# Impact of Auditory and Visual discrimination deficits on cognitive profile among children

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# Abstract

**Background**: Auditory discrimination is the ability to identify similarities and differences in between auditory stimuli. Visual discrimination is the ability to identify, differentiate the sameness and differences in visual stimuli. Auditory discrimination and Visual discrimination help in perceiving the information appropriately to process.

**Aim:** To examine the effect of auditory discrimination and visual discrimination  among children on the cognitive profile.

**Method:** A correlation of IQ scores, IQ sub scores with visual discrimination and auditory discrimination was established to understand the level of significance. Sample (N=92) was collected from various regular schools. Children in the age range of 6-10 years were assessed on Malin's Intelligence Scale For Indian Children (MISIC). On Learning Inventory test, 23 children with visual discrimination and 48 children  with auditory discrimination and 21 children with global deficits. All participants had Verbal and Performance IQ scores of 70 or higher. The  groups were divided into 3 based on their deficit type.

**Results:** The group with  visual discrimination deficit had a profile characterized by a high score on information and blocks  with a low score of mazes and vocabulary. The auditory deficits group had a profile characterized by a high score on information and blocks  with a low object and vocabulary  score. The global deficits group had a profile characterized by a high score on information and blocks  with a low mazes.

Results have shown significant correlation (0.01) of visual discrimination with arithmetic, vocabulary, blocks, object assembly, verbal quotient, performance quotient and full scale IQ and 0.05 with similarity and comprehension. Even though, correlation between auditory discrimination and subtests of intelligence like similarity, Vocabulary, verbal quotient and full scale IQ were significant at 0.01 and 0.05 with Information, picture completion, blocks and performance quotient were significant.

Results are discussed in terms of the substantial correlation in cognitive structure between these 3 groups and are considered in the context of the learning deficits reported for cognitive outcome.

**Key words: auditory discrimination, visual discrimination, global deficits, MISIC**

# Introduction

Visual discrimination and auditory discrimination are important components and pre determinants of visual and auditory perception respectively. These skills help in differentiating and identifying figures, objects and shapes.

Eleanor Gibson (1969) and Gibson and Levin (1975) extended principles to the development of visual perception in children and theorized that children over the course of development learn to attend to this invariant information in the environment. Although it appears that nondisabled children acquire this information about the real world environment quite early in development, this knowledge about invariant information in the visual environment may not always be helpful to children when they are trying to discriminate among graphic symbols such as letters.

There are many researchers have proved that auditory discrimination and visual discrimination abilities have an impact on reading to a large extent. King, E. M. (1964) found in his study that there is a significant change in reading pattern after visual discrimination training. Felipe Pegado (2011) stated that "when one learns to read, letters should be recognized in a fixed orientation, forcing the visual system to discriminate their orientations in an effortful manner." According to Bellis, T. J., & Ferre, J. M. (1999); Chermak, G. D., & Musiek, F. E. (1997), Katz, J. (1992) school aged children with central auditory processing disorder faces difficulties in learning, speech, language including written expression, reading, spelling, social and other related functions. Difficulty in auditory discrimination which involved differentiating between word pairs like discriminating vowel sounds (phonetics) in a word like pet/pat/pit, discriminating beginning sounds like rhyming words e.g house/mouse, book/look, discriminating ending sounds like car /jar, beat/street demonstrated higher relationships with all aspects of failure in reading achievement (Reynolds (1953)), Dykstra, R. (1966). Thus, auditory and visual discrimination deficits are affecting children's performance in academics.

This study explains the correlation between auditory and visual discrimination deficits and cognitive abilities. This correlation is of interest as these deficits have a great impact on learning abilities of children. Most of the diagnosticians ask for IQ testing along with various tests of learning disabilities in order to diagnose the children with specific learning disabilities to meet criteria given in DSM-V and ICD-10. In this study, results have shown that deficits in visual and auditory discrimination abilities are affecting specific subtests of MISIC profile.

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# Methods

**Participants**

To fulfil the assessment criteria for auditory discrimination deficits and visual discrimination deficits, and to exclude children with intellectual disability, all students had Verbal and Performance and full scale IQ of 70 and above. Identification of ADD and VDD were established on Ann Arbor Learning Inventory.

All 92 children of age group 6 to 10 years of both genders (male and female) had undergone MISIC (Malin's Intellectual Scale for Indian Children) and Ann Arbor Learning Inventory. Then, three groups were made on the basis of findings. The group with Auditory discrimination deficit had 48, with visual discrimination had 23 children and with global deficits had 21 children. In the group of children with ADD, there were 4,10,16 and 18 students from 1st, 2nd, 3rd and 4th grade respectively. In the group of children with VDD, there were 12,3,3 and 5 students from 1st, 2nd, 3rd and 4th grade respectively. In the group of children with Global deficits, there were 12,3,3 and 3 students from 1st, 2nd, 3rd and 4th grade respectively.

Demographic, deficits and cognitive data are presented in Table 1.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Variable | ADD | | VDD | | Global deficits | |
| Age | 8.04 | 1.07 | 7.08 | 0.94 | 6.95 | 0.86 |
| Std | 3.04 | 0.99 | 2.04 | 1.26 | 1.85 | 1.15 |
| MISIC- VQ | 100.29 | 10.65 | 97.48 | 12.90 | 96.98 | 11.92 |
| MISIC- PQ | 100.54 | 11.55 | 95.26 | 13.74 | 94.66 | 13.87 |
| MISIC- IQ | 100.48 | 9.73 | 96.36 | 12.69 | 95.82 | 12.29 |
| VDD errors | 1.04 | 1.07 | 7.00 | 2.48 | 7.04 | 2.55 |
| ADD errors | 11.53 | 6.40 | 14.04 | 8.99 | 15.09 | 8.68 |

**Procedure**

All children had undergone MISIC (Malin’s Intelligence scale for Indian Children) test for the assessment of intelligence to exclude children with intellectual disability. Their scores of verbal and performance components were recorded.

To classify the groups, all 92 children undergone Ann Arbor Learning Inventory (AALI). The AALI offers an assessment of central processing skills important to learning: Visual Discrimination (VD), Visual Memory, Auditory Discrimination (AD), and Auditory Memory. This was done by presenting a variety of tasks that require listening, manipulating, showing, matching, visualizing, telling, and writing.

Children were divided into three groups; children with auditory discrimination deficits (ADD), children with visual discrimination deficits (VDD) and children with global deficits on the basis of number of errors in auditory discrimination skills and visual discrimination skills respectively. There were 48 children in ADD group, 23 children in VDD group & 21 children in global deficit group. A Pearson's correlation between ADD, VDD, Global deficits and Full scale IQ was analyzed followed by subtest of VQ & PQ on MISIC.

**Results**

Demographic, deficits and cognitive data are presented in Table 1. There were children of ages 6 to 10 from standards 1 to 4. After segregating them into groups on the basis of findings, there were more students in 1st grade who had VDD and global deficits as compared to ADD. Whereas, in the group of children with ADD, there were more children in grade 4 than in grade 1.

There was significant correlation at 0.01 level between global deficits and VQ,PQ & Full scale IQ (Table 2). Whereas, results have shown significant correlation at 0.01 of visual discrimination with performance quotient and 0.05 with full scale IQ (Table 3). Though, correlation between auditory discrimination deficits and verbal quotient and full scale quotient were significant at 0.01 and 0.05 with PQ (Table 4).

The group with  visual discrimination deficit had a profile characterized by a high score on coding and  with a low score of mazes and vocabulary. The auditory deficits group had a profile characterized by a high score on comprehension, blocks and mazes with a low object and vocabulary  score. The global deficits group had a profile characterized by a high score on coding and with a low score in vocabulary and mazes (Graph 1).

Results have shown significant correlation (0.01) of visual discrimination with arithmetic, vocabulary, blocks, object assembly, verbal quotient, performance quotient and full scale IQ and 0.05 with similarity and comprehension. Even though, correlation between auditory discrimination and subtests of intelligence (like similarity, Vocabulary, verbal quotient and full scale IQ were significant at 0.01 and 0.05 with Information, picture completion, blocks and performance quotient were significant.

*Table 2. Correlation of VQ, PQ, IQ with Global deficits in visual and auditory discrimination skills.*

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | | VDD | ADD | VQ | PQ | IQ |
| VDD | Pearson Correlation | 1 | .267 | -.302 | -.552\*\* | -.462\* |
| Sig. (2-tailed) |  | .241 | .184 | .009 | .035 |
| N | 21 | 21 | 21 | 21 | 21 |
| ADD | Pearson Correlation | .267 | 1 | -.648\*\* | -.557\*\* | -.638\*\* |
| Sig. (2-tailed) | .241 |  | .001 | .009 | .002 |
| N | 21 | 21 | 21 | 21 | 21 |
| VQ | Pearson Correlation | -.302 | -.648\*\* | 1 | .786\*\* | .937\*\* |
| Sig. (2-tailed) | .184 | .001 |  | .000 | .000 |
| N | 21 | 21 | 21 | 21 | 21 |
| PQ | Pearson Correlation | -.552\*\* | -.557\*\* | .786\*\* | 1 | .952\*\* |
| Sig. (2-tailed) | .009 | .009 | .000 |  | .000 |
| N | 21 | 21 | 21 | 21 | 21 |
| IQ | Pearson Correlation | -.462\* | -.638\*\* | .937\*\* | .952\*\* | 1 |
| Sig. (2-tailed) | .035 | .002 | .000 | .000 |  |
| N | 21 | 21 | 21 | 21 | 21 |
| \*\*. Correlation is significant at the 0.01 level (2-tailed). | | | | | | |
| \*. Correlation is significant at the 0.05 level (2-tailed). | | | | | | |

*Table 3. Correlation of VQ, PQ, IQ with Visual Discrimination Deficits (VDD)*

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | | | | | |
|  | | VDD | VQ | PQ | IQ |
| VDD | Pearson Correlation | 1 | -.352 | -.572\*\* | -.493\* |
| Sig. (2-tailed) |  | .100 | .004 | .017 |
| N | 23 | 23 | 23 | 23 |
| VQ | Pearson Correlation | -.352 | 1 | .789\*\* | .943\*\* |
| Sig. (2-tailed) | .100 |  | .000 | .000 |
| N | 23 | 23 | 23 | 23 |
| PQ | Pearson Correlation | -.572\*\* | .789\*\* | 1 | .948\*\* |
| Sig. (2-tailed) | .004 | .000 |  | .000 |
| N | 23 | 23 | 23 | 23 |
| IQ | Pearson Correlation | -.493\* | .943\*\* | .948\*\* | 1 |
| Sig. (2-tailed) | .017 | .000 | .000 |  |
| N | 23 | 23 | 23 | 23 |
| \*\*. Correlation is significant at the 0.01 level (2-tailed). | | | | | |
| \*. Correlation is significant at the 0.05 level (2-tailed). | | | | | |

*Table 4. Correlation of VQ, PQ, IQ with Auditory Discrimination Deficits (ADD)*

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | | ADD | VQ | PQ | IQ |
| ADD | Pearson Correlation | 1 | -.392\*\* | -.358\* | -.424\*\* |
| Sig. (2-tailed) |  | .005 | .012 | .002 |
| N | 49 | 49 | 49 | 49 |
| VQ | Pearson Correlation | -.392\*\* | 1 | .553\*\* | .873\*\* |
| Sig. (2-tailed) | .005 |  | .000 | .000 |
| N | 49 | 49 | 49 | 49 |
| PQ | Pearson Correlation | -.358\* | .553\*\* | 1 | .888\*\* |
| Sig. (2-tailed) | .012 | .000 |  | .000 |
| N | 49 | 49 | 49 | 49 |
| IQ | Pearson Correlation | -.424\*\* | .873\*\* | .888\*\* | 1 |
| Sig. (2-tailed) | .002 | .000 | .000 |  |
| N | 49 | 49 | 49 | 49 |
| \*\*. Correlation is significant at the 0.01 level (2-tailed). | | | | | |
| \*. Correlation is significant at the 0.05 level (2-tailed). | | | | | |

**Discussion**

This study compared the significance of correlation in IQ and it's components with visual discrimination deficits, auditory discrimination deficits and global deficits in an effort to understand the effects of these deficits on cognitive abilities. Group of 92 children were divided into 3 groups based on the number of errors in auditory discrimination and visual discrimination skills in Ann Arbor Learning Inventory test. In general, ADD group performed better than VDD and GD group in comprehension, blocks and mazes (Graph 1).

Graph 1: Comparison of various subtests of MISIC with VDD & ADD

Pearson's correlation of the subtests MISIC profiles suggests that there is significant correlation between visual discrimination with arithmetic, vocabulary, blocks, object assembly, verbal quotient, performance quotient and full scale IQ at 0.01 and 0.05 with similarity and comprehension. However, correlation between auditory discrimination and subtests of intelligence like similarity, vocabulary, verbal quotient and full scale IQ were significant at 0.01 and 0.05 with Information, picture completion, blocks and performance quotient were significant.

The results of the study have shown that there is significant relationship in auditory and visual discrimination with cognitive abilities. The reason why children with auditory discrimination deficits scored high on comprehension, blocks and mazes could be due to the fact that the visual component might be getting strengthened to compensate for the deficits in auditory component.

**Conclusion**

* Visual and auditory discrimination skills deficits have an impact on the cognitive profile.
* There is significant correlation between visual discrimination with arithmetic, vocabulary, blocks, object assembly, verbal quotient, performance quotient full scale IQ, similarity and comprehension.
* There is also a significant correlation between auditory discrimination and subtests of intelligence like similarity, vocabulary, verbal quotient and full scale IQ, Information, picture completion, blocks and performance quotient.
* Children with auditory discrimination deficits scored high on comprehension, blocks and mazes could be due to the fact that the visual component might be getting strengthened to compensate for the deficits in auditory component.
* A longer study with more data or higher sample size from schools of diverse socio economic groups is recommended to analyze findings.

**References**

*Amitay, S., Ahissar, M., & Nelken, I. (2002). Auditory processing deficits in reading disabled*

*adults. JARO-Journal of the Association for Research in Otolaryngology, 3(3),302-320.*

*Cacace, A. T., & McFarland, D. J. (1998). Central auditory processing disorder in school*

*aged children: A critical review. Journal of Speech, Language, and Hearing*

*Research, 41(2), 355-373.)*

*Chermak, G. D., & Musiek, F. E. (1997). Central auditory processing disorders: New*

*perspectives. San Diego, CA: Singular.*

*Gerald Goldstein , Sue R. Beers , Don J. Siegel & Nancy J. Minshew (2001) A Comparison of*

*WAIS-R Profiles in Adults With High-Functioning Autism or Differing Subtypes of*

*Learning Disability, Applied Neuropsychology, 8:3, 148-154,*

*Gibson, E. J. (1969). Principles of perceptual learning and development. New York:*

*Appleton-Century Crofts*

*Gibson, E. J., & Levin, H. (1975). The psychology of reading. Cambridge, MA: MIT Press*

*Gibson, E. J., & Rader, N. (1979). Attention: The perceiver as performer. In G. A. Hale & M.*

*Lewis (Eds.), Attention and cognitive development. New York: Plenum Publishing*

*Corporation*

*King, E. M. (1964). Effects of different kinds of visual discrimination training on learning to*

*read words.*Journal of Educational Psychology, 55*(6), 325-333.*

*Pegado F, Nakamura K, Cohen L, Dehaene S (2011) Breaking the symmetry: Mirror*

*discrimination for single letters but not for pictures in the Visual World Form Area.*

*Journal of Neuroimage 55:742-749*

*Reynolds (1953)), Dykstra, R. (1966). Auditory discrimination abilities and beginning*

*reading achievement. Reading Research Quarterly, 5-34.*