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Nonverbal intelligence in deaf children: A comparative analysis on Raven progressive matrices

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Different types of intelligence tests are available today, but special considerations should be made when you have a deaf population. So, keeping in view the importance of language acquisition the research tool for this study was selected "Raven progressive matrices" (1998) Developed by Jhon c Raven. Raven test is internationally known as a culture-free and Nonverbal test for cognition measures. The motivation behind this study was to find out the difference in cognitive learning among acquired and congenital deaf students at the secondary level. Booklet version of Stander progressive Matrices test was applied. The test was taken from 61 congenital deaf and 13 students were taken as acquired deaf. Through simple random sampling, 50% from each group were taken as the sample. The results indicate that there was a less significant difference (.657) was found among both types of deafness. The congenital deaf student result was (.73) higher than the acquired deaf. The result shows that most deaf students have average or above-average intellectual properties (88%) so, it is concluded that there is less effect of deafness on cognition. The results also illustrate a less significant difference between males and females Found as t value is (.331). furthermore, a less significant difference is found on the basis of locality and grade. Finally, it appears that after the age of 16 years the child developed maximum intellectual capacity so, there was a (0.02) significance value found in correlation that less relation is found to age and score of cognition. This study concludes that more appropriate programs for acquired deaf students should be established and further research is needed to take into account social-economic background, level of hearing loss, and genetic factors of the child on cognitive learning.

Keywords: cognitive ability, deaf, special education, hearing impairment, nonverbal intelligence.

Introduction:

Intelligence is considered as analysis of language and non-language tasks it includes the perception of the student, memory skill of participant, imagery skills, and ability to move in a new situation (Burkholder, 2006).

Hearing is the process through which our mind perceives sound. A child with hearing impairment has difficulty in receiving the sound perceiving them or feels difficulty in identifying sound properly. Hearing impairment may be due to some auditory problems or some defect in mind (Marion, 2013).

The majority of intelligence tests in Pakistan being used vividly are adaptation, modified, or translations of other European tests. recently some efforts are done but nonverbal tests are not got value recognition. as they are errors in content and invalid methodology and thus, they are not up to the mark (Hussain, 2001).

Raven has a lot of work on nonverbal intelligence he has developed an innovative test design that is very effective in measuring nonverbal intelligence and it minimizes the major issues of educational intelligence as it is based on culture-reduced tests and reduces the use of language validity of test content and child ability to read or write with speed (Smirni, 2020).

The Raven's stander progressive test is now used very efficiently all over the world with a variety of educational settings for adults between the ages of 16 and 20 and cognitive learning data can be successfully obtained for among others (Smirni, 2020).

Raven Matrices are a nonverbal test group which mostly used all over the world for educational settings. This test is consisting of a 60-item test that is commonly used to measure reasoning ability and is commonly known as non-verbal intelligence and to obtain the score of intelligence. All the Items in tests have been built up to find the average solution option to each question all question is identical to each other (Raven et al.,2004).

Intelligence is about the human being's abilities to cope with new environment which the person does not have faced and using previous knowledge to gain from new experience (peter et al., 2006).

Dr. Sharmista's (2013) Research suggests that very early childhood hearing loss and language degree option amongst parents is very early in life. Effect of deafness on child development and in the classroom in the learning process listening plays an important role.

A supportive learning environment is essential for deaf children. Students using auditory aids can have a hard time adjusting background noise to hear the important thing. Suitable measures can be taken to improve the acoustics of a classroom, including carpeting, the use of soft furnishings like cupboards, curtains, the installation of sound prof rooms such as carpet tiles on walls, and close of doors and windows to remove ambient noise from outside Such facilities help the student to focus and participate in learning. (Lee, 2007).

Statement of problem

Literature review suggests that the child cognition process can be delayed due to hearing loss but different researcher suggest that language deficit cannot impact

cognition because our mind is the owner of numerous qualities and languages so the rationale of the study is to explore does acquire deafness have an effect on child cognitive learning continental deafness affect the cognition. Does the impact of age also have on the cognitive score? while comparing two different types of deafness student obtained score the researcher want to analyze does the deafness effect nonverbal intelligence.

Literature review

Intelligence can be subcategories into three basic types the first type of Intelligence is what we generally related to academic ability is called analytic intelligence (Foreman, 2004). Creative intelligence is the ability is relating novel situations to already known situations to perceive the same things and new things and it brings the process of adaptation. After using experience person become able to solve problems and learn rapidly. The third type of intelligence is Practical Intelligence also known as 'street smarts that enable the person (Bauman et al., 2004).

The cognitive-developmental theory emphasizes addressing the unique question of how a person cognitive learning can be differing in the pattern of their intellectual learning and cognition growth (Geers, 2007).

The central premise of cognitive theory is that thoughts are the most important determinant of Piaget, Jean Piaget is famous for his cognitive was devoted to investigating his own children's growth.it Illustration Piaget, Jean Piaget (1896-1980) was an influential cognitive theorist who was inspired to study children's ability to think and reason after observing his own children (Peter et al., 2010).

Raven et al (1990) suggest that SPM has been related to the Piagetian concept of intelligence. Most of the research is in favor of cognitive learning theories is derived from the environment, and varying degrees of intellectual development are observed in coping with different types of cognitive or intellectual work.

Charles Spearman was the first person who described the presence of general intelligence and discuss intelligence 1904. According to Spearman, the general factor of intelligence is used to cope with the overall performance of mental ability. spearman discuss the two-basic type of intelligence and this ability is present at birth and its deals with the nonverbal intelligence environment (Bauman al., 2004).

Anderson had a lot of work on human cognition how a person adapts or modifies problems posed in their environment. The person perceives the available information that poses in the environment, analysis the given factors and produces the optimal solution (Kunda, 2013).

Analytic intelligence enables the person to solve problems and get new knowledge. Problem-solving skills have got the information, joining them and comparing part of information and getting a suitable solution to the given problem solution (Wood, 2011).

The method of scoring is best because no prior assumption is made about child performance on the test it is compared with other students' performance. The average score will indicate average intellectual capacity. A child who scores above 90 will be considered intellectually superior and a child with 75% marks have good intellectual abilities and all result are mentioned at the stander progressive result chart. The result chart shows quickly and accurately results (SPM manual, 2004).

All potential measurements of intelligence might be separated into two independent components, according to his "two-factor" theory of intelligence. The general or 'g' component is determined by "that which the measure has in common with al," according to Spearman (Smirni, 2016).

It is argued that Raven's SPM can represent an effective assessment tool in measuring nonverbal intelligence in this context (Bauman, 2008).

1.3 ***Objectives of the Study***

Research objectives play vital role in any study. This study is specially designed to find out the effectiveness of deafness on cognition. The main objectives of this study were to.

• Access the effect of deafness on cognition among children with hearing impairment.

• Compare the effect of acquired deafness and congenital deafness on cognition among children with hearing impairment.

•Find out that intelligence scores obtained from the test increase with age.

•Evaluate the role demographic variable such as gender, locality and class on cognition

Research Methodology

Research Design:

This was a quantitative survey as a test was applied to all participants. The main purpose of this study was to find out the effect of deafness on intelligence score, the difference in cognition score of acquired and congenital deafness and make further recommendations about teaching children with hearing impairment.

Population:

This study was conducted in Multan and Khanewal so, all the students of public and private school and centers of hearing impairment at the secondary level constitutes the population of this study.

Sample:

Through systematic random sampling technique, every 2nd student enrolled in the secondary school of Multan and Khanewal city was taken as a sample as a list of all students was available. The sampling framework is based on 50% of acquired deaf and 50% of congenital deaf participants.

Sampling frame work

Table 1. District wise distribution of population

District	No of school/ center	No of students enrolled	Class 9th	Class 10th	Acquired deaf	Congenital deaf
Multan	03	103	53	50	15	88
Khanewal	03	41	15	26	6	15
Total	6	144	68	76	25	119

Table 1 illustrate the sampling frame work for this study as total number of students in Multan and Khanewal city is 144 students and 25 acquired deaf and 119 congenital deaf were taken as population through which 50 % of each subgroup is taken as sample.

Sampling probability.

The sampling technique for this study was systematic random sampling because lists of students were available and these students were already placed as congenital and acquired deaf in the criteria of the school. While using systematic sampling the 6-secondary school in Multan, Khanewal were selected. Total enrolled students categorized as congenital deaf were 122 and 50% percent sample was taken which were 61 students. On the other hand, 26 students lie in the subgroup of acquired deaf So, 13 students were taken which constitutes 50% of the sample. Through Systematic random sampling, every 2nd student from the list was selected as a sample of this study from each school. Through systematic sampling, each student was selected according to the weightage of enrollment in school in each district. Each class grade participants were taken equally through systematic sampling

Tool for this study

Tool for this study is "Raven advance progressive matrices" developed by Jhon c Raven (1998). The Progressive matrices is nonverbal intelligence test. The test is adopted as only 36 questions of A, B and C series were taken. The maximum score was 36 and consist of three sets of twelve matrix designs arranged in order to stages of mental development according to age.

Validation of Tool

Before selection of final series of test, it was given to the psychologist and educationalist, they were requested to check it and give suggestions to make it more reliable and valid according to the objectives of the study. So, the psychologist and professors have studied the tool and found it suitable for the cognition measurements as it two first series measure the average intellectual ability and c series is to measure the high level of thinking and problems solving abilities, finally, 36 questions

statements were added in the research instrument. These professor's psychologist was having much experience in the field of special education department.

Data Collection & Analysis

Before the selection of the final series of tests, it was given to the psychologist and educationalist, they were requested to check it and give suggestions to make it more reliable and valid according to the objectives of the study. So, the psychologist and professors have studied the tool and found it suitable for the cognition measurements as it two first series measure the average intellectual ability and c series is measure the high level of thinking and problems solving abilities, finally, 36 questions statements were added in the research instrument. These professors' psychologists as having much experience in the field of the special education department.

Data Collection & Analysis

Data was collected in following steps.

1. Permission letter was collected from the focal person of special education in district Khanewal, Multan and presented it to the head of secondary schools. After that the researcher seek the permission from the all the principals of district Khanewal schools for the collection of data in their schools.

2. The record of following demographic data was taken from school (1) Name (2) Age (3) Gender (4) class (5) nature of the disability to check whether or not each participant lies in selection criteria before beginning of test, also verified by the school's enrollment record and many necessary corrections were done.

3. With the permission and help of the class teacher no verbal test SPM was presented to the respondents. instruction was given in sign language as participants were deaf and these instructions were also given through the total communication method and translation method. Where needed the class teacher's sign langue interpretation was provided with help of sign language.

4. The test was done by the respondents and then collected back personally and their result was recorded on stander form of stander progressive matrices.

Data Analysis

After the data collection data analysis procedure was started which involves editing of data coding the data classifying it and tabulating the collected data. The results of the advance progressive matrices for adults were entered in the program named Statistical Package for Social Science (SPSS). The program represents the numerical and graphical results of the study. A statistical tool such as percentage, mean, SD, (Independent samples t-test, ANOVA) tests were used to analyze participants' perception on SPSS version 2021. The correlation technique was used to find out the relationship between cognition score and the age of the child.

Results

Following results were concluded on the base of data collection

Table2.: Comparison on the Base of Nature of Disability of Acquired Deaf and Congenital Deaf

Variables	*N*	*Mean*	*S. D*	*Mean*	*T*	*Sig.*
Congenital deaf	*61*	*19.57*	*5.50*	*.300*	*.446*	*.657*
Acquired Deaf	*13*	*18.84*	*4.43*			

*Significance Level **P < .05*

Table 2. Shows that calculated significance value (.657) was more than significance level (.05) that shows that statistically there is less significant difference among the congenital and acquired deaf students scores on SPM. The mean score of congenital deaf(M=19.57) is higher than acquired deaf mean score (18.84). S.D value of congenital deaf (5.50) is higher than acquired deaf S.D value (4.433), which shows that congenital deaf student has better cognition than acquired deaf students. The t-value (.44) shows less differentiation between congenital deaf and acquired test scores.

Table: 3. Comparison of Score on SPM

Comparison of Score	*Df*	*Mean Square*	*F*	*Sig.*
Between Groups	2	19.352	.679	.510
Within Groups	71	28.501		
Total	73			

Significance Level **P <.05

The table 3 the comparison of score on SPM are presented between the acquired deaf and congenital deaf. The mean scores for the test are 19.35 on advance progressive matrices score of acquired deaf and congenital deaf, the participant's score was taken through t test. The test shows that significance value is .510 which is higher than the stander value of 0.05 so it's does not prove our claim that there is any significance effect of deafness on cognitive of a child.

Table 4. Comparison on the Base of Age as urged by Raven

Correlations		*Score on SPM*	*Age of participant*
Score on SPM	Pearson Correlation	1	.002
Age of participant	Pearson Correlation	.002	1

Table 4 shows the correlation of score of acquired deaf and congenital deaf and their age respectively the co-relation test shows less significance value of (0.02) which evidence that score increase with the age so, it does not prove our claim that there is any significance effect of age this is due to reason that above 16 children have developed the cognitive maturity so the minor difference in age has less significance effect.

Table 5. Cognition Score of Acquired and Congenital Deaf Students

Cognition level	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
Average	34	45.9	45.9	45.9

above average	32	43.2	43.2	89.2
Superior	8	10.8	10.8	100
Total	74	100	100	

Table 5 illustrate that more than 45% student have average intellectual ability .43% student have above average intellectual cognition.10% students have superior cognitive ability only a few numbers of student have below average cognition. So, result does not support our claim that deafness put impact on cognition

Table 6: comparison on the base of Gender

Variables	N	Mean	SD	T	Sig.
Male	61	19.54	5.48	.331	.381
Female	13	19.00	4.50		

Significance Level **P > .05

Table 6. shows that calculated significance value (.381) was more than the significance level (.05) so, its shows that there is a statistically significant difference is not found among the male deaf and female deaf scores of students on the base of gender.

Table 7: Comparison on the Base of Locality

Variables	N	Mean	S. D	Df	T	Sig.
District Multan	44	19.29	4.9	72	-2.93	.048
District Khanewal	30	19.68	6.12			

Significance Level **P < .05

Table 7 shows that calculated significance value (.048) was greater than significance level (.05) that shows a statistically there is less significant difference found among the district Multan and district Khanewal scores of students. The mean score of Multan district is (M=19.29) is lower than district Khanewal mean score (19.68). S.D value of district Khanewal (6.12) is more than S.D value (4.9) of district Multan. However, the t-value (-2.93) also support the claim.

Table 8: Comparison on The Base of Grade

Variables	N	Mean	SD	Df	T	Sig.
Class 9th	36	19.37	5.63	71	0.08	.571
Class 10th	37	19.38	5.06			

Significance Level **P > .05

Table 8 illustrate that calculated t value (.008) was greater than standard level (.05) that shows a statistically there is less difference on the base of class grade is present. The

mean score of 9^{ths} is (M=19.37) is only .1 lower than the mean score (19.38). S.D value of 9th is (5.63) is more than S.D value (5.06) of class 10th. the significance value of 5.71 also does not support the claim.

Findings

The mean score of acquired deaf and congenital deaf on stander progressive matrices conclude that there is no significant difference is found in the two categories of hearing loss on the basis of the nature of the disability. As compared to congenital deaf and acquired deaf score mean of congenital deaf is 19.57 and acquired deaf is 18.84 which is only 1 percent more than the congenitally deaf and the t value is .446 which is greater than our target value of 0.05 so it does not support our claim.

While talking about cognitive score and effectiveness of deafness statistics shows that 45% percent of students lie in average intellectual score only a few students are below average intelligence score, they very little number not significant to be discussed.

The finding regarding the effect of acquired deafness on cognition does not support our claim as there was a difference found was very minimum not a value to be discussed in both types of categories scores on SPM. The conclusion suggests that it is minimal or no effect of deafness is presented on the cognitive score of the deaf participant, when comparing to congenital deaf to acquired deaf the significance value is greater than the stander value of (0.05).so, it does not support our claim

As urged by Raven (1990) SPM scores increase with age. with the exception of the 19_20 years age group has a higher score in the test but (where an exceptionally high score of 23 mean was elevated by the age group of 18 years) This finding does not support Raven et al.'s (1990) that test scores on the Raven's SPM increase with age. So, an inconsistent pattern in the mean test scores for partisans in the different age groups is evident. Keeping in view the fact that there was a significant difference in the sample between the male participant and female participant as there are very few deaf female students are enrolled in Multan and Khanewal district. But the less significant difference was present in performance (less than one percent level) was evidenced which is not a value to be discussed, that males scoring significantly higher than the females. The t-test result illustrates that the problem of small group size due to the low rates of female student's enrollment experienced precludes any claim to this effect, and instead a consistent trend in which males outperformed females is not significant. So, the finding of this study is contrary to Raven et al.

Thus, it seems that in verbally test the male participant has a good perception but when applying non-verbal intelligence in Limited and drawback in sense of variation in the genders score may not need to be considered in light of this sample there was no significant effect found on the base of locality and gender. Through data analysis, it is concluded that there is no significant effect of class grade is found as 9TH and 10TH class obtained almost equal score.

Discussion

The study was conducted to explore the two types deafness congenital deafness and acquired deafness effect on cognitive learning at secondary school students. A comparative analysis was made among acquired deaf and congenital deaf student score on SPM standardized progressive matrices by Raven. It has been argued here that the

Raven's CPM is a reliable and valid instrument for the assessment of non-verbal intelligence (Bass, 2000).

The cognitive score was obtained from secondary school students through Raven progressive matrices and analysis was made by the standardized percentage formula given by Raven manual (2004). Through their response, it is concluded that the majority of deaf students have the average intellectual cognitive ability. There was a less significant difference found between acquired deaf and congenital deaf they both have almost the same score on SPM and have an average intellectual score which shows that deafness does not affect the cognitive learning of the children, they follow the same pattern of intelligence as normal child pose.

Furthermore, the impact of age and grade on cognition was less significant because of low intervals in age and grade. As discussed by Bass no significant effect of education was noted, and a consistent tendency for males to score higher than the females was evident (Bass, 2000). The results show that this is a valid measure to assess the intelligence of Pakistani youth as discussed by (Chaudhry et al.,2018). So, it is argued that this study is precise because deaf students are facing considerable difficulty in their psychological development and educational achievement.

The test validity shows it's good for measuring nonverbal intelligence as it is culture free and Raven's progressive matrices would be able to identify their only current level of non-verbal intelligence if they don't have other psychological issues and have proper guidelines line thus researcher hopefully provide some help as according to the nature of their difficulties.

Conclusion

From the finding of the data analysis, it can be concluded that both acquired and congenital deafness pose the same cognition. There is no significant effect of deafness on the cognitive learning of deaf children.

1.There is a less significant effect of deafness on cognition.

2.The cognitive score of acquired and congenital deaf is the same so there is no difference on the base of disability on cognition.

3.According to raven et all, the cognitive score increases with the age but it is identified that students after 16 years have developed the cognition as an adult so no effect is found on the base of age group.

4.less significant effect found on the base of gender when compared none verbal intelligence both male and female have same level of thinking and problem-solving abilities.

5.The Less significant difference is found on the basis of the class grade, gender, and locality.

Recommendations

1.On the basis of this study finding raven test must with any verbal test and low performance and high-performance students can be given a pretest and posttest to know

the effects of the cognitive score of participants on this test and their school achievement when compared with their peers.

2.Deaf children have many other issues that can impact the results, for this reason, researchers can use the second set of data to make decisions regarding cognitive learning to hearing loss level from mild to moderate.

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