%
5.	Included in animate objects as living	12	28%

TABLE 8: **Frequency of Types of Responses**

* The percentage include multiple responses for the different categories listed and are calculated based on sample of 42 children.

One striking result of this analysis is that a relatively small number 12% (5 pupils) were able to sort the picture cards into the two categories correctly, indicating that a large number (88%) of children in the 4+ to 6+ age range have not fully understood the scientific conception of "living things". Most of these children (52%) were not able to classify plants as "living things". Two children were not able to include marine animals as living. On the other hand 28% of the children included in-animate objects as living things.

	Type of responses n = 42	Total	AGE			SEX		ETHNICITY		
			n = 12 4+	n = 18 5+	n = 12 6+	n = 22 male	n = 20 female	Malay n = 15	Chinese n = 18	Others n = 9
1.	Do not know what living things are	6	2	1	3	4	2	1	2	3
2.	Classified correctly	5	0	3	2	3	2	3	1	1
3.	Included Plants ad "Non-living"	22	8	6	8	9	13	7	10	5
4.	Included Marine animals as "Non-living"	2	1	0	1	1	1	1	0	1
5.	Included in-animate objects as "living"	12	2	5	5	6	9	4	5	3

TABLE 9: **Frequency of responses by age, sex and ethnicity**

Table 9 reports the breakdown of the responses in the 5 categories by age, sex and ethnicity.

As the sample is insufficient, cross tabulations of the responses by the different independent variables such as sex, age and ethnicity cannot be made. However, bearing this in mind, some tentative interpretations could be gleaned from the results.

1. It is interesting to note that for the variable age, the responses are spread out over the entire age range, suggesting the persistence of the intuitively held concepts through the age range and perhaps extending beyond to older children.

2. There do not seem to be any sex differences in these responses. However, there need to be a much more extensive sampling to able to substantiate this interpretation. This observation holds true to the ethnicity variables.

Concept of "Animals"

Table 10 shows the different types of responses for the task of extracting pictures of animals from the set of picture cards. Unlike the earlier task, all the children were able to complete this task.

RESPONSE	Total	FREQUENCY							
		Age			Sex		Ethnicity		
		4+	5+	6+	Male	Female	Malays	Chinese	Others
1. Exclusion of human animals	42	12	18	12	22	20	15	18	9
2. Exclusion of marine animals	5	2	3	1	3	2	0	3	2
3. Exclusion of insects	3	1	1	1	2	1	0	2	1

TABLE 10: **Frequency of types of responses for task II with breakdown for age, sex and ethnicity**

From this table, it can be seen at, as discussed earlier, the entire sample of children did not regard man as an animal. While this is an important finding, it is not possible because of the total response to analyse it any further and relate it to any of the independent variables.

On the other hand, the low frequency of the other responses have also rendered it impossible for further analyses and interpretation.

Conclusions and Implications

From the discussion earlier, it would seem that the attributes of the intuitively held concept of "living things" for young Malaysian children are related to some human characteristics. Even the main attribute used, that is, movement, are explained in human terms, such as "don't have legs", "can't walk". There is seemingly an effort to equate the different features of other objects to human characteristics. Another aspect of this relation-

ship observed is the efforts by some children to classify objects as living if they support human life, i.e. food, shelter etc. This ego centricity of these attributes are well defined and are perhaps to be expected at such an early age. The question arises here then is how long do these conceptions persist? Do they go beyond the ego-centric stage of child development?

Similarly these questions can be raised with regards to the concept of "animals" which according to the data obtained is not inclusive of man. This view is extensively held as all the children studied hold it.

What is most interesting is that some of the children will use "humaness" to classify object as living and on the other hand use it to exclude man from other animals. The attributes used are similar but applied differently.

This study in a limited way is able to pin point some of the attributes of intuitively held concepts and the extent to which they are being held by a small group of children. A much larger study will be needed to investigate fully and meaningfully some of the questions posed earlier.

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