Age and Cognitive Equivalence: An Analysis of Bengali Primary School Children

Sharif Khan [a] and Lalit Lalitav Mohakud [b]

[a] Former M. Phil Scholar, Dept. of Education, Jadavpur University, Kolkata, India

[b] Assistant Professor, Dept. of Education, Jadavpur University, Kolkata, India

Abstract

The present study is an attempt to assess cognitive equivalence ability of Bengali primary school children in relation to their age. A total number of 83 children were selected randomly as sample from grade- I and III and V. Children's cognitive equivalence ability was measured by applying "Cognitive Equivalence Measuring Pictorial Task" developed by Khan & Mohakud. Available data were analysed through percentage analysis, *t*-test and one-way ANOVA technique in SPSS- 21. Results of the study revealed that cognitive equivalence ability of the children increases with increase in their age (grade).

KEYWORDS: Age, Perceptibility, Functional Cognitive Equivalence and Cognitive equivalence

Introduction

Cognitive development is the process of obtaining knowledge, including perceiving, recognizing, reasoning as well as judging (Bransford & Cocking, 2000). Among the various process of cognitive development equivalence is an important one. Cognitive equivalence is the ability to find out similar characteristics among different objects/ things/ situations or the logical explanation of how different things/ objects are alike. Concept of equivalence appears in children after the development of identity conservation as identity conservation is easier than equivalence conservation (Gold, 1983). Identity and equivalence are simply "conservation" from the standpoint of the theory (e.g., Piaget, 1968). The concept of conservation appears in children at about eight years of age and this age falls in the stage of concrete-operational stage. Elkind has suggested that identity normally emerges during the late preschool years and equivalence normally emerges during the early elementary school years (Elkind & Schoenfeld, 1972). Olver & Hornsby argued that children and adults differ in thinking about similarity judgement depending on diversity in environment and such equivalence making is in large measure a learned achievement, it may be expected to change with growth and development in a manner consistent with more general changes in cognitive development. According to Bruner this course of development by which finally all three modes of representation come in to force- the enactive, iconic and symbolic representation. Depending upon these modes of representation children impose equivalence on things of their world. Under this mode of enactive representation similarity of things being judged on the bases of a common role in some action. In iconic representation grouping of items depends upon perceptual likeness. With the achievement of symbolic representation equivalence is expected to be governed by grammatical principles as synonym, super ordination, or syntactic substitutability.

Rationale of the Study

Kagan (1966) suggested that individual differences in the rate of habituation, differentiation and information processing may be more prognostic of future level of cognitive development than the developmental changes suggested by Piaget and Werner. Omotoso & Shapiro, (1976) said age is an influential factor of cognitive development. They found that the concrete operational stage was not generally attained by the majority of the children until the age of eight. That was approximately one year later than the American children. Lastly they found a little evidence for sex difference of primary student of grade- III, (eight year olds) in favour of boys. Murray (1969) revealed that first and second graders conserved the mass, weight and volume of an object before conserve their own mass, weight and volume. Mitchel & Duncan (1978) revealed that conservation of mass and volume is achieved after mental age (MA) 7.6, and they also suggested that conservation follows more closely the development of MA than CA. Gakhar & Kaur (1990) reported that ability of seriation and Gradeification was found to have become operational at 8 and 9 years of age respectively. Elkind (1961) reported a close relation with Piaget's findings that success in comparing development of quantity, age related, hierarchically ordered and stage specific. Bhogle & Fatima (1981) found that age, type of quantity and type of material had significant effect on quantities thinking. Fahrmeier & Medin (1977) while examining the nature of dimensional processing in children, reported that age differences were generally confined to the color set. The judgments of the older children were more internally consistent and more similar to those of other children in their age group than were the younger children's. In their study "On Equivalence" Olver & Honrsby (1966) found that at early stage/ age students find out similarity on the basis of perceptible attributes and it goes towards functional attributes. They also found that equivalence formation with verbal materials is more functionally based in comparison to equivalence formation with pictures. Bush et al., (1975) found that older children performed better on all judgement tasks. However, kindergarten children performed better on identity conservation than the other two tasks, while first and second graders performed similarly on conservation of identity and equivalence but more poorly on compensation. Saraswathi & Sawhney (1989) found responses based on perceptual judgement to those of a somewhat more conceptual nature. With increase in age, there was decrease in the number of response error. No conclusive main effect of contiguity as a stimulus variable was observed. Although a significant main effect of the two factors age and stimulus complexity was evidenced. Riley (1989) revealed no significant differences existed in performance between males and females.

While going through many other related studies, it found that though many researches have been conducted in this field, but still this field needs special attention of researchers. Moreover, the investigator could not find any comprehensive study, which was conducted to measure cognitive equivalence ability of primary school children with respect to age in West Bengal, India. The present study is an attempt to fill up this research gap by analysing the cognitive equivalence of Indian Bengali primary school children with relation to age.

Objective of the Study

The main objective of the present study was

1. To analyse cognitive equivalence among Bengali primary school children with regard to their age.

2. To analyse perceptibility in equivalence among Bengali primary school children with regard to their age.

3. To analyse functional cognitive equivalence among Bengali primary school children with regard to their age.

Hypotheses of the Study
Following hypotheses were proposed to be tested:

H_{01}: Age is not an influential factor of cognitive equivalence among Bengali primary school children.

H_{02}: Age is not an influential factor of perceptibility among Bengali primary school children.

H_{03}: Age is not an influential factor of functional cognitive equivalence among Bengali primary school children.

Methodology
All the Bengali primary school children ranging from age group of six to twelve years old are the population of the present study. To find out the level of cognitive equivalence in young Bengali children; 83 school going children were selected purposively as subject from one rural and one urban district of West Bengal namely, Bardhaman and Kolkata. In this cross-sectional observational study, subjects were observed in a controlled situation. Anyway this study was to some extent conducted in an experiment like situation. In order to measure cognitive equivalence ability of Bengali primary school children a self-developed pictorial task (test) namely "Cognitive Equivalence Measuring Pictorial Task" by Khan and Mohakud was presented before the children in a controlled situation and their responses were observed and recorded by the researcher. It was a set of 42 pictures of different objects, fruits and vegetables; those, the children familiar with, presented in a 10/4.2 array.

Procedure of Data Collection
With taking prior permission from the HM/ TIC researcher went to the Grade room and make a little introductory conversation with students and then selected the sample randomly from the whole Grade and prepared a list of these subjects or representatives. After that, selected subjects were asked to come one by one to the researcher in another room. There the tool was presented before the student on a table, then he/ she was asked to come forward and observe the picture array minutely. Each student was encouraged to observe the picture array taking sufficient time. S/he was first asked to identify each picture to ensure that he/ she had seen and was familiar with all of them. Whenever, s/he was unable to provide any sort of identification for a picture, he was told what it was. Then s/he was asked to choose pictures that were alike in some way- "any way at all in which a group of things is the same"- and to remove them from the array and put them in a different place bellow the array. S/he could take as many pictures as s/he wanted. When s/he had completed her/his grouping, s/he was asked to tell how the pictures s/he selected were alike. The pictures were then replaced in their original position in the array, and s/he was asked to form another group. The task was repeated ten times, the child selecting new groups from the full set of pictures each time.
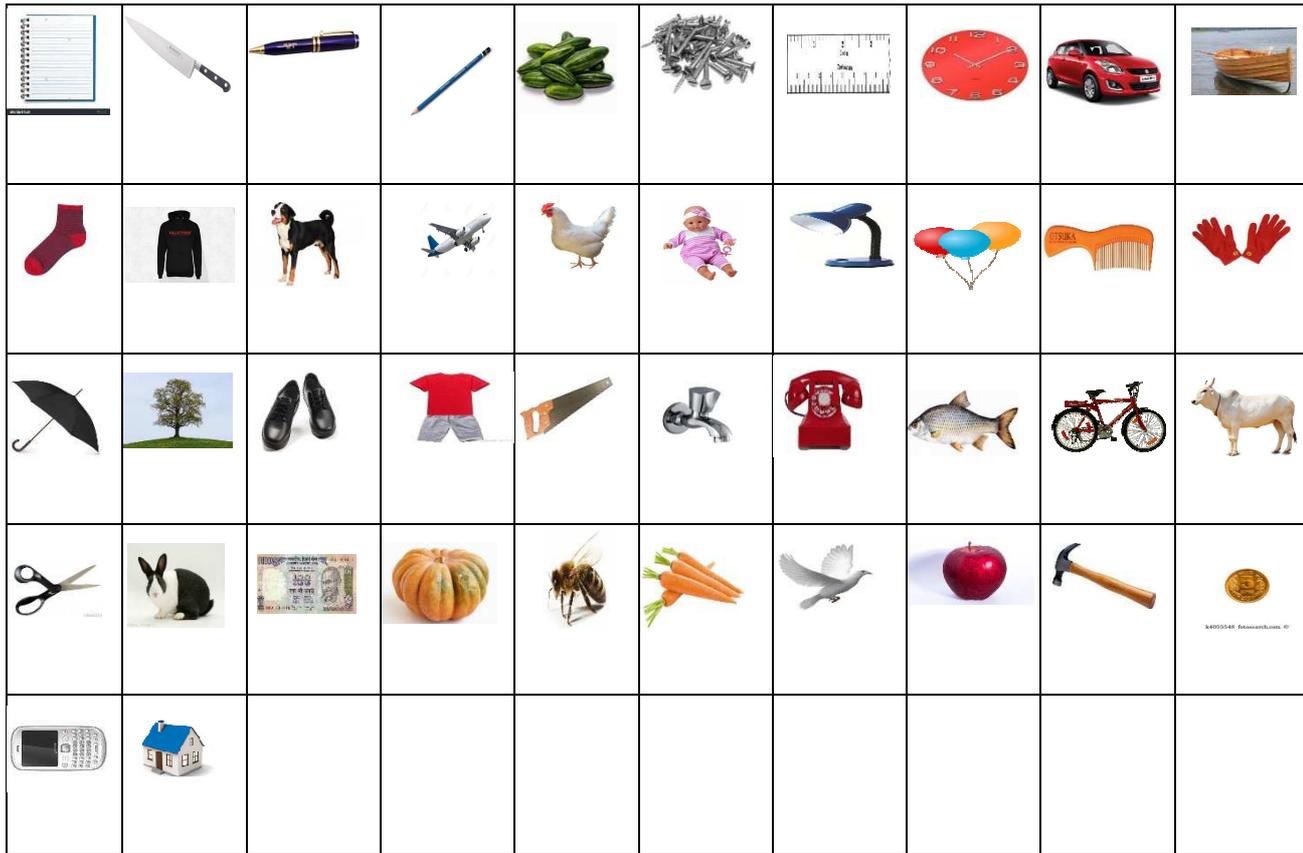
Age wise Comparison of Cognitive Equivalence

Table-1 Age wise Comparison of Cognitive Equivalence

Mean Age	Grade	N	Mean	Std. Deviation
6.8	I	28	13.71	5.112
8.7	III	28	15.71	5.227
10.5	V	27	19.59	4.299
	Total	83	16.30	5.425

Analysis of Variance Result					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	489.523	2	244.761	**10.177**	**.000**
Within Groups	1923.947	80	24.049		
Total	2413.470	82			

Multiple Comparisons				
(I) Mean age	(J) Mean age of The Children	Mean Difference (I-J)	Std. Error	Sig.
6.8 years	8.7 years	-2.000	1.311	.317
	10.5 years	**-5.878***	**1.323**	**.000**

8.7 years	6.8 years	2.000	1.311	.317
	10.5 years	-3.878[*]	1.323	.017
*. The mean difference is significant at the 0.05 level.				

The ANOVA result (i.e. **10.177** for **80/2** df) shows that there exists a significant difference between and within the groups as the p value (i.e**. .000**) is less than 0.05 level of significance. Therefore, it can be concluded that these groups differ significantly.

Further the Scheffe test in multiple comparison revealed that mean age of 6.8 years (Grade-I) and 8.7 years (Grade-III) old children do not differ significantly because the P value (i.e. .317) is greater than the 0.05 level of significance (P> 0.05). In case of 6.8 years old (Grade-I) and 10.5 years old (Grade-V), it is found that the groups differ significantly because the P value (i.e. 0.000) is less than 0.05 level of significance (P< 0.05) and also while comparing 8.7 years old children (Grade-III) with 10.5 years (Grade-V) old children, it is revealed that the groups differ significantly because the P value (i.e. 0.017) is less than 0.05 level of significance (P< 0.05). Hence, it can be concluded that the significant difference exists between 6.8 years old and 10.5 years old children and also between 8.7 years old and 10.5 years old children but 6.8 years old and 8.7 years old students do not differ significantly with regard to their cognitive equivalence ability.

Table: 2 Representing Age wise Comparison in Perceptible Equivalence Ability

	Mean Age	Grade	N	Mean	Std. Deviation
Score in perceptible equivalence	6.8	I	28	5.29	3.441
	8.7	III	28	5.43	3.795
	10.5	V	27	4.48	4.246
	Total		83	5.07	3.812

		Sum of Squares	df	Mean Square	F	Sig.
Score in perceptible equivalence	**Between Groups**	14.254	2	7.127	.484	.618
	Within Groups	1177.312	80	14.716		
	Total	1191.566	82			

The ANOVA result (i.e. **0.484** for **80/2** df) shows that there exists no significant difference between and within the groups as the p value (i.e. **.618**) is greater than 0.05 level of significance (**p>0.05**). Therefore, it can be concluded that these groups do not differ significantly.

Table: 3 Representing Age wise Comparison in Functional Equivalence Ability

		Mean Age	N	Mean	Std. Deviation
Score in functional equivalence	**Grade One**	6.8	28	3.96	3.260
	Grade Three	8.7	28	4.64	3.582
	Grade Five	10.5	27	6.52	2.847
	Total		83	5.02	3.386

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	95.818	2	47.909	**4.540**	**.014**
Within Groups	844.134	80	10.552		
Total	939.952	82			

| Multiple Comparisons					
Dependent Variable	(I) Mean age	(J) Mean Age of The Children	Mean Difference (I-J)	Std. Error	Sig.
Score in functional equivalence	6.8 years	8.7 years	-.679	.868	.738
		10.5 years	**-2.554**[*]	**.876**	**.018**
	8.7 years	6.8 years	.679	.868	.738
		10.5 years	-1.876	.876	.108
*. The mean difference is significant at the 0.05 level.					

The ANOVA result (i.e. **4.54** for **80/2** df) shows that there exists a significant difference between and within the groups as the p value (i.e. **.014**) is less than 0.05 level of significance. Therefore, it can be concluded that these groups differ significantly.

Further the Scheffe test in multiple comparison revealed that mean age of 6.8 years (Grade I) and 8.7 years (Grade-III) old children do not differ significantly because the P value (i.e. **.738**) is greater than the 0.05 level of significance (P> 0.05). In case of 6.8 years (Grade-I) and 10.5 years (Grade-V) old children, it is found that the groups differ significantly because the P value (i.e. **0.018**) is less than 0.05 level of significance (P< 0.05) but while comparing 8.7 years old (Grade-III) and 10.5 years old (Grade-V) children, it is revealed that the groups do not differ significantly because the P value (i.e. **0.108**) is greater than 0.05 level of significance (**P> 0.05**). Hence, it can be concluded that the significant difference exists between 6.8 years old (Grades-I) and 10.5 years old (Grade-V) children but 6.8 years old and 8.7 years old & 8.7 years old and 10.5 years old children do not differ significantly with respect to their functional equivalence ability.

Table: 4 Representing Age wise Overall Percentage Comparison between Perceptible and Functional Equivalence Ability

Mean Age	Grade	Total Number of Response	Perceptible Equivalence %	Functional Equivalence %
6.8	I	259	57.14	42.86
8.7	III	282	53.9	46.1
10.5	V	297	40.74	59.26
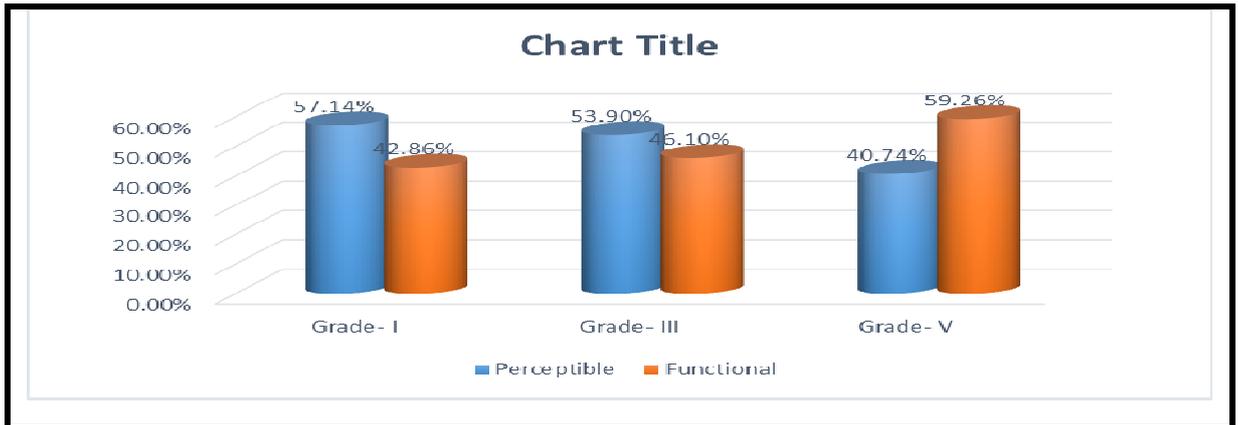
Interpretation

Here the average percentage of perceptible and functional explanation regarding grouping of picture task for mean age of 6.8 years (Grade-I) are 57.14% and 42.86%. That means at mean age of 6.8 years (Grade-I) there are greater uses of perceptible attributes than the functional attributes as the basis of grouping in the picture task. Although for 8.7 years old children (Grade-III) the perceptual basis of grouping in the picture task i.e. 53.90% is more than functional basis i.e. 46.10% but the difference between these are not so high like at 6.8 years of age. Further for mean age of 10.5 years at (Grade-V) 40.74% of the groupings in the picture task are perceptually based, 59.26% are functionally based. At this stage there is a significantly greater use of functional attributes as the basis of grouping the picture task.

Although picture materials produced a greater reliance for both group, mean age of 6.8 years and 8.7 years old on perceptible properties as the basis of grouping or judging likeness, the 6.8 years old children still bases far more of their groupings on the way things look than do elder children. The use of perceptible attributes decline steadily from 57.14% at 6.8 years of age to 53.90% at 8.7 years of mean age and to 40.74% at 10.5 years of age. It is also observed that the use of functional attributes increase steadily from 42.86% at 6.8 years to 46.10% at 8.7 years to 59.26% at 10.5 years. That means with increase in age and grade, perceptual equivalence ability as the basis of grouping picture task decline steadily and functional equivalence ability increase gradually.

Major Findings of the Study

As per the analysis and interpretations, the following findings were drawn

1. It is found that age of Bengali Primary School children is an influential factor in cognitive equivalence ability (H_{01} is rejected).
2. It is found that children of grade- I whose mean age is 6.8 years differ from grade- V, mean age of 10.5 years; in cognitive equivalence ability.
3. It is also found that mean age of 8.7 years old and 10.5 years old children differs significantly in cognitive equivalence ability.
4. Result also showed that 6.8 years old and 8.7 years old children do not differ significantly in their cognitive equivalence ability.
5. It is found that perceptibility of students does not differ significantly with respect to their age.
6. It is found that functional equivalence ability of students differs significantly with respect to their age.

7. Mean age of 6.8 years and 10.5 years old students differs significantly in their functional equivalence ability.
8. Mean age of 6.8 years and 8.7 years old children & 8.7 and 10.5 years old students does not differ significantly in their functional equivalence ability.
9. Result of the study revealed that with increase in age, perceptual equivalence ability as the basis of grouping picture task decline steadily and functional equivalence ability increase gradually.
10. At mean age of 6.8 years (Grade-I) there are greater uses of perceptible attributes than the functional attributes as the basis of grouping in the picture task.
11. For 8.7 years old children (Grade-III) the perceptual basis of grouping in the picture task is more than functional basis but the difference between these are not so high like at 6.8 years of age.
12. At 10.5 years of age there is a significantly greater use of functional attributes than perceptible as the basis of grouping the picture task.

Discussion and Conclusion

It is found that age and grade of schooling of Bengali primary school children is an influential factor in total cognitive equivalence ability. This result was corroborated by Olver & Honrsby (1966), Elkind (1961), Bush et al., (1975), Saraswathi & Sawhney (1989), Mitchel, M. M. & Duncan, P. G. (1978), Gakhar & Kaur (1990), Fahrmeier, E. D. & Medin, D. L. (1977), Murray, F. B. (1969), Bevli, Kapoor, Bharti & Tiwari, Bhogle & Fatima (1981), Sinha, D. & Jha (1989) and Rao (1989). This study has great educational implication. Result revealed that cognitive equivalence ability increases with age that means when children learn more about their world there thinking patterns changes rapidly, hence special attempts should be taken for children that they can be familiar with their surroundings. Identity conservation is pre-requisite for development of equivalence ability, so when children learn new things, it is elders' responsibility to help then to know different aspects of about new things.

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