# To explore and examine the Logical mathematical abilities of children with visual impairment and normal sight of higher secondary school students

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## Abstract

The purpose of present study was to examine the relationship between **Logical mathematical abilities of children with visual impairment and normal sight of higher secondary school students**. The schools were randomly selected from Hyderabad district, telengana state, and India country. To explore, examine and correlation between the logical and mathematical abilities of children with visual impairment children. Two different independent normally distributed populations with respect to the variables are selected. The researcher by random stratified sampling technique selected total 64 children from IX standard. Out of which 32 children are visually impaired and 32 children sighted children.

**Keywords**—Mathematics self-efficacy, Mathematics ability, structural model, Mathematics performance

## Introduction

As the aim of the study is to know the logical mathematical abilities in visually impaired children, we will discuss what is mathematics, what is the mathematical curriculum for visually impaired children, the special methods employed to study mathematics, what are the achievements in mathematics by visually impaired children and also what are the limitations for these children to learn mathematics.

As a subject, mathematics plays an important role in society and the school curriculum is formulated in such a way that mathematics is given a central and significant place in it. The mathematical curriculum for visually impaired students involves the same content areas as for the sighted students. However, the material and methods used are likely to be different (Napier, 1973). This is due to the limitations imposed by loss of sight resulting in more reliance on touch and audition. But often while teaching Mathematics, to visually impaired students, some specific areas considered complicated, are omitted by the teacher.

## Objectives of the study

1. 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. Their "logical and mathematical abilities".

2. To examine the correlation between the logical and mathematical abilities in sighted and visually impaired children

3. There is no significant difference between the sighted boys and sighted girls with respect to their "logical and mathematical abilities".

4. There is no significant correlation between the logical and mathematical abilities in sighted children".

5. There is no significant correlation between the logical and mathematical abilities in visually impaired children".

**Hypotheses**

1. There is no significant difference between the visually impaired and sighted children with respect to their "logical and mathematical abilities".

2. There is no  significant difference between the boys and girls belonging to visually impaired with respect to

**Population, Sample and Sampling technique**

The two different independent normally distributed populations with respect to the variables are selected for this study. To understand and examine the above hypothesis, visually impaired Children and Sighted Children class IX

in Hyderabad are considered as the Populations. Since very few schools

are catering to the educational needs of the children with visual impairment in the city of Hyderabad, the researcher selected the school that has proper Physical Facilities, English Medium of Instruction, Learning Resources, Residential Facilities, Enrolment of Children and willingness to conduct the study.

The researcher after a through field survey and wide consultations with the head of the institutions have 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  school and Raghunatha Model High School, Chaitanapuri, Hydreabad -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 children from Raghunatha model high school for the present study

**Table:1.0.0Thesample distribution**

| School | Girls | Boys | Total |
|---|---|---|---|
| Devnar school for blind | 16 | 16 | 32 |
| Raghunatha model high school | 16 | 16 | 32 |

## Tools Tool, design Development, Standadizationnd Implementation

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.

**A logical mathematical ability is** related to reasoning, calculations, logic, critical thinking, and abstract thinking, all of which are related to the complexity of mathematics. People with highly developed logical mathematical abilities are able to understand systems and patterns, can rely on abstract thinking to solve problems, and can make logical and practical decisions more easily than most people. Children differ significantly with respect to their logical and mathematical abilities. These abilities of children need to be studied in relation to

other important variables like learning styles, meta-cognition and self-efficacy .To understand the Logical Mathematical Abilities in visually impaired children, both Piaget's Test of Logical Operations and Piagetian Logical-Mathematical Test Battery were administered.

## 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.

**1.1.0.Objective I: 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.**

Logical and Mathematical abilities are the capacity to reason, calculate, recognise patterns and handle logical thinking.

One of the objectives of this research work *is to explore the Logical and 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 (as presented in chapter-III ) and the responses of the children is collected and analysed. The data is presented below.

Table 1.1.0. Distribution of children and mathematical abilities with respect to the ability of "logical
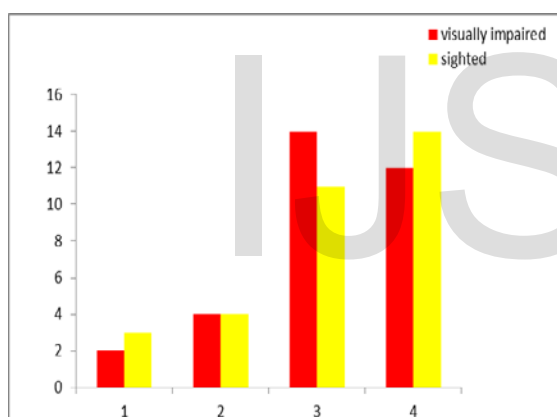
| Sample | Gender | Logical and mathematical abilities | | | | TOTAL |
|---|---|---|---|---|---|---|
| | | POOR | FAIR | GOOD | VERY GOOD | |
| Visually impaired | BOYS | 2<br><br>12.5% | 0<br><br>(0%) | 8<br><br>50.0% | 6<br><br>37.5% | 16<br><br>100% |
| | GIRLS | 0<br><br>(0%) | 4<br><br>25.0% | 6<br><br>37.5% | 6<br><br>37.5% | 16<br><br>100% |
| Sighted | BOYS | 1<br><br>6.25% | 4<br><br>25% | 3<br><br>(0%) | 8<br><br>50% | 16<br><br>100% |
| | GIRLS | 2<br><br>12.5% | 0<br><br>(0%) | 8<br><br>50% | 6<br><br>37.5% | 16<br><br>100% |
| TOTAL | | 5<br><br>7.81% | 8<br><br>12.5% | 25<br><br>39.06% | 26<br><br>40.62% | 64<br><br>100% |



X-axis Sample distribution.Y-axis Logical and Mathematical abilities.

From the above table it is clear that majority of visually impaired and

categories. Out of 32 sighted children, 14 children's performance is very good. Out

of 32 visually impaired children 12 children's performance is very good. Further it is observed that the performance of boys and girls across the samples, by they are in good and very good and large, is same. However, for the purpose of finding statistical differences between the visually impaired and sighted children, the sighted children's performance is towards higher side of the scale, i.e., 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 and mathematical abilities".

2.There is no significant difference between the boys and girls belonging to visually impaired with respect to their "logical and mathematical abilities".

3.There is no significant difference between the sighted boys and sighted girls with respect to their "logical and mathematical abilities".

**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 |
|---|---|---|---|---|---|---|
| Hypo thesis -1 | Visually impaired | Sighted | Visually impaired | Sighted | 1.99 | .501 |
| | 2.166 | 2.7 | 1.176 | .8769 | | |
| Hypo thesis -2 | Visually impaired boys | Visually impaired girls | Visually impaired boys | Visually impaired girls | .447 | .658 |
| | 3.1333 | 3.0667 | .51640 | .25820 | | |
| Hypo thesis -3 | Sighted boys | Sighted Girls | Sighted boys | Sighted girls | 1.382 | .178 |
| | 3.20000 | 3.0000 | .41404 | .37796 | | |

mathematical abilities. Hence, the null hypothesis-1 is accepted.

## Visually impaired boys vs. visually impaired girls: logical mathematical abilities:

The above table indicates that the mean and standard deviation values of visually impaired boys and visually impaired girls are 3.1333, 0.51640 and 3.0667, 0.25820. 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 mathematical abilities. Hence, the null hypothesis-2 is accepted.

## Sighted boys vs. sighted girls: logical mathematical abilities:

The above table indicates that the mean and standard deviation values of sighted boys and sighted girls are 3.20000, 0.41404 and 3.0000,0 .37796. The obtained t-value is 1.382 (two-tailed) and p(.178)> 0.05 level of significance. This result indicates that sighted boys and

## Visually impaired children vs. sighted Children: logical mathematical abilities:

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, 0.8769.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

sighted girls do not differ significantly with respect to their logical mathematical abilities. Hence, the null hypothesis-3 is accepted.

## 2.11.0. Objective2: To examine the correlation between the logical and mathematical abilities in sighted and visually impaired children

In the present study nine parameters are considered to study the logical and mathematical abilities of visually impaired children. They are classification, seriation, logical multiplication and operation, conservation, measurement, compensation abilities, proportionality thinking, probability thinking and Correlation thinking.

One of the objectives of this research work *is to examine the correlation between the logical and mathematical abilities in sighted and visually impaired children* by administering the appropriate tools (as presented in chapter-III) and the responses of the children is collected and analysed. The data is presented below.

However, for the purpose finding statistical differences between the visually impaired and sighted children the following two null hypotheses have been formulated:

"There is no significant correlation between the logical and mathematical abilities in sighted children".

"There is no significant correlation between the logical and mathematical abilities in visually impaired children".

## 2.1.1 Correlation table of Visually impaired children

| | Classification | Seriation | Logical multiplication and operation | Measurement | Conservation | Compensation | Ratio and proportion | Probability | Correlation |
|---|---|---|---|---|---|---|---|---|---|
| Classification | 1 | .670** | .784** | .681* | .881** | .543** | .420* | .481** | .592** |
| Seriation | .670** | 1 | .576* | .697** | .631** | ..797** | .553* | .497** | .539* |
| Logical multiplication and operation | .784** | .576* | 1 | .699** | .742** | .592** | .481* | .539* | .439** |
| Measurement | .681** | .697** | .699** | 1 | .824** | .648** | .450* | .488* | .448* |
| Conservation | .881** | .631** | .742** | .824** | 1 | .703** | .488* | .466** | .410* |
| Compensation | .543** | .797** | .592** | .648** | .703** | 1 | .502** | .515* | .493* |
| Ratio and proportion | .420* | .553* | .481* | .450* | .488* | .502** | 1 | .691** | .595** |
| Probability | .481** | .497** | .539* | .488* | .466** | .515* | .691** | 1 | .454* |
| Correlation | .592** | .539* | .439** | .448* | .410* | .493* | .595** | .454* | 1 |

## 2.1.2 Correlation table of sighted children

| | Classification | Seriation | Logical multiplication and operation | Measurement | Conservation | Compensation | Ratio and proportion | Probability | Correlation |
|---|---|---|---|---|---|---|---|---|---|
| Classification | 1 | .675** | .754** | .685* | .781** | .573** | .473* | .281** | .392** |
| Seriation | .675** | 1 | .546* | .657** | .651** | ..767** | .353* | .497** | .339* |
| Logical multiplication and operation | .754** | .546* | 1 | .599** | .642** | .562** | .480* | .339* | .434** |
| Measurement | .685** | .657** | .599** | 1 | .823** | .658** | .420* | .288* | .348* |
| Conservation | .781** | .651** | .642** | .823** | 1 | .603** | .480* | .366** | .210* |
| Compensation | .473** | .767** | .562** | .658** | .603** | 1 | .202** | .315* | .293* |
| Ratio and proportion | .227* | .353* | .480* | .420* | .480* | .202** | 1 | .391** | .205** |
| Probability | .381** | .497** | .339* | .288* | .366** | .315* | .391** | 1 | .305* |
| Correlation | .592** | .339* | .434** | .348* | .210* | .293* | .205** | .305* | 1 |

From the above table2.1.1 and 2.1 2 it is clear that in both visually impaired and sighted children there is a significant positive correlation (ranged from .6to.8) in case of basic concrete logical operations such as classification, seriation, logical multiplication and operation, conservation, measurement and compensation abilities. And there is a positive correlation between proportionality, probability and correlation thinking. However the correlation values are relatively low (.2to.4) in case of visually impaired children and moderate(.4to.6) in case of sighted children.

Further it is observed in case of visually impaired children the correlation values between the logical and mathematical abilities are statistically significant at 0.01 and 0.05 level. Hence null hypothesis is rejected.

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### Discussion

The right of education of the disabled people cannot be prevented

by any reason. The disabled children, youngsters and adults are provided with equal education with the non-disabled people and in inclusive environments by taking the special conditions and differences into consideration. It is found in the above study that there is no gender difference in visually impaired and sighted children in logical mathematical abilities.

In case where the abstract concept and logical reasoning required the sighted children performed better than visually impaired children. This difference in performance can be explained by the unique perception. The world is differently exhibited by sighted and visually impaired children in their abstract and concrete conceptualization. Sighted people create abstract concepts by putting many characteristics in a group. This abstract concepts are used to classify and understand objects by sighted people .This abstract concept is a model in their mind that can be manipulated, rotated, stretched or represented in a two dimensional form. In case of visually impaired student concrete concept of the world has objects that are tactually explored and identified and will have meaning but a picture of the same object will be difficult to identify. visually impaired students tend to conceptualize concretely. Since abstract concepts are based on visual information; a student's ability to form these concepts depends on their amount of residual vision.

Hence sighted or visually impaired children develop uniquely and at their own pace depending upon their temperament (the inherited component of their personalities), genetic makeup, supports available to them in their environments, and their learning experiences. Different children will show mastery of specific operations sooner than others. Most children will display more advanced operations when in familiar or mandatory environments (e.g., at school, working on school tasks). They may tend to become confused and perform more poorly when confronted with novel situations.

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