

Development 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 conservation measurement and compensation 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

Index Terms: Visually challenged children, concrete concepts, conversation, measurement and compensation

1. Introduction

In an inclusive education visually challenged children and sighted children with same chronological age are grouped and placed in the same class but their development levels may differ significantly as well as the rate at which individual children pass through each Piaget stage. This may be due to difference in maturity, experience, culture, and the ability of the child. Piaget believed that children develop steadily and gradually throughout the varying stages and that the experiences in one stage form the foundations for movement to the next. All children have to pass through each stage before starting the next one; no one skips any stage. Hence according to Piaget work on cognitive development of children believed that the development of a child occurs through a continuous transformation of thought processes. This study is to understand the concert concept based learning of logical and mathematical abilities in visually impaired children in relation to sighted children.

2.Objectives

1. To explore the Conservation abilities of children with visual impairment and normal sight and to compare these abilities with respect to their gender background.
2. To explore the Measurement abilities of children with visual impairment and normal sight and to compare these abilities with respect to their gender background.
3. To explore the Compensation abilities of children with visual impairment and normal sight and to compare these abilities with respect to their gender background.

3.Hypotheses

1.Conservation

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

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

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

2. Measurement.

a) Children with visual impairment and children with sight differ significantly with respect to their Measurement thinking.

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

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

3. Compensation

a) Children with visual impairment and children with sight differ significantly with respect to their Compensation thinking.

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

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

4. Research Procedures:

4.1. 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. 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.

4.3. 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.

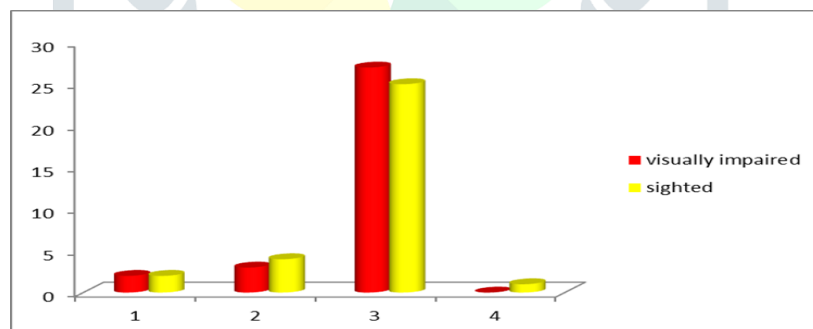
5.1.0. Objective 1: To explore the Conservation abilities of children with visual impairment and normal sight and to compare these abilities with respect to their gender background.

Conservation is one of Piaget's developmental accomplishments, in which the child understands that changing the form of a substance or object does not change its amount, overall volume, or mass. Conservation refers to a logical thinking ability to determine that a certain quantity will remain the same despite adjustment of the container, shape, or apparent size.

One of the objectives of this research work is *to explore the Conservation 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 below.

Table5.1.1. Distribution of children with respect to the ability of “conservation”

		poor	fair	good	very good	total
visually impaired	boys	2 (12.50%)	0 (0%)	14 (87.5%)	0 (0%)	16 (100%)
	girls	0 (0%)	3 (18.75%)	13 (81.25%)	0 (0%)	16 (100%)
sighted children	boys	1 (6.25%)	1 (6.25%)	14 (87.5%)	0 (0%)	16 (100%)
	girls	1 (6.25%)	3 (18.75%)	11 (68.75%)	1 (6.25%)	16 (100%)



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

From the table 5.1.1 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 25 children's performance is in good category. Out of 32 visually impaired children 27 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 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 “conservation abilities”.
2. There is no significant difference between the boys and girls belonging to visually impaired with respect to their “conservation abilities”.
3. There is no significant difference between the sighted boys and sighted girls with respect to their “conservation abilities”.

5.1.2. 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	.826	.412
	2.9	2.966	.4025	.1825		
Hypothesis-2	visually impaired boys	visually impaired girls	visually impaired boys	visually impaired girls	1.0000	.326
	3.000	2.933	.0000	.25820		
Hypothesis-3	sighted boys	sighted girls	sighted boys	sighted girls	1.0000	.326
	3.0000	2.9333	.0000	.25850		

Visually impaired children vs. sighted Children: Conservation abilities:

The above table indicates that the mean and standard deviation values of visually impaired and sighted children are 2.9, 0.4025 and 2.966, 0.1825. The obtained t-value is .826 (two-tailed) and $p(.412) > 0.05$ level of significance. This result indicates that children belonging to the visually impaired and sighted categories do not differ significantly with respect to their conservation abilities. Hence, the null hypothesis-1 is accepted.

Visually impaired boys vs. visually impaired girls: Conservation abilities:

The above table indicates that the mean and standard deviation values of visually impaired boys and visually impaired girls are 3.000, 0.00000 and 2.933, .25820. The calculated t-value is 1.0000 (two-tailed) and $p(1.000) > 0.05$ level of significance. This result indicates that the boys and girls belonging to visually impaired group do not differ significantly with respect to their conservation abilities. Hence, the null hypothesis-2 is accepted.

Sighted boys vs. sighted girls: Conservation abilities:

The above table indicates that the mean and standard deviation values of sighted boys and sighted girls are 3.0000, .0000 and 2.9333, .25850. The obtained t-value is 1.0000 (two-tailed) and $p(.326) > 0.05$ level of significance. This result indicates that sighted boys and sighted girls do not differ significantly with respect to their conservation abilities. Hence, the null hypothesis-3 is accepted.

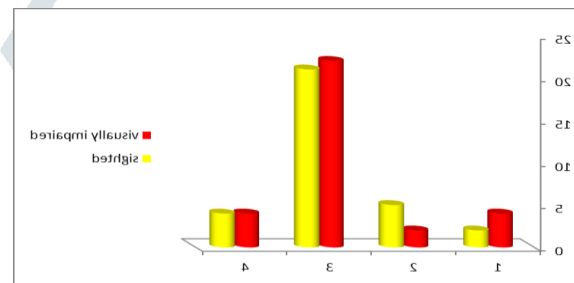
5.2.0. Objective II: To explore the Measurement abilities of children with visual impairment and normal sight and to compare these abilities with respect to their gender background.

Measurement is the assignment of a number to a characteristic of an object or event, which can be compared with other objects or events. The scope and application of a measurement is dependent on the context and discipline.

One of the objectives of this research work is *to explore the Measurement 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 below.

Table 5.2.0. Distribution of children with respect to the ability of “Measurement”

	mean		s.d		t-value	significance
	visually impaired	sighted	visually impaired	sighted		
hypothesis-1	visually impaired	sighted	visually impaired	sighted	.211	.833
	3.13333	3.1666	.3457	.7914		
hypothesis-2	visually impaired boys	visually impaired girls	visually impaired boys	visually impaired girls	.0000	1.000
	3.0667	3.0667	.25820	.25820		
hypothesis-3	sighted boys	sighted girls	sighted boys	sighted girls	.000	1.000
	3.0667	3.0667	.25820	.25820		



X-axis Sample distribution Y-axis Measurement abilities.

From the table (5.2.0) 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 21 children’s performance is in good category. out of 32 visually impaired children 22 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 “measurement abilities”.
2. There is no significant difference between the boys and girls belonging to visually impaired with respect to their “measurement abilities”.
3. There is no significant difference between the sighted boys and sighted girls with respect to their “measurement abilities”.

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

		poor	fair	good	very good	total
visually impaired	boys	2 12.50%	0 0%	14 87.5%	0 0%	16 100%
	girls	2 12.5%	2 12.5%	10 62.5%	2 12.5%	16 100%
sighted children	boys	1 6.25%	2 12.50%	11 68.75%	2 12.50%	16 100%
	girls	1 6.25%	3 18.75%	10 62.5%	2 12.50%	16 100%

Visually impaired children vs. sighted Children: Measurement abilities:

The above table indicates that the mean and standard deviation values of blind Children (which includes completely and partially sighted children) and sighted children are 3.13333, 0.3457 and 3.1666, 0.7914. The obtained t-value is .211 (two-tailed) and $p(.833) > 0.05$ level of significance. This result indicates that children belong to the blind (which includes completely and partially sighted children) and sighted categories do not differ significantly with respect to their measurement abilities. Hence, the null hypothesis-1 is accepted.

Visually impaired boys vs. visually impaired girls: Measurement abilities:

The above table indicates that the mean and standard deviation values of visually impaired boys and visually impaired girls are 3.0667, .25820 and 3.0667, .25820. The calculated t-value is .0000 (two-tailed) and $p(1.000) > 0.05$ level of significance. This result indicates that the boys and girls belonging to visually impaired group do not differ significantly with respect to their measurement abilities. Hence, the null hypothesis-2 is accepted.

Sighted boys vs. sighted girls: Measurement abilities:

The above table indicates that the mean and standard deviation values of sighted boys and sighted girls are 3.0667, .25820 and 3.0667, 0.25820. The obtained t-value is .000 (two-tailed) and $p(1.00) > 0.05$ level of significance. This result indicates sighted boys and sighted girls do not differ significantly with respect to their measurement abilities. Hence, the null hypothesis-3 is accepted.

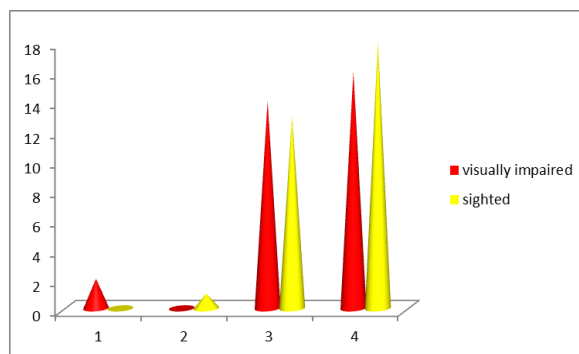
5.3.0. Objective III: To explore the Compensation abilities of children with visual impairment and normal sight and to compare these abilities with respect to their gender background.

According to Piaget, a student's ability to solve conservation problems depends on an understanding of three basic aspects of reasoning: identity, compensation, and reversibility. With mastery of identity, the student realizes that material remains the same if nothing is added to or subtracted from the material. One number is rounded simply to the calculation, then the answer is adjusted to compensate for the original change. With compensation number close to the numbers in the problem are chosen to make the computation easier and then adjust the answer for the number chosen.

One of the objectives of this research work is to explore the Compensation abilities of children with visual impairment and normal sight and to compare these abilities with respect to their gender background by administering appropriate tools and the responses of the children is collected and analysed. The data is presented below.

Table5.3.0. Distribution of children with respect to the ability of “compensation abilities”

Sample	Gender	Ability of compensation abilities				TOTAL
		POOR	FAIR	GOOD	VERY GOOD	
Visually impaired	BOYS	2 (12.5%)	0 (0%)	2 (12.5%)	12 (75%)	16 100%
	GIRLS	0 (0%)	0 (0%)	12 (75%)	4 (25%)	16 100%
Sighted	BOYS	0 (0%)	0 (0%)	7 (43.75%)	10 (62.5%)	16 100%
	GIRLS	0 (0%)	1 (6.25%)	6 (37.5%)	8 (50%)	16 100%
TOTAL		4 (6.24%)	1 1.56%)	23 (5.88%)	36 (56.16%)	64 100%



X- Axis Sample distribution. Y- axis compensation abilities.

From the above table it is clear that majority of visually impaired children's performance is towards higher side of the scale, i.e., they are in good and very good categories. Out of 32 sighted children 18 children's performance is in very good category. Out of 32 visually impaired children 16 children's performance is 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 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 "compensation abilities".
2. There is no significant difference between the boys and girls belonging to visually impaired with respect to their "compensation abilities".
3. There is no significant difference between the sighted boys and sighted girls with respect to their "compensation abilities".

5.3.1. 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
	visually impaired	sighted	visually impaired	sighted		
hypothesis-1	3.633	3.633	.4901	.556	.000	1.000
hypothesis-2	3.7333	3.5333	.45774	.51640	1.122	.271
hypothesis-3	3.5333	3.7333	.51640	.45774	1.122	.271

Visually impaired children vs. sighted Children: Compensation thinking:

The above table indicates that the mean and standard deviation values of visually impaired children and sighted children are 3.633, 0.4901 and 3.633, 0.556. The obtained t-value is .000 (two-tailed) and $p(1.000) > 0.05$ level of significance. This result indicates that children belong to the visually impaired and sighted categories do not differ significantly with respect to their compensation abilities. Hence, the null hypothesis-1 is accepted.

Visually impaired boys vs. visually impaired girls: compensation abilities:

The above table indicates that the mean and standard deviation values of visually impaired boys and visually impaired girls are 3.7333, .45774 and 3.5333, .51640. The calculated t-value is 1.122 (two-tailed) and $p(.271) > 0.05$ level of significance. This result indicates that the boys and girls belonging to visually impaired group do not differ significantly with respect to their compensation abilities. Hence, the null hypotheses-2 is accepted.

Sighted boys vs. sighted girls: Compensation abilities:

The above table indicates that the mean and standard deviation values of sighted boys and sighted girls are 3.5333, 0.51640 and 3.7333, 0.45774. The obtained t-value is 1.122 (two-tailed) and $p(.271) > 0.05$ level of significance. This result indicates that sighted boys and sighted girls do not differ significantly with respect to their compensation abilities. Hence, the null hypothesis-3 is accepted.

6. 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.

Shibley Hyde (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 conservation, measurement and compensation 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.

7. Bibliography

- AbdelAziz, Sartawi Othman N. Alsawaie Hamzeh, Dodeen Sana Tibi Iman M. Alghazo (2015) Predicting mathematics achievement by motivation and Self-efficacy across gender and achievement levels.
- Barbe, W. B., & Milone, M. N. (1981). What we know about modality strengths. *Educational Leadership*, 38(5), 378-380.
- Cawley J.F. (1984), Preface. In J.F. Cawley (Ed.) *Developmental Teaching of Mathematics for the Learning Disabled*. Rockville, MD: Aspens
- Davies C. Development of the probability concept in children. *Child Development*. 1965;36:779–788.
- Emmanuel Jimenez and Marlaine E. Lockhead (1989), *Enhancing girls learning single-sex education: evidence and a policy conundrum*.
- Falk, R., and Wilkening, F. (1998). Children's construction of fair chances: adjusting probabilities. *Developmental Psychology*, 34(6), 1340–1357.
- Gronmo, S. J., & Augestad, L. B. (2000). Physical activity, self-concept, and global self-worth of blind youths in Norway and France. *Journal of Visual Impairment & Blindness*, 94(8), 522-527.
- Hegarty, S. and Evans, P. (1985) *Research and Evaluation Methods in Special Education*. Windsor: NFER-Nelson.
- Ibrahim Haruna USMAN, Dr. Mamman MUSA, (2011) *Effect of Piagetian Formal Operations on Mathematics Performance of Senior Secondary Students in Kaduna State, Nigeria*.
- Jonassen, David H. & Grabowski, Barbara L. (1993). *Handbook of Individual Difference, Learning, and Instruction*. Hillsdale, NJ: Lawrence Erlbaum Associates, Publishers.
- Karplus, R. (1977). Science Teaching and the Development of Reasoning. *Journal of Research in Science Teaching*, 14(2), 169-175.
- Langenfield, T. E., & Pajares, F. (1993). The mathematics self-efficacy scale: A validation study. <http://www.eric.ed.gov/PDFS/ED364413.pdf>
- Marzi, C. (1999). Why is blind sight blind? *Journal of Consciousness Studies*, May, 12-18.
- Naseema, C. and Usha, V. (2007) School adjustment, self-concept and achievement in 193 mathematics of visually impaired and normal secondary school pupils in the integrated system-A comparative study, *Disabilities and Impairments*, 21(1): 49-55.
- Osterhaus, S.A. (2005) *Collaborative/ Inclusive Strategies. Secondary Mathematics Teacher*. Available On-line: <http://www.tsbvi.edu/math/>
- Pajares, F. (1995). Self-efficacy beliefs in academic settings. *Review of Educational Research*, 66, 543-578.
- Ruffell, M., Mason, J., & Allen, B. (1998). Studying Attitude to Mathematics. *Educational Studies in Mathematics*, 35, 1-18.
- Schraw, G., & Denison, R. (1994). Assessing metacognitive awareness. *Contemporary Educational Psychology*, 19, 460-475.
- Tröster, H., & Brambring, M. (1992). Early social emotional development in blind infants. *Child Care, Health and Development*, 18, 207–227
- Uppal, J. and Dey, H (2001) *Inclusive education: essential aids and appliances for children with disabilities*, *Employment News*, Dec, 1-7, 2001, 1-4.
- Vamadevappa (2005) *The impact of parental involvement on academic achievement among higher primary students*
- Ward, W. C.. & Jenkins, H. M. (1965). The display of information and the judgment of contingency. *Canadian Journal of Psychology*. 19. 23 1-24 1.
- Xing Liu, Hari Koirala (2009), *The Effect of Mathematics Self-Efficacy on Mathematics Achievement of High School Students*
- Zarch, M.K., & Kadivar, P. (2006). The role of mathematics self-efficacy and mathematics ability in the structural model of mathematics performance. *WSEAS Transactions on mathematics*, 6, 713-720.