

RESEARCH ARTICLE

The effect of early diagnosis of hearing loss on school performance of children

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Abstract: The present research was aimed at finding out the effect of early diagnosis of hearing impairment on school performance of hearing-impaired children. The study was carried out on a sample of parents of fifty two students of primary classes (half male and half female) and their teachers. Students were selected randomly from two special schools for hearing-impaired children situated in Rawalpindi city. The causal comparative method was used to study the effect of early diagnosis on school performance of children. Two separate questionnaires were used to collect information from parents and the teachers. Information regarding school performance of children was gathered through a checklist. Before distributing the questionnaires, a pilot study was conducted to test the validity of the questionnaires. Results indicated that majority of students were deaf by birth. It was also revealed that 75% of students with hearing impairment received pre-schooling service facility after diagnosis. The students whose disability was diagnosed within a time period of six months from birth performed better than the students whose disability was diagnosed after six months of their age. There exists a strong relationship between the early diagnosis and school performance of the hearing-impaired children. Results of the study showed that generally parents were not aware of the early steps which could be taken for the better development and performance of hearing-impaired children. This study generated information about various factors and elements regarding the early diagnosis of hearing impairments. It also pointed out numerous difficulties faced by the parents in the early diagnosis of the hearing impairment.

Keywords: Early diagnosis, hearing loss, school performance.

INTRODUCTION

Hearing refers to the reception of sound by ear, its analysis and its transmission to the brain. Any loss or abnormality of psychological, physiological or anatomical structure or function of the ear cause hearing impairment (deafness). Hearing impairment brings about

worse affects in the life of the hearing impaired persons. Early interventions and diagnosis of hearing loss can help the individual to minimise these bad impacts.

Detection of hearing loss in early stages of life has a great impact on speech, language, cognitive, social and academic development of the infants. Children who are diagnosed earlier achieve academic targets more effectively. Early diagnosis is also helpful for the professionals to start management and rehabilitation of hearing loss at appropriate time. For example the occurrence of hearing impairment can be controlled by providing immunisation to the children against childhood diseases; measles, meningitis, rubella and mumps (WHO Media Centre, 2006).

Hearing loss in one ear (unilateral) can affect the school grades of the children. Dalebout & Martinez (2002) compared the school grades of children suffering from unilateral hearing loss with children having no hearing loss and found school grades of children with unilateral hearing loss ten times less than their counterparts in the study sample.

Powers (2007) discusses the causes of deficiencies in academic achievement of hearing-impaired children in contrast to their hearing peers. His results indicated that reading is one of the most affected academic activities, because generally hearing-impaired students achieve only one third reading growth as compared to their hearing peers. The other academic area affected by hearing loss is mathematics.

Studies on hearing impairment show that some hearing-impaired children have achieved academic and social success in general education settings. It confirms that the early decisions about individual based placement

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are the best strategies. According to Schirmer (2001), “significance of early interventions on overall successes in the life to come can never be out casted”.

Olusanya *et al.* (2004) also stressed the impact of hearing loss on functional development and educational attainment of school children, particularly in the developing countries. The research pointed out implications for early intervention services and importance of collaboration among professionals.

Being a developing country, the special schools in Pakistan suffer a lot in early diagnosis and intervention of hearing loss. A great majority of children with hearing loss remain behind academically due to the non-availability of timely intervention services; medical or educational. Many factors affect the education and training of hearing-impaired children; for example, lack of awareness about the disease, consultation with professionals, lack of awareness about the resources and provision of timely intervention services. Out of these factors, lack of awareness about the disease and non-availability of timely intervention services may affect the hearing impaired person a lot and make them lag behind in independent living skills, development of language, communication, education and overall well being of the person.

The counselling services provided at special school under the supervision of special education teachers may be helpful in informing the need of early diagnosis and intervention. The personnel working in special schools have a direct contact with the parents and medical professionals. Hence, they are in the best position to create awareness among the members of the society.

Since the special education teacher is having an important role to play in education and training of hearing-impaired children, he/she must have knowledge about the significance of early intervention, diagnosis and their impact on better school performance of hearing-impaired children. Therefore, this study has been designed to investigate the effect of early diagnosis of hearing impairment on school performance of the students at primary level.

THE STUDY DESIGN

The objectives of the study were as follows:

1. To find out the age of the children at the time of diagnosis of hearing loss.
2. To identify the diagnostic factors influencing the academic progress of hearing-impaired children at primary level.

3. To ascertain factors that cause delay or denial of early diagnosis.
4. To identify the school performance of hearing-impaired children from class one to five.
5. To identify the difference in school performance of hearing-impaired children with early diagnosis as compared to late diagnosis of hearing loss.
6. To identify the relationship between early diagnosis of hearing impairment and academic performance of hearing-impaired children at primary level.

Hypothesis

Following was the null hypothesis of the research study; There is no significant relationship between early diagnosis and school performance of children with hearing impairment at primary level.

Research questions

This research also attempted to find answers to the following research questions:

1. Is the performance of hearing-impaired children diagnosed earlier is better than those not diagnosed in time.
2. What are the diagnostic factors that affect the school performance of a child with hearing impairment?
3. What steps should be taken for raising the awareness about early diagnosis among parents?

Assumptions

1. Hearing-impaired children are generally provided with the technical assessment of their hearing loss at the time of onset of hearing impairment.
2. After early diagnosis, parents tend to take measures in order to minimise the impact of disability.

LITERATURE REVIEW

Children with hearing impairment face learning difficulties particularly in the areas of reading and mathematical concept. The academic achievement of children having mild to moderate hearing loss was found one to four grade levels lower, when compared with their normal-hearing peers. The difference in school performance usually becomes prominent in higher grades

as hearing-impaired children progress through school. Smith & Brady (2009) discuss that levels of academic achievement of the children can be enhanced through parental involvement and proper utilisation (quantity, quality and timing) of the support services provided to the children.

Hearing loss occurs in a broad range starting from slight to profound. The hearing-impaired child individually differs in type and degree, and requires proper management of hearing impairment for spoken and receptive language development. Hearing loss affects the ability to read, write and the whole academic achievement of children.

Powers (2007) suggests that language acquisition deficiency can be filled in by adopting some specific measures at the early stages of life for positive results in academic achievement. Well organised early intervention strategies expedite the improvement in academic results.

Schirmer (2001) stresses a variety of placement settings ranging from general education classrooms to residential schools to provide educational and support services to the hearing-impaired children. Russ *et al.* (2004) analyse parents' comments regarding the diagnosis and intervention of their hearing-impaired children. In their study it was observed that parents become upset at the time of diagnosis and showed feelings of denial and shock. Parents become frustrated on delay in diagnosis and communication difficulties with the test providers and when screen failure occurs during testing. It is recommended that the professionals should be given sufficient training regarding informing the results of diagnosis to the parents. Similarly a further assessment for prescribing hearing aid may also be done in a sophisticated manner to satisfy the parents. According to Kavitha *et al.* (2009), the determination of hearing loss must be done at any age for health purposes. But undetected hearing loss at schools causes learning failure and results in poor school performance.

Golz *et al.* (2000) examined the effect of middle ear diseases of childhood and associated hearing loss on reading performance later at school, this study was conducted on a sample of 160 children of 6.5 to 8 years of age. It was found that the children with hearing disease and hearing loss performed poorly, in all reading tests, as compared to their hearing peers. In contrast, Wake *et al.* (2005) studied the impact of age of diagnosis and severity of hearing impairment on a population of 7–8 year old children and found that age of diagnosis, severity and IQ, did not contribute to language scores. Bess *et al.* (1998), as cited in Holstrum *et al.* (2009), indicate

the importance of early identification and intervention in communication, academic and behavioural performance of children with mild hearing loss at schools.

METHODOLOGY

The study population

All parents and teachers of hearing-impaired children studying at primary level in special schools for hearing-impaired children of Rawalpindi city comprised the study population. Following schools for hearing-impaired children of Rawalpindi city were included.

1. Government Deaf and Defective Hearing School, Swan Camp, Rawalpindi.
2. Sir Syed Academy of Special Education, Sadler, Rawalpindi.

The schools function under the Directorate of Special Education, Punjab and, Capital Administration and Development Division, respectively.

The study sample

Parents of 52 students (comprising 26 boys and 26 girls) and teachers (in-charge of class) of these students were selected as the study sample. Primary classes of each special school was chosen for the study.

Sampling technique

Simple random sampling technique was employed to select the sample. All sections of primary classes were included in the sample to the proportion of their strength. Following is the sampling frame.

Table 1: Sampling frame

Subject	Population	Sample size	%
Hearing-impaired students	104	52	50%
Hearing-impaired boys	60	26	43%
Hearing-impaired girls	44	26	59%

Research tools

Two questionnaires and a checklist were used in this study. One questionnaire was administered on the parents and the other questionnaire and a checklist were used to collect information from the teachers.

The questionnaires were developed on the basis of preliminary visits to special schools for hearing-impaired

children and by collecting and sorting professional opinions from the experts. Statements were developed on the basis of the expert opinions. The parents and teachers were asked to respond to the questions regarding early diagnosis and school performance of hearing-impaired children. The answers given by them were coded, analysed and grouped. Initially thirty items composed the two questionnaires. Both questionnaires and the checklist were pilot tested before their finalisation.

Pilot testing

A pilot study was conducted in two steps to test the validity of questionnaires. At first, few parents and teachers were contacted and their opinions about the early diagnosis and school performance of the hearing-impaired children were sought. At the second stage four parents and two teachers were requested to complete the questionnaire and the checklist for validation purposes. At this stage the questionnaire 1 contained 14 items and the questionnaire for teachers contained 7 items. The checklist contained information regarding school performance; obtained/total marks as well as percentage marks of the annual results of hearing-impaired students from class one to four, and mid year result of class five.

Administration of tools and collection of data

Questionnaires were administered on the sample respondents (parents and teachers) personally. Recovery of questionnaire was ensured through personal liaison and contact with respondents. The teachers of primary classes were contacted and given verbal brief about the questionnaires. Questionnaire for the parents were delivered through students to their homes. After five days the completed questionnaires were collected. Information on responses were noted, tabulated and analysed.

RESULTS

The data collected through the questionnaire for parents was analysed and presented in the following tables.

Table 2: Occurrence of disability

S.No.	Age of occurrence	Responses	%
1	by Birth	46	88%
2	Six month	2	04 %
3	One year	4	08 %

Table 2 indicates that 88% students are deaf by birth and only small proportion of 12% students fall prey to disability after the birth. It was found that most of the hearing-impaired children were deaf by birth.

Table 3: Ages of children when parents recognised the disability

S.No.	Age of children	Responses	%
1	(0-6) months	23	44%
2	(6-12) months	19	36%
3	(12-18) months	4	08%
4	(18-24) months	4	08%
5	(24-30) months	2	04%

Table 3 informs that 44% of the parents had realised hearing impairment of their children within six months of their age. Whereas, 36% of the parents came to know about the disability within one year, while the rest 20% knew about hearing impairment of child after one year. Therefore, it was found that a majority of parents had come to realise the hearing impairment of child within six months of the child's age.

Table 4: Provision of medical facility for students

S.No.	Statement	Level	Response	%
1	Medical facility is given after diagnosis	Yes	37	71%
2	Medical facility is given after diagnosis	No	15	29%

Table 4 depicts that most of hearing-impaired children (71%) are provided the medical facility after diagnosis. Only a minor portion (29%) of children were not able to get medical services. Therefore, it was concluded that majority of the hearing-impaired children received medical facility after diagnosis.

Analysis of open ended questions

Table 5: Method of finding the disability

(Item No. 7: How did you come to know about deafness of your child?)

S.No.	Response	Frequency	%
1	By visiting doctor	14	27 %
2	No response on sounds	22	42 %
3	Personal assessment/observation	4	8 %
4	Hospital checks up	4	8 %
5	Due to hearing-impaired siblings	3	6 %
6	Due to family history	5	9 %

Table 5 shows that 42% of the parents realised the deafness of their children due to "no response to sounds", 27% of the parents came to know about disability by visiting a doctor, 9% parents knew about problem of child by family history, 6% learned about the hearing loss by hearing-impaired siblings, whereas, 8% of the parents understood hearing loss of their children by personal observation.

Table 6: Steps taken for diagnosis

(Item No. 8: what steps were taken for diagnosis?)

S.No.	Response	Frequency	%
1	Visiting hospital	19	37 %
2	Visiting ENT Specialist	7	13 %
3	Personal assessment/observation	7	13 %
4	Audiometry	14	27 %
5	Taken to religious and spiritual pundits	5	10 %

Table 6 depicts that 37% of the parents took their children for diagnosing hearing impairment to hospital, 27% of parents visited audiologists, 13% of parents rushed to ENT specialist about problem of child, 13% employed personal methods that were used for detecting hearing loss of hearing-impaired siblings, whereas 10% of the parents took their children to spiritual pundits for diagnosing hearing loss of their children.

Table 7: Difficulty in diagnosis of hearing impairment (Item No.14: What difficulties have you faced in diagnosis of hearing impairment of your child?)

S.No.	Response	Frequency	%
1	No difficulty	4	8 %
2	No Institution	7	13 %
3	Lack of awareness and information	18	35 %
4	Lack of equipment and insufficient facilities	14	27%
5	Many countless difficulties	6	11 %
6	Other (unclear)	3	6 %

Table 7 indicates that 35% of parents were of the view that there is lack of awareness about hearing impairment type of disability, 27% parents think that lack of technical facilities for early diagnosing have created problems, 13% parents argue that non availability of proper institutions is the main difficulty, 11% spoke out about countless hurdles, while 8% parents were of the opinion that there is no difficulty they have ever faced.

Table 8: Medical Services

(Item No. 6: Provision of medical services for students at school)

S.No.	Statement	Level	Responses	%
1	Are you provided with medical services at school?	Yes	NIL	0%
2	Are you provided with medical services at school?	No	52	100%

Table 8 shows that 100% hearing-impaired students are deprived of medical facilities at both schools. Therefore, it was found that hearing-impaired children were not facilitated with medical service at schools.

Analysis of school performance of hearing-impaired children

The hearing-impaired children who scored 50% or more marks were collectively considered as good school performers, while hearing-impaired children who scored less than 50% marks collectively were not considered as good school performers. Hearing-impaired children whose diagnosis of hearing loss was carried out within first six months of their infancy were considered early diagnosed while hearing-impaired children whose diagnosis of hearing loss took more than six months of age were considered as children with late diagnosis.

Table 9: Diagnosis of hearing-impaired students

S.No.	Statement	Frequency	%
1	Hearing-impaired children with early diagnosis	23	44%
2	Hearing-impaired children with late diagnosis	29	56%

Table 9 describes that 23 (44 %) hearing-impaired students were diagnosed within six months, while 29 (56 %) hearing-impaired students were diagnosed after six months of age.

A checklist was used to observe the school performance of hearing-impaired children at primary level. Marks obtained by the children in classes one to five were collected through the checklist and analysed as shown in Table 10.

Table 10 (pg.112) reveals mean marks of 23 hearing-impaired students whose disability was diagnosed within six month was 57%. Hence, it was found the early diagnosed hearing-impaired students were good performers.

Table 12 (pg.113) depicts result of 29 hearing-impaired students whose disability was diagnosed lately. The result showed them as weak performers compared to the first group.

Results of Table 10 and Table 12 indicate that performance of hearing-impaired children whose disability diagnosed within six months is better than those who were diagnosed at later stages.

Testing of null hypothesis

The t-test was applied to observe the significance of the school performance of hearing-impaired students with the early diagnosis and late diagnosis. After computing, the value of t and respective p values are mentioned in Table 11.

Table 10: School performance of hearing-impaired students with early diagnosis: marks obtained (MO) by early diagnosed hearing-impaired students in classes I to V at primary level.

Student	Class 1	Class 2	Class 3	Class 4	Class 5	Mean Marks
1	61	72	59	85	73	70
2	34	42	63	51	60	50
3	35	39	45	38	43	40
4	62	39	73	59	72	61
5	50	39	41	53	42	45
6	38	33	34	38	32	35
7	40	47	59	68	76	58
8	40	61	71	74	59	61
9	45	75	59	98	71	63
10	71	73	50	61	70	65
11	76	65	73	72	69	71
12	88	78	79	82	63	78
13	51	53	58	55	67	57
14	68	51	53	62	41	55
15	61	52	61	63	53	58
16	60	63	58	65	68	63
17	62	55	64	71	53	61
18	40	34	56	60	35	45
19	45	49	43	61	37	47
20	42	38	42	33	40	39
21	82	85	71	80	37	71
22	65	67	72	70	71	69
23	41	42	45	53	64	49

Mean = 57%

Table 11: Inferential statistics

N	M	SD	Std.Error M	df
23	57	11.55	2.41	22
29	42	9.62	1.78	28

Calculated $t = 2.671$, $p = 1.676$ with significance level at $\alpha = .05$

As $t > p$, null hypothesis (H_0) is rejected. Hence, H_1 is accepted that there is a significant difference between the two means. Therefore, it was concluded that there was a significant difference in school performance between hearing-impaired students with early diagnosis and hearing-impaired students with late diagnosis.

Table 13 reveals that 65% of early diagnosed hearing-impaired students participated in co-curricular activities, whereas 35% were not involved in co-curricular activities. Therefore, it was found that majority of students with early diagnosis do participate in co-curricular activities.

Table 13 also reveals that 59% of lately diagnosed hearing-impaired students participated in co-curricular

activities whereas 41% were not involved with co-curricular activities. Therefore, it was found that early diagnosed students' participation in curricular activities is greater than lately diagnosed students' participation.

DISCUSSION

The study was conducted in order to investigate early diagnosis and early detection of hearing loss and its relationship with school performance of hearing-impaired students. Many variables; age of the child at the time of diagnosis, method of diagnosis, speech therapy, routine check-up, medical services and awareness among parents were taken into account in order to study their effect on learning of hearing-impaired children at schools. The results revealed that some factors; early detection, timely identification of disability, parents' knowledge about deafness and early intervention enhanced the performance of hearing-impaired children and minimised the adverse amplification of disability on learning. The present research found a strong relationship between early diagnosis of hearing loss and school performance.

Table 12: School performance of hearing-impaired students with late diagnosis: marks obtained by hearing-impaired students without early diagnosis in classes I to V at primary level.

Student	Class 1	Class 2	Class 3	Class 4	Class 5	Mean Marks
1	46	52	54	58	45	51
2	52	40	38	33	32	39
3	58	41	45	36	35	43
4	42	45	47	55	49	46
5	43	37	39	36	40	39
6	47	50	53	42	52	42
7	33	44	39	42	52	42
8	31	40	33	50	51	41
9	41	37	34	33	30	35
10	40	46	41	45	33	41
11	38	53	61	45	63	52
12	50	51	57	59	48	53
13	44	50	39	42	30	41
14	40	39	42	43	51	43
15	41	46	36	40	37	40
16	38	31	33	36	32	34
17	37	35	51	47	45	43
18	30	31	32	30	32	31
19	39	51	48	47	35	44
20	58	52	49	44	32	47
21	34	41	43	35	42	39
22	51	49	54	44	47	49
23	35	31	45	49	50	42
24	34	30	35	38	33	34
25	34	45	43	50	33	41
26	34	33	31	36	41	35
27	45	48	37	41	44	43
28	53	41	36	51	54	47
29	34	31	53	48	44	42

Mean = 42%

Table 13: Curricular activities of who are early and lately diagnosed

Statment	Level	Early diagnosed		Lately diagnosed	
			%		%
Co-curricular Activities	Y	15	65%	17	59%
Co-curricular Activities	N	08	35%	12	41%
Total		23	100%	29	100%

A similar study conducted by Martineau *et al.* (2001) identified significant association between academic achievement and parent-centred services that were started before the age of two years and suggested oral mode of communication for better auditory intervention. Similarly, as argued by Kavitha *et al.* (2009), the

determination of hearing loss must be done at any age for health purpose but undetected hearing loss at schools causes learning failure and results in poor school performance.

The results of the present study revealed that parents (37%) took steps for early intervention and diagnosis by visiting hospitals and taking audiometry tests. The results also revealed that due to lack of awareness, some parents (35%) faced difficulty in diagnosis. The study supports the findings of Russ *et al.* (2004), who analysed parents' comments regarding the diagnosis and intervention of their hearing-impaired children and found that parents become upset at the time of diagnosis and showed the feelings of denial and shock. They become frustrated with delay in diagnosis and communication

difficulties with the test providers and when there occurs screen failure during testing. It was recommended that the professional should be trained to inform the results of diagnosis to the parents.

The results of the present study revealed that lack of facilities have created difficulties in school performance of children. These results are in line with the findings of a study by Golz *et al.* (2000), who examined the effect of hearing loss on reading performance later at school and found poor performance of hearing-impaired children in all reading tests, as compared to their hearing peers.

In contrast to the results of the present study, Wake *et al.* (2005) found that age of diagnosis, severity and IQ did not contribute to school performance. They concluded that the severity of hearing loss of children of 7 – 8 years of age, with late diagnosis, strongly related to the poor language development. But Olusanya *et al.* (2004) stressed the impact of hearing loss on functional development and educational attainment of school children, particularly in the developing countries. Another study by Bess *et al.* (1998), as cited in Holstrum *et al.* (2009), also indicated the importance of early identification and intervention in communication, academic and behavioural performance of children with mild hearing loss at schools.

In the light of this discussion, it is safe to conclude that early diagnosis of hearing disability and then taking intervention steps at early stage play an important role in enhancing the overall performance of hearing-impaired children in schools.

CONCLUSIONS

The early diagnosis of hearing impairment of children clearly contributes to learning improvement. The authors also found numerous difficulties faced by the parents in the early diagnosis and assessment of the hearing impairment of children. The parents of hearing-impaired children were not aware of the technical assessment methods for assessing hearing loss through which the disability could be traced early. A strong relationship existed between the early intervention and diagnosis of hearing impairment and performance of the child at academic as well as social level, which ultimately helped them mitigate the repercussion of the disability.

RECOMMENDATIONS

1. Future research should explore possible application of speech therapy and language developmental strategies in promoting education among children.

2. A comparable study at the college level can be undertaken to check the validity of the relationship established in the present study.
3. There is a need to develop home based guidance programs for parents for early identification of hearing-impaired children and helping them to perform well in special education institutions.

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