

To understand the concrete concepts of logical-Mathematical in visually challenged children

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Abstract:The purpose of the study was to determine the level of concrete operational logical and Mathematical abilities namely classification, seriation Logical Multiplication and Operations of High School students of visually impaired children. This empirical study is essentially an exploratory clinical research. The approach of this investigation is quantitative and is supported by simple description. The researcher involved students individually and also in group to collect data by clinical method. Two different independent normally distributed populations with respect to the variables are selected for this study. To understand and examine the above hypotheses, visually impaired children and sighted children of class IX in Hyderabad are considered as the populations. The tools used to collect data are 1. The Test of logical Operations in mathematics (TLO – A Paper Pencil Test). Designed and constructed on the basis of Piaget’s seven logical operations.2. The modified Piagetian Logical-mathematical Test Battery. The researcher has adopted quantitative research techniques for the purpose of data representation, classification and interpretation. Inferential statistical technique ,chi-square and correlation are adopted for the purpose of testing the hypothesis. Interpretations are drawn on this basis of parametric and non-parametric statistical techniques.

Key words: Concrete concepts, classification, seriation, Logical Multiplication and Operations, Visually challenged children.

1. Introduction

The Physical abilities of a person indirectly in some cases directly influence the person achievement and ambitions. When we think of visual impairment the first question comes in the mind is about the abilities of the visually impaired persons and the foremost ability to be discussed is cognition.

Many studies in this area have discussed why how and when the disabilities of a person influence his cognitive development. When it comes to the concept based learning of mathematics’ in school students it may be delayed in the visually impaired child because of the absence of the concept of “what happens when.” They understand the concept in pieces and then perceived as a whole.

Achievement in mathematics by visually impaired students tends to be poor, in relative to performance in other academic subjects. This may be because of mathematics is very visual in nature. Descriptions such as direction, quantity, shape etc., can be best explained visually.

The aim of the study is to know the logical mathematical abilities in visually impaired children, what are the achievements in mathematics by visually impaired children and also what are the limitations for these children to learn mathematics in comparison with sighted children.

2.Objective of this study

1. To explore the classification abilities of children with visual impairment and normal sight and to compare these abilities with respect to their gender background.
2. To explore the Seriation abilities of children with visual impairment and normal sight and to compare these abilities with respect to their gender background.
3. To explore the abilities of Logical Multiplication and Operation of children with visual impairment and normal sight and to compare these abilities with respect to their gender background.

3.Hypotheses:

1. Classification Abilities

- a) Children with visual impairment and children with sight differ significantly with respect to their classification abilities.

b) Girls and boys belonging to visual impairment differ significantly with respect to their classification abilities.

c) Girls and boys belonging to sighted category differ significantly with respect to their classification abilities.

2. Seriation.

a) With respect to seriation abilities children with visual impairment and children with sight differ significantly.

b) Girls and boys belonging visually impaired differ significantly with respect to their seriation abilities.

c) Girls and boys belonging to sighted category differ significantly with respect to their seriation abilities.

3. Logical Multiplication and Operations

a) There are significant differences between children with visual impairment and sight with respect to their Logical Multiplication and Operations.

b) Girls and boys belonging to visual impairment differ significantly with respect to their Logical Multiplication and Operations.

c) Girls and boys belonging to and sight category differ significantly with respect to their Logical Multiplication and Operations.

4. Research Procedures:

4.1.0. Population and Sample:

Two different independent normally distributed populations with respect to the variables are selected for this study. To understand and examine the above hypotheses, visually impaired children and sighted children of class IX in Hyderabad are considered as the populations. While selecting the school a few variables like, physical facilities, medium of instruction, learning resources, residential facilities, enrolment and willingness to conduct the study are considered.

The researcher after a through field survey and wide consultations with the head of the institutions has identified 8 schools of sighted children and 3 residential schools catering to the educational needs of the visually impaired children that are willing to conduct the study. From these schools by adopting random sampling technique the Devnar school for Blind, Mayur Marg, Begampet, Hyderabad-500016 and Raghunatha Model High School, Chaitanapuri, Hyderabad -500060 are finally selected. By random stratified sampling technique the researcher selected total 64 children from IX standard. Out of which 32 children are visually impaired who were selected from Devanar blind school and 32 sighted children from Raghunatha model high school for the present study

4.2.0. Standardization and tools

For studying the cognitive behaviour of children especially for the visually impaired, the researcher did extensive survey of the research literature in various libraries was being made and consulted various experts in the field to develop, select, and administer the tool which could be equally suitable to both visually challenged and sighted children. The tools used to collect data are

1. The Test of logical Operations in mathematics (TLO – A Paper Pencil Test). Designed and constructed on the basis of Piaget's seven logical operations.

2. The modified Piagetian Logical-mathematical Test Battery.

5. Data Analysis: Techniques and Procedures

The researcher has adopted quantitative research techniques for the purpose of data representation, classification and interpretation. Inferential statistical technique, chi-square and correlation are adopted for the purpose of testing the hypothesis. Interpretations are drawn on this basis of parametric and non-parametric statistical techniques

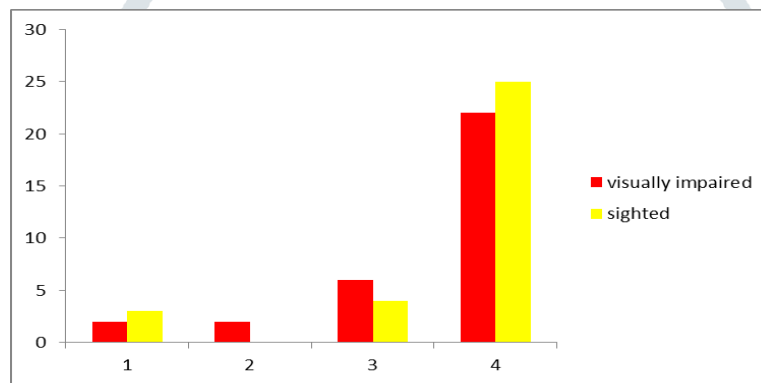
6.1.0. Objective I: To explore the classification abilities of children with visual impairment and normal sight and to compare these abilities with respect to their gender background.

Karplus (1977) describes classification as the systematic arrangement in groups or categories according to established criteria, the ability to simultaneously sort things into general and more specific groups, using different types of comparisons.

One of the objectives of this research work is to explore the logical mathematical abilities of children with visual impairment and normal sight and to compare these abilities with respect to their gender background. To study this objective appropriate tools are administered and the responses of the children are collected and analysed. The data is presented below.

Table 6.1.0. Distribution of children with to visually impaired with respect to their “classification abilities”.

sample	gender	ability of classification				total
		poor	fair	good	very good	
visually impaired	boys	2 (12.5%)	0 (0%)	2 (12.5%)	12 (75%)	16 (100%)
	girls	0 (0%)	2 (12.5%)	4 (25%)	10 (62.5%)	16 (100%)
sighted	boys	1 (6.25%)	0 (0%)	0 (0%)	15 (93.75%)	16 (100%)
	girls	2 (12.5%)	0 (0%)	4 (25%)	10 (62.5%)	16 (100%)
total		5 (7.81%)	2 (3.12%)	10 (15.62 %)	47 (73.43%)	64 (100%)



X-axis Sample distribution Y- axis Ability of Classification

From the above studies it is clear that the performance is towards higher side of the scale, i.e., they are in good and very good categories. Out of 32 sighted children, 25 children’s performance is very good. Out of visually impaired children, 22 children’s performance is very good.

Further it is observed that the performance of boys and girls across the samples, by and large, is same. However, for the purpose of finding statistical differences between the visually impaired and sighted children, the following three null hypotheses have been formulated:

1. There is no significant difference between the visually impaired and sighted children with respect to their “classification abilities”.
2. There is no significant difference between the boys and girls belonging visually impaired and sighted children with respect to their “classification abilities”.
3. There is no significant difference between the sighted boys and sighted girls with respect to their “classification abilities”.

6.1.1. In order to test the above null hypotheses the statistical test, “t-test”, has been adopted and the results are presented below:

	mean		s.d		t-value	Significance
Hypothesis-1	visually impaired	sighted	visually impaired	sighted	3.114	.163
	3.366	3.866	.668	.571		
Hypothesis-2	visually impaired - boys	visually impaired girls	visually impaired boys.	visually impaired girls	1.387	.176
	3.5333	3.2000	.51640	.77460		
Hypothesis-3	sighted-boys	sighted-girls	sighted-boys	sighted-girls	.814	.422
	3.2667	3.4667	.70373	.63994		



Visually impaired children vs. sighted Children: Classification Abilities:

The above table indicates that the mean and standard deviation values of visually impaired children and sighted children are 3.366, 0.668 and 3.866, 0.571. The obtained t-value is 3.114 (two-tailed) and $p(.163) > 0.05$ level of significance. This result indicates that children belonging to the visually impaired and sighted categories belonging to visually impaired group do not differ significantly with respect to their classification abilities. Hence, the null Hypotheses 1 accepted.

With respect to classification abilities. Hence, the null hypothesis-2 is accepted

Sighted boys vs. sighted girls: Classification Abilities:

The above table indicates that the mean and standard deviation values of sighted boys and sighted girls are 3.2667, 0.70373 and 3.4667, 0.63994. The obtained t-value is 0.814 (two-tailed) the $p > 0.05$ level of significance. This result indicates that sighted boys and sighted girls do not differ significantly with respect to their classification abilities. Hence the null hypothesis-3 is accepted

6.2.0. Objective II: To explore the Seriation abilities of children with visual impairment and normal sight and to compare these abilities with respect to their gender background. Seriation, which refers to the ability to sort objects or situations according to any characteristic, such as size, colour, shape, or type. Seriation or sorting considered to result from serial, symbolic processing in which the child acquires a set of procedures and then learn how and when to apply them in order to produce an orders series.

One of the objectives of this research work is *to explore the Seriation abilities of children with visual impairment and normal sight and to compare these abilities with respect to their gender background.* To study this objective appropriate tools are administered and the responses of the children is collected and analysed. The data is presented.

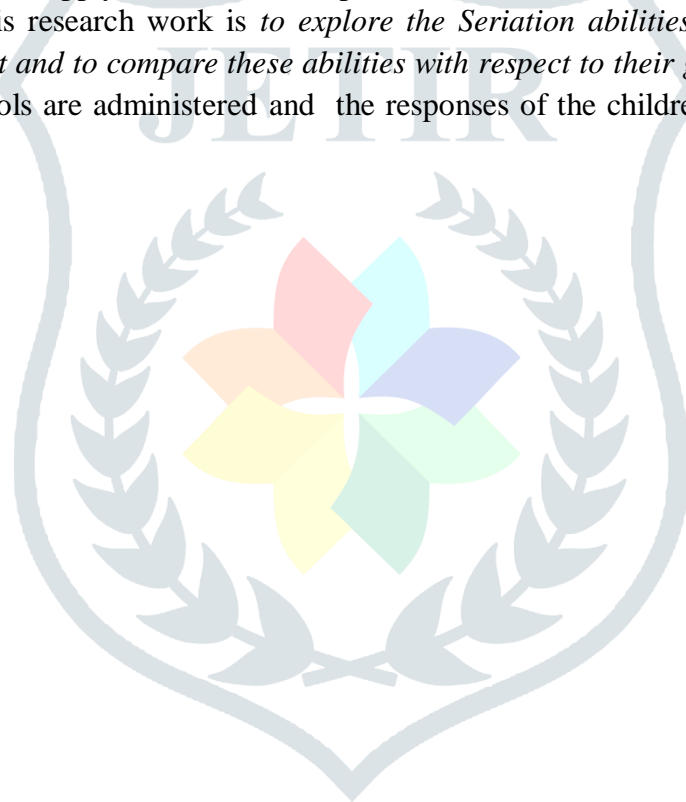
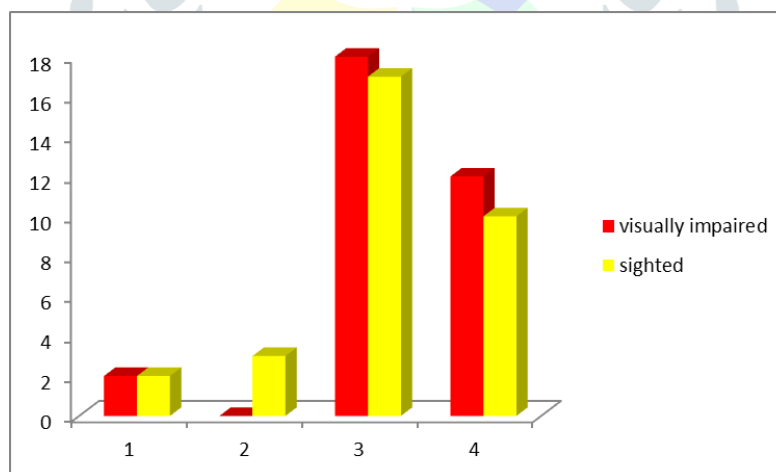


Table 6. 2.1. Distribution of children with respect to the ability of “seriation”

seriation											
	gender	visually impaired					sighted				
		poor	fair	good	very good	total	poor	fair	good	very good	total
Seriation	boys	2 12.50%	2 12.50%	10 62.50%	2 12.50%	16 (100%)	4 (25%)	0 (0%)	2 12.50%	10 62.50%	16 (100%)
	girls	0 (0%)	6 37.5%	6 37.5%	4 (25%)	16 (100%)	5 31.25%	0 (0%)	4 (25%)	7 43.75%	16 (100%)
Seriation	boys	2 12.50%	4 (25%)	4 (25%)	6 37.5%	16 (100%)	1 6.25%	3 18.75%	4 (25%)	8 (50%)	16 (100%)
	girls	0 (0%)	6 37.5%	8 (50%)	2 12.50%	16 (100%)	1 6.25%	4 (25%)	6 37.5%	5 31.25%	16 (100%)
Seriation	boys	2 12.50%	0 (0%)	0 (0%)	14 87.5%	16 (100%)	1 6.25%	3 18.75%	4 (25%)	8 (50%)	16 (100%)
	girls	0 (0%)	0 (0%)	0 (0%)	16 (100%)	16 (100%)	1 6.25%	2 12.50%	5 31.25%	8 (50%)	16 (100%)
Seriation	boys	2 12.50%	0 (0%)	10 62.50%	4 (25%)	16 (100%)	6 37.5%	2 12.50%	0 (0%)	8 (50%)	16 (100%)
	girls	0 (0%)	0 (0%)	8 (50%)	8 (50%)	16 (100%)	3 18.75%	2 12.50%	4 (25%)	7 43.75%	16 (100%)
average	boys	1 6.25%	0 (0%)	8 (50%)	6 37.5%	16 (100%)	1 6.25%	2 12.50%	7 43.75%	6 37.5%	16 (100%)
	girls	1 6.25%	0 (0%)	10 62.50%	6 37.5%	16 (100%)	1 6.25%	1 6.25%	10 62.50%	4 (25%)	16 (100%)



X-axis Sample distribution. Y-axis Ability of seriation

From the table it is clear that majority of visually impaired and sighted children’s performance is towards higher scale i.e. in good and very good category. And also out of 32 sighted children 27 are in good and very good category. Out of 32 visually impaired children 12 are in good and very good category. Further it is observed that the performance of boys and girls across the samples, by and large, is same. However, for the purpose of finding statistical differences between the visually impaired and sighted children the following three null hypotheses have been formulated:

1. There is no significant difference between the visually impaired and sighted children with respect to their “seriation abilities”.
2. There is no significant difference between the boys and girls belonging to visually impaired with respect to their “seriation abilities”.
3. There is no significant difference between the sighted boys and sighted girls with respect to their “seriation abilities”.

6.2.2. In order to test the above null hypotheses the statistical test, “t-test”, has been adopted and the results are presented below:

	mean		s.d		t-value	significance
hypothesis-1	visually impaired	sighted	visually impaired	sighted	1.141	.259
	3.233	3.4	.626	.498		
hypothesis-2	visually impaired boys	visually impaired girls	visually impaired boys	visually impaired girls	.727	.473
	3.4667	3.333	.51640	.48795		
hypothesis-3	sighted boys	sighted girls	sighted boys	sighted girls	.0000	1.0000
	3.4000	3.4000	.50709	.5709		

The above table indicates that the mean and standard deviation values of visually impaired boys and girls are 3.5333, .51640 and 3.2000, .77460. The calculated t-value is 1.387 (two-tailed) and $p(.176) > 0.05$ level of significance. This result indicates that the boys and the girls belonging to visually impaired group do not differ significantly.

Visually impaired children vs. sighted Children: Seriation:

The above table indicates that the mean and standard deviation values for visually impaired and sighted children are 3.233, 0.626 and 3.4, 0.498. The obtained T-value is 1.141 (two-tailed) and $p(.259) > 0.05$ level of significance. This result indicates that visually impaired and sighted children do not differ significantly with respect to their seriation abilities. Hence, the null hypothesis-1 is accepted.

Visually impaired boys vs. visually impaired girls: Seriation:

The above table indicates that the mean and standard deviation values of visually impaired boys and visually impaired girls are 3.4667, 0.51640 and 3.333, 0.48795. The calculated T-value is .727 (two-tailed) and $p(.473) > 0.05$ level of significance. This result indicates that the boys and girls belonging to visually impaired group do not differ significantly with respect to their seriation abilities. Hence, the null hypothesis-2 is accepted.

Sighted boys vs. sighted girls: Seriation:

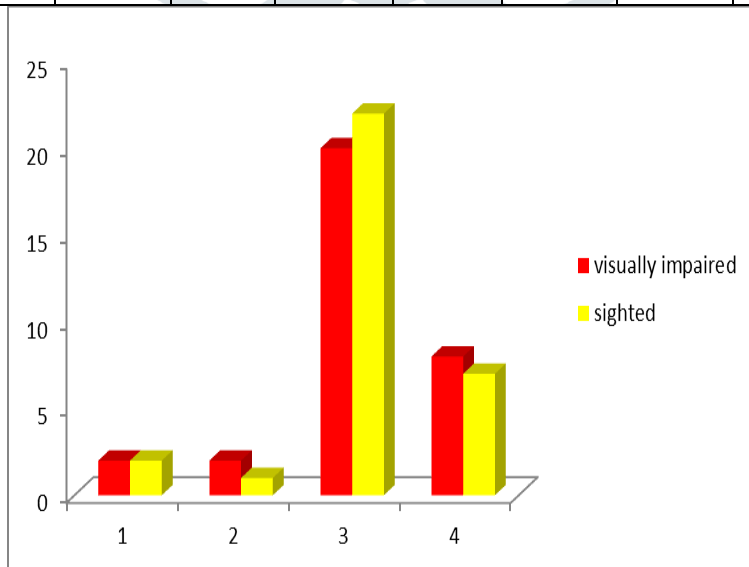
The above table indicates that the mean and standard deviation values of sighted boys and sighted girls are 3.4000, 0.50709 and 3.4000, 0.5709. The obtained T-value is .0000 (two-tailed) and $p(1.00) > 0.05$ level of significance. This result indicates that sighted boys and sighted girls do not differ significantly with respect to their seriation abilities. Hence, the null hypothesis-3 is accepted.

6.3.0. Objective III: To explore the abilities of Logical Multiplication and Operation of children with visual impairment and normal sight and to compare these abilities with respect to their gender background.

One of the objectives of this research work is to explore the abilities of Logical Multiplication and Operation of children with visual impairment and normal sight and to compare these abilities with respect to their gender background. To study this objective appropriate tools are administered and the responses of the children is collected and analysed. The data is presented below.

6.3.1. Distribution of children with respect to the ability of “Logical Multiplication and operation.”

logical multiplication and operation											
	gender	visually impaired					sighted				
logical multiplication and operation-1		poor	fair	good	very good	total	poor	fair	good	very good	total
	boys	2 12.50%	0 (0%)	6 37.5%	8 (50%)	16 (100%)	1 6.25%	0 (0%)	2 12.50%	13 81.25%	16 (100%)
	girls	0 (0%)	0 (0%)	8 (50%)	8 (50%)	16 (100%)	1 6.25%	0 (0%)	3 18.75%	12 (75%)	16 (100%)
	boys	2 12.50%	4 (25%)	8 (50%)	2 12.50%	16 (100%)	1 6.25%	4 (25%)	7 43.75%	4 (25%)	16 (100%)
	girls	0 (0%)	2 12.50%	12 (75%)	2 12.50%	16 (100%)	1 6.25%	5 31.25%	5 31.25%	5 31.25%	16 (100%)
	boys	2 12.50%	4 (25%)	6 37.5%	4 (25%)	16 (100%)	1 6.25%	3 18.75%	8 (50%)	4 (25%)	16 (100%)
	girls	0 (0%)	4 (25%)	6 37.5%	6 37.5%	16 (100%)	1 6.25%	6 37.5%	6 37.5%	3 18.75%	16 (100%)
	boys	2 12.50%	2 12.50%	8 (50%)	4 (25%)	16 (100%)	1 6.25%	4 (25%)	9 56.25%	2 12.50%	16 (100%)
	girls	14 87.5%	2 12.50%	0 (0%)	0 (0%)	16 (100%)	4 (25%)	4 (25%)	5 31.25%	3 18.75%	16 (100%)
	boys	2 12.50%	0 (0%)	8 (50%)	6 37.5%	16 (100%)	1 6.25%	0 (0%)	11 68.75%	4 23.5%	16 (100%)
	girls	0 (0%)	2 (12.5%)	12 (75%)	2 (12.5%)	16 (100%)	1 (6.25%)	1 (6.25%)	11 (68,75%)	3 (18.75%)	16 (100%)



X-axis Sample distribution. Y-axis Ability of Logical Multiplication and Operation

From the table it is clear that majority of visually impaired children’s performance is towards higher scale i.e. in good category. And also out of 32 sighted children 22 children’s performance is in good category. Out of 32 visually impaired children 20 children’s performance is in good category. Further it is observed that the performance of boys and girls across the samples, by and large, is same. However, for the purpose finding

statistical differences between the visually impaired and sighted children the following three null hypotheses have been formulated:

1. There is no significant difference between the visually impaired and sighted children with respect to their “logical multiplication and operation”.
2. There is no significant difference between the boys and girls belonging to visually impaired with respect to their “logical multiplication and operation”
3. There is no significant difference between the sighted boys and sighted girls with respect to their “logical multiplication and operation”.

6.3.2. In order to test the above null hypotheses the statistical test, “t-test”, has been adopted and the results are presented below

	mean		s.d		t-value	significance
	visually impaired	sighted	visually impaired	sighted		
hypothesis-1	2.166	2.7	1.176	.8769	1.99	.501
hypothesis-2	visually impaired boys	visually impaired girls	visually impaired boys	visually impaired girls	.447	.658
	3.1333	3.0667	.51640	.25820		
hypothesis-3	sighted boys	sighted girls	sighted boys	sighted girls	1.382	.178
	3.20000	3.0000	.41404	.37796		

Visually impaired children vs. sighted Children: Logical Multiplication and operation:

The above table indicates that the mean and standard deviation values of visually impaired and sighted children are 2.166, 1.176 and 2.7, .8769. The obtained t-value is 1.99 (two-tailed) and $p(.501) > 0.05$ level of significance. This result indicates that visually impaired children and sighted categories do not differ significantly with respect to their Logical Multiplication and operation. Hence, the null hypothesis-1 is accepted.

Visually impaired boys vs. visually impaired girls: Logical Multiplication and operation:

The above table indicates that the mean and standard deviation values of visually impaired boys and visually impaired girls are 3.1333, .51640 and 3.0667, .25820. The calculated t-value is .447 (two-tailed) and $p(.658) > 0.05$ level of significance. This result indicates that the boys and girls belonging to visually impaired group do not differ significantly with respect to their logical multiplication and operation. Hence, the null hypothesis-2 is accepted.

Sighted boys vs. sighted girls: Logical Multiplication, and operation:

The above table indicates that the mean and standard deviation values of sighted boys and sighted girls are 3.20000, .41404 and 3.0000, 0.37796. The obtained t-value is 1.382 (two-tailed) and (.178) it is significant at 0.05 level of significance. This result indicates that sighted boys and sighted girls do not differ significantly with respect to their Logical Multiplication and operation. Hence, the null hypothesis-3 is accepted.

7. Discussion

The above findings show that both in visually impaired children and sighted children there are no differences in logical mathematical abilities with respect to gender. From the analysis of the data and testing of hypothesis, it is clear that by and large the gender does not influence on the mathematical abilities as shown in the above study. ShibleyHyde(1990) found in her study that, boys and girls understood maths concepts equally well and any gender differences actually narrowed over the years, belying the notion of a fixed or biological differentiation factors. The gender gap has been closing over time. In fact, they reported that the gap is smaller in countries with greater gender equality, suggesting that gender differences in maths achievements are largely due to cultural and environmental factors.

The above findings indicate that the tasks such as classification, seriation, logical multiplication and operation, of logical mathematical abilities have no difference in performance of visually challenged children and sighted children. As these tasks of operations are "concrete" and they are based on actual people, places and things those children have observed in the environment. Hence Children's mental representations remain concretely linked to these things they have seen and touched throughout the middle childhood period.

This may be understood because children's ability to consciously, thoughtfully and pro-actively choose to pursue goals (instead of simply reacting to the environment) appears during this developmental period does not differ with gender nor with vision. In addition, children's thinking style gradually becomes more logical, organized, and flexible at this stage and their ability to perform mental arithmetic increases. Children at this age become capable of mastering addition and subtraction and similar operations and consequently are able to arrive at the answer without having to actually do the experiment.

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