WWW.IJRPR.COM

International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

A Comparative Study of Academic Skills between Students with Hearing Aid Users and Cochlear Implanted from Class 1st to 5th Standard

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A B S T R A C T

The purpose of this study was to compare the academic skills of students with hearing aid users and cochlear implants to understand how these assistive devices/technologies influence academic development. The language development plays a crucial role for cognition, academic success and overall well-being, particularly for students with hearing impairments. The research involves combining quantitative assessments with qualitative insights. This study involved 60 bilateral sensorineural hearing impaired students from class 1st to 5th standard whose age range between 6-15 years. Thirty hearing impaired students had moderately severe/severe hearing loss with hearing aid users and 30 hearing impaired students severe to profound hearing loss with cochlear implants, drawn from special schools, inclusive schools and specialized clinics. Academic skills were assessed using student's class result, focusing on subjective result. The findings suggest that students with cochlear implants demonstrate higher proficiency in academic skills compared to their hearing aid-using counterparts, potentially due to enhanced auditory input and speech perception. However, students using hearing aids showed comparable performance in academic performance. These insights can guide educators, therapists, and policymakers in developing inclusive educational strategies and interventions to enhance the language and academic development of students with hearing impairments.

Keywords: Hearing aids, cochlear implants, hearing impairment, Language Development, Academic Skills, Special Schools and Inclusive Skills etc.

1. Introduction:

Hearing Impairment/Disability, particularly during childhood, can profoundly influence language development, communication abilities, and social engagement. Communication is basic needs to human interaction, fostering cognitive abilities, academic performance, emotional health, and overall quality of life. Students with hearing impairment often exhibit unique cognitive characteristics, which may be difficult to interpret or recognize with precision. Support from family members and peer groups play a critical role in helping these individuals manage emotional stress and providing a sense of belonging and encouragement. Strong emotional bonds with family members, caregivers, friends and educators along with active participation in social networks, are essential for the healthy psychological, social and academic development of adolescents. An individual's self-concept is shaped by the alignment between their own feelings, attitudes, and those of their social peers. Personality traits and self-confidence are key internal factors that significantly influence academic outcomes. The capacity for independent functioning and self-care also impacts classroom behavior, academic success, and peer relationships. A typical auditory capacity supports optimal speech and language acquisition. Assistive listening devices, such as hearing aids (HAs) and cochlear implants (CIs), offer critical auditory support, enhancing sound perception, and facilitating both language proficiency and social participation. However, the degree to which these technologies improve hearing can vary depending on their design, efficiency, and the individual's adaptability to using them. Speech and Language competence spans various skills, including verbal and non-verbal communication, social adaptability, Academic skills, Emotional understanding, and the ability to interact effectively across different social environments. Children with hearing impairments often face difficulties in these areas due to delays in hearing sensitivity, language development, incidental learning opportunities, and potential social exclusion. Some research has examined the impact of hearing technologies like hearing aids and cochlear implants in mitigating these challenges and enhancing communicative and social functioning. **The World Federation of the Deaf (WFD)** is an international non-governmental organization that represents 70 million Deaf people in the world. 80 percent of these 70 million are in developing countries, which are not able to meet the needs, or even know the needs of Deaf people. Generally Haring impairment has two major categories i.e.

a) Deaf , b) Hard of Hearing

(a) **"Deaf"** means persons having 70 dB hearing loss in speech frequencies in both ears.

(b) **"Hard of Hearing"** means person having 60 dB to 70 dB hearing loss in speech frequencies in both ears.

Aristotle believed that the deaf were incapable of learning or thinking. The kind of prejudice based on speech and hearing that Aristotle has expressed has influenced methods of teaching the deaf.

A hard of hearing person in the one who generally with the use of a hearing aid, has residual hearing sufficient to enable successful processing of linguistic information through audition (**Brill, Mac Neil and Newman, 1986).** A deaf child or adult is one who sustained a profound (91dB or greater) primarily sensorineural hearing impairment prelingually **(Quigley and Kretschmer, 1982).** Hearing impairment means loss of 6decibles or more in the better ear in the conversational range of frequencies. The term hearing impairment includes the subsets of deaf and hard of hearing **(The persons with disabilities (PWDs) Act, 1995).** The losses of hearing, temporary or permanent range from mild to profound and sometimes total **(Sian Tesni, 1996).** Hearing impairment refers to a partial or complete loss of auditory perception, which may affect one or both ears and vary in severity from mild to profound **(WHO, 2018).** Hearing impairment is a condition that limits the ability to perceive auditory stimuli, thereby influencing language learning, communication skills, and educational performance (Flexer, C. 1999). A disorder of the hearing system, hearing impairment reduces an individual's ability to detect or differentiate sounds, thereby affecting social and communicative interactions (Katz, J. 2002).

The primary listening devices used to assist individuals with hearing loss—hearing aids (HAs) and cochlear implants (CIs) offer varying levels of auditory restoration. While hearing aids operate by amplifying ambient sound, cochlear implants bypass impaired auditory structures to deliver electrical signals directly to the auditory nerve. This fundamental difference in function may profoundly influence the development of users' social skills. This review examines the social functioning of individuals utilizing HAs versus CIs, considering factors such as speech perception, peer interaction, and emotional well-being. Children with severe to profound sensorineural hearing loss (SNHL) frequently face delays in language acquisition, which can hinder effective communication and limit social participation. Before the introduction of cochlear implants, hearing aids were the only available technological means for children with hearing impairments to access sound both in industrialized and low-resource settings.

The advent of cochlear implants has represented a groundbreaking breakthrough, significantly advancing auditory and linguistic outcomes in children with hearing impairments. Today, these devices have greatly facilitated the development of speech and language among children with sensorineural hearing loss. A wealth of research has explored various aspects of language acquisition, speech recognition, and verbal communication abilities in individuals with cochlear implants. Although it is now broadly recognized that cochlear implants can provide auditory input nearing that of typical hearing, an equally vital goal lies in fostering social engagement among implanted children. Enhancing interpersonal communication skills plays a crucial role in reducing social isolation, marking a key advantage of cochlear implantation. Hearing aid is an electronic device for amplifying or enhancing environmental sounds. A hearing aid can be defined as any devices whose function is to amplify the acoustic signals to a degree that enables an individual with a hearing loss to use his or her remaining hearing in a useful and efficient manner **(Suzanne H Kimball, 2010).** According to **Katz (2002), Hearing Aids** are **electronic devices** that elevate sound intensity to facilitate communication for those with hearing challenges. **Dillon (2012)** describes a hearing aid as a **compact electronic apparatus** designed to assist individuals with hearing loss by amplifying ambient sounds for everyday communication. The **World Health Organization (2018)** characterizes hearing aids as **sound-enhancement tools** that provide improved auditory access, thereby fostering better social interaction. Similarly, **Lloyd & Kaplan (1978)** define a hearing aid as an **electroacoustic system** that processes sound inputs to improve hearing for users with auditory impairments.

A cochlear implant has external components such as the microphone, a speech processor and a magnetic coil; and internal parts such as the implant and the electrodes. The microphone picks up the sound signals and converts them into electrical signals, the speech processor manipulates the signals as desired, and the magnetic coil serves as a system for transmitting this information to the internal components. The electrodes are implanted during surgery and ate not visible externally. These electrodes stimulate the nerves fibers; which in turn stimulate the higher auditory structures. Cochlear implants are neuroprosthetic devices that convert sound into electrical signals to stimulate the auditory nerve, enabling individuals with severe hearing loss to perceive sound. (Zeng, F. G., Rebscher, S., Harrison, W., Sun, X., & Feng, H. 2008). Cochlear implants are electronic medical devices that provide a sense of sound to individuals with severe-to-profound sensor neural hearing loss by directly stimulating the auditory nerve. (Wilson, B. S., & Dorman, M. F. 2008). A cochlear implant is a prosthetic device that replaces the function of the damaged cochlea by converting sound into electrical impulses sent directly to the auditory nerve. (NIH Consensus Statement, 1995).

2. Review of Literature

Hearing aids enhance sound perception and improve access to auditory information, which aids in speech comprehension and effective communication. Nevertheless, research suggests that students who depend on hearing aids may encounter social difficulties stemming from factors such as background noise interference, challenges in distinguishing speech, and a need to rely on visual supports like lip reading **(Moeller, 2000).** A study on 'Effects of Cochlear Implants on Children's Reading and Academic Achievement.' The purpose of this study was to assess the impact of cochlear implant on children's reading and academic achievement. The result show that good positive effects on reading and academic achievement to the cochlear implants student **(Marschark, M., Rhoten, C. & Fabich, M., 2007). Spencer, L.J., Gantz, B.J. & Knutson, J.F. (2004)** found that provide long-term speech perception and production, educational, vocational, and achievement outcome data for pediatric cochlear implant recipients. **Casto, G., & Mastropieri, M. A. (1986)** a large analysis of studies on the efficacy or effectiveness of early intervention programs found that early intervention programs are immediately beneficial for people with disabilities. The results were indicative of a variety of the four measures obtained, including I.Q. and motor, language, and academic achievement. **George, A., Joy, J.M. & Sreekumar, S. (2020)** conducted a study on 'Academic Outcomes and Coping Mechanisms of Children using Cochlear Implants in Mainstream Schools in Kerala, India'. The class teachers rated the performance of 71 % of these children as 'above average'. Though the academic outcomes were found to be good on the questionnaire and classroom tests, most of the children with cochlear implants faced various difficulties and had used different compensatory strategies to give their optimum performance in the classroom. **Choi,**

J.E., Hong, S.H. & Moon, J. (2020) conducted a study on 'Academic Performance, Communication, and Psychosocial Development of Prelingual Deaf Children with Cochlear Implants in Mainstream Schools'. Result of this study was most implanted children attending mainstream school appeared to have positive self esteem and confidence, and had little difficulty in conversing in a quiet classroom. **Huber, M., & Kipman, U. (2012)** conducted a study on 'Cognitive Skills and Academic Achievement of Deaf Children with Cochlear Implants'. The Result of this study was to the children with CI equaled normal-hearing children and performed significantly with cognitive skills and academic achievement.

Cochlear implants (CIs) provide direct electrical stimulation to the auditory nerve, granting broader auditory input than traditional hearing aids. Studies indicate that children with CIs often exhibit enhanced speech recognition, more developed language skills, and greater social participation compared to peers who rely on hearing aids **(Geers et al., 2013).** CIs have also been linked to improved linguistic abilities and better reading comprehension **(Vijetha, P., 2014).** Numerous comparative studies have explored differences in language abilities between students with hearing aids and those with cochlear implants. These findings contribute valuable insight to the ongoing discourse surrounding cochlear implant eligibility. Notably, both groups—children with CIs and those with HAs—achieved high scores in speech perception, language skills and academic development during conversational scenarios.

3. Objective of the Study:

The primary objective of this study is to compare the Academic skills—specifically class 1st–5th standard —between students who use hearing aids and those who use cochlear implants.

- Examine the differences in academic outcomes between the two groups.
- Identify the strengths and challenges associated with each hearing device in relation to academic acquisition.
- Explore the impact of age at intervention, duration of device use, access to speech-language therapy on language proficiency and schooling strategies for academic growth.
- Provide insights that can inform educators, therapists, and parents in selecting and supporting effective communication interventions.

4. Methodology

4.1 Hypothesis –

1: There is a significant difference in the Academic skills of Children using Hearing Aids and Cochlear Implants from class 1st to 5th Standard.

4.2 Sample

This study involved 60 children with bilateral sensorineural hearing impairment, aged 6-15 years from class 1st to 5th standard. 30 children with moderately severe/ severe hearing loss using hearing aids as assistive device, and 30 children with severe to profound hearing loss using cochlear implants as assistive devices.

4.3Tool Used

The academic skills were assessed from their class results.

4.4 Procedure

To gain insights into academic abilities, the researcher collected photocopies of the students' previous class mark sheets. Academic performance was evaluated based on the students' results in relevant subjects, and the data was statistically analyzed to interpret outcomes. Information regarding the students' academic records was obtained either from their respective schools or parents. The following table presents the number of students using hearing aids and cochlear implants across different class levels:

Class	**Hearing Aid users**	**Cochlear Implants**
Class-1	8	7
Class-2	5	7
Class-3	5	6
Class-4	6	5
Class-5	6	5
Total	**30**	**30**

4.5 Statistical Analysis

The "t" test was used to determine the significance of mean differences.

5. Results and Discussion

The result of present study are presented table wise.

Hypothesis – 1: There is a significant difference in the Academic skills of Children using Hearing Aids and Cochlear Implants from class 1st to 5th Standard.

The following tables present the class-wise distribution of students utilizing hearing aids and cochlear implants, based on the collected statistical data.

Class-I

Groups	Subject	Mean	SD	t-value	df	Significant level
Children using Hearing Aids	8	64.25	3.12	4.75	13	0.01
Children using Cochlear Implants	7	72.71	3.69			

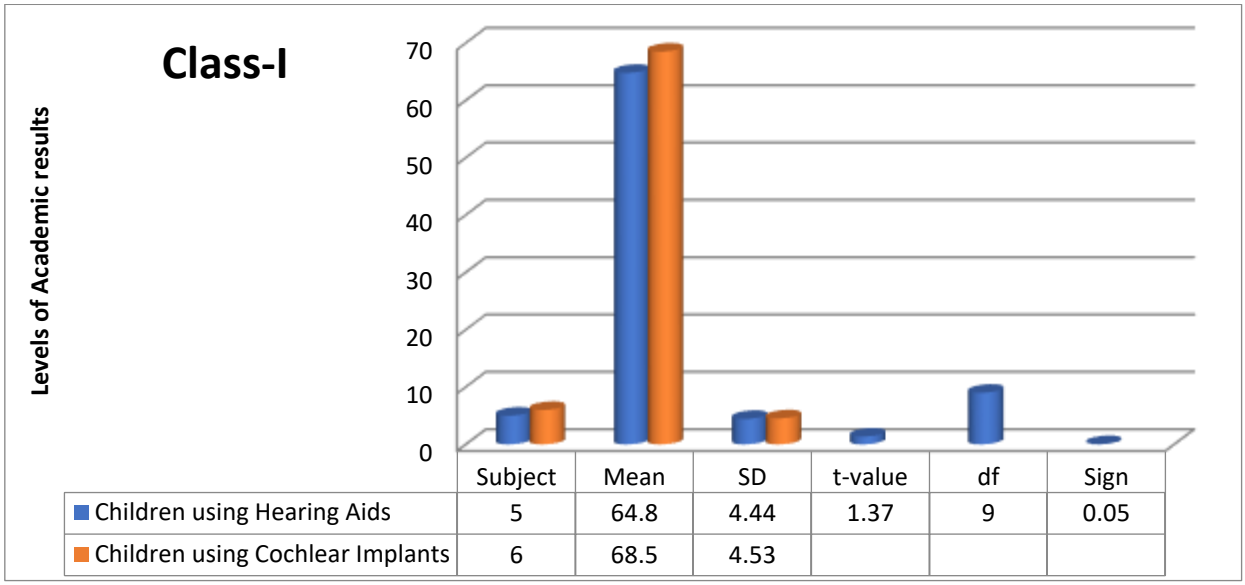

Figure No. – 1: Difference in the academic skills of Children using Hearing Aids and Children using Cochlear Implants in class-I.

The table and figure number – 1 reveals that the mean value of academic skills / results of class-I Children using Hearing Aids are 64.25 and SD value is 3.12, whereas mean value of academic skills / results of Children using Cochlear Implants is 72.71 and SD value is 3.69. The 't' Test value between the mean of Children using Hearing Aids and Children using Cochlear Implants is 4.75, which shows significant difference at 0.01 levels. That means there is a significant difference between the academic skills of Children using Hearing Aids and Children using Cochlear Implants in class- I. But when we compare mean value the academic skills of Children using Cochlear Implants is better as compared to Children using Hearing Aids. Children using Cochlear Implants have high level of reception of environmental sound than the Children using Hearing Aids. So children using cochlear implant can hear better sound clarity. This advantage contributes to improve cognitive skills, which can positively impact on school readiness and academic skills.

Class-II

Groups	Subject	Mean	SD	t-value	df	Significant level
Children using Hearing Aids	5	65	5.05	4.41	10	0.01
Children using Cochlear Implants	7	76.86	3.85			

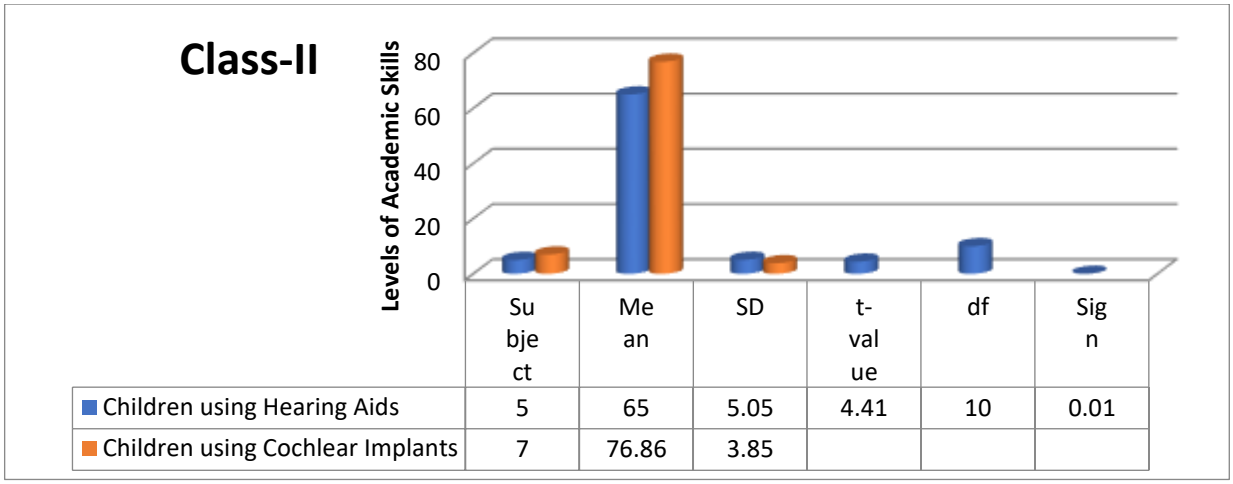

Figure No. – 2: Difference in the academic skills of Children using Hearing Aids and Children using Cochlear Implants in class-II.

The table and figure number –2 reveals that the mean value of academic skills / results of class-II Children using Hearing Aids are 65 and SD value is 5.05, whereas mean value of academic skills / results of Children using Cochlear Implants is 76.86 and SD value is 3.85. The 't' Test value between the mean of Children using Hearing Aids and Children using Cochlear Implants is 4.41, which shows significant difference at 0.01 levels. That means there is a significant difference between the academic skills of Children using Hearing Aids and Children using Cochlear Implants in class- II. When comparing the average academic performance of children, those with cochlear implants tend to outperform their peers who use hearing aids. Children with cochlear implants generally demonstrate a higher ability to perceive environmental sounds, which results in clearer sound reception. This enhanced auditory input plays a key role in supporting the development of cognitive abilities, ultimately contributing to better school readiness and academic achievement.

Class-III

Groups	**Subject**	**Mean**	**SD**	**t-value**	**df**	**Significance**
Children using Hearing Aids	5	64.8	4.44	1.37	9	0.05
Children using Cochlear Implants	6	68.5	4.53			Not Significant

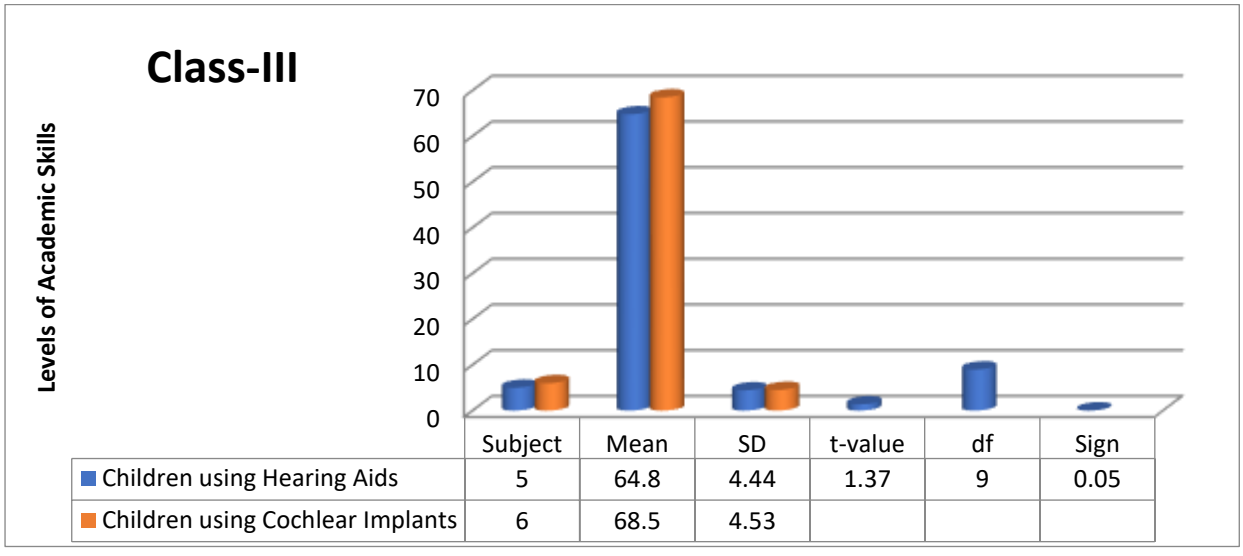

Figure No. – 3: No Difference in the academic skills of Children using Hearing Aids and Children using Cochlear Implants in class-III.

The table and figure number –3 reveals that the mean value of academic skills / results of class-III Children using Hearing Aids are 64.8 and SD value is 4.44, whereas mean value of academic skills / results of Children using Cochlear Implants is 68.5.86 and SD value is 4.53. The 't' Test value between the mean of Children using Hearing Aids and Children using Cochlear Implants is 1.37, which shows no significant difference at 0.05 levels. This indicates that there is no significant difference in the academic performance between children using hearing aids and those using cochlear implants in Class-III. Both groups achieved nearly the same average scores. On average, both groups demonstrated comparable academic outcomes. High-quality hearing aids enhance auditory sensitivity, which positively influences students' academic performance in the classroom.

Class-IV

Groups	Subject	Mean	SD	t-value	df	Significant level
Children using Hearing Aids	6	65.83	4.4	2.68	9	0.05
Children using Cochlear Implants	5	74	5.52			

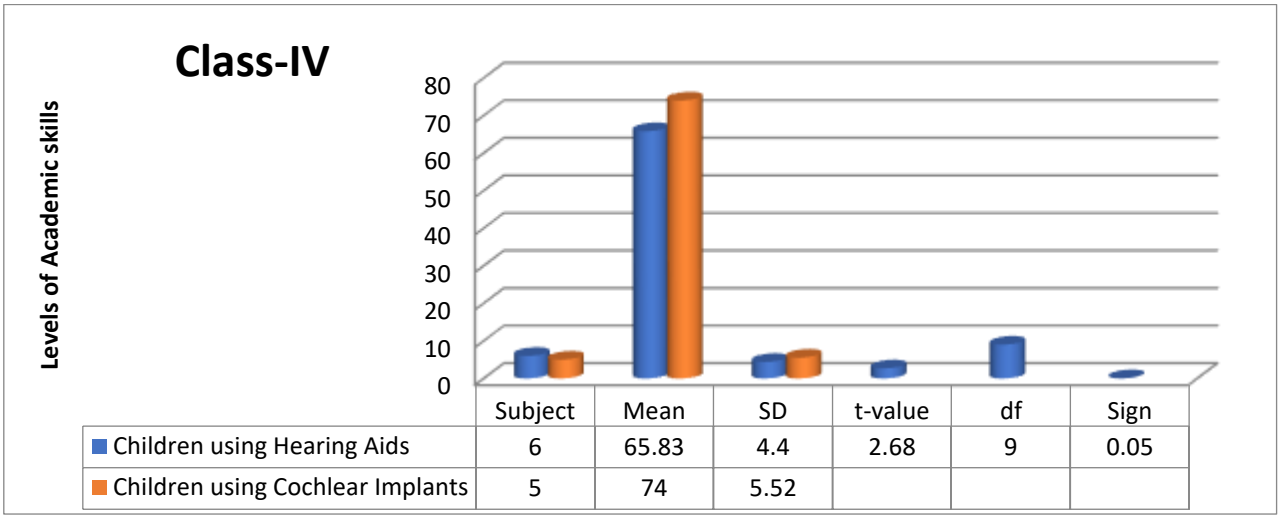

Figure No. – 4: Difference in the academic skills of Children using Hearing Aids and Children using Cochlear Implants in class-IV.

The table and figure number –4 reveals that the mean value of academic skills / results of class-IV Children using Hearing Aids are 65.83 and SD value is 4.4, whereas mean value of academic skills / results of Children using Cochlear Implants is 74 and SD value is 5.52. The 't' Test value between the mean of Children using Hearing Aids and Children using Cochlear Implants is 2.68, which shows significant difference at 0.05 levels. This indicates that there is a significant difference in the academic performance between children using hearing aids and those using cochlear implants in Class-IV. However, when comparing the average performance, children with cochlear implants demonstrate superior academic abilities compared to those using hearing aids. Children with cochlear implants exhibit a heightened perception of environmental sounds relative to their peers with hearing aids. This enhanced auditory clarity enables them to process sounds more effectively. Such an advantage fosters the development of cognitive abilities, which in turn can have a positive influence on school preparedness and overall academic performance.

Class-V

Groups	Subject	Mean	SD	t-value	df	Sign
Children using Hearing Aids	6	70.33	1.51	2.3	9	0.05
Children using Cochlear Implants	5	76.2	5.54			

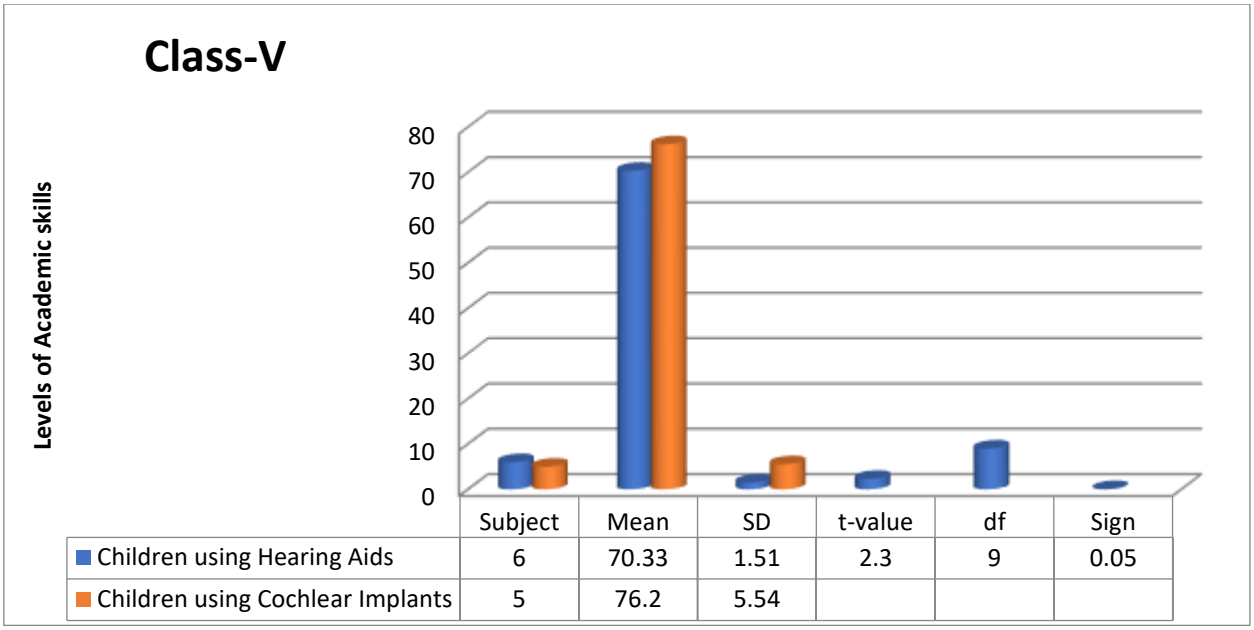

Figure No. – 5: Difference in the academic skills of Children using Hearing Aids and Children using Cochlear Implants in class-V.

The table and figure number –5 reveals that the mean value of academic skills / results of class-V Children using Hearing Aids are 70.33 and SD value is 1.51, whereas mean value of academic skills / results of Children using Cochlear Implants is 76.2 and SD value is 5.54. The 't' Test value between the mean of Children using Hearing Aids and Children using Cochlear Implants is 2.3, which shows significant difference at 0.05 levels. This indicates that there is a significant difference in the academic performance between children using hearing aids and those using cochlear implants in Class-V. However, when evaluating overall performance, students with cochlear implants tend to show stronger academic capabilities than those relying on hearing aids. Children fitted with cochlear implants display an improved awareness of surrounding sounds compared to their peers using hearing aids. This increased auditory precision allows them to interpret sounds more efficiently. This benefit supports the growth of mental faculties, which can subsequently enhance readiness for school and contribute positively to academic success.

The overall academic performance was statically analyzed for understanding the academic skills of students using hearing aids and cochlear implants at primary section.

Groups	**Subject**	**Mean**	**SD**	**SED**	**t-value**	**Significant level**
Children using Hearing Aids	30	66	4.14	1.22	6.25	P<0.01
Children using Cochlear Implants	30	73.63	5.1			

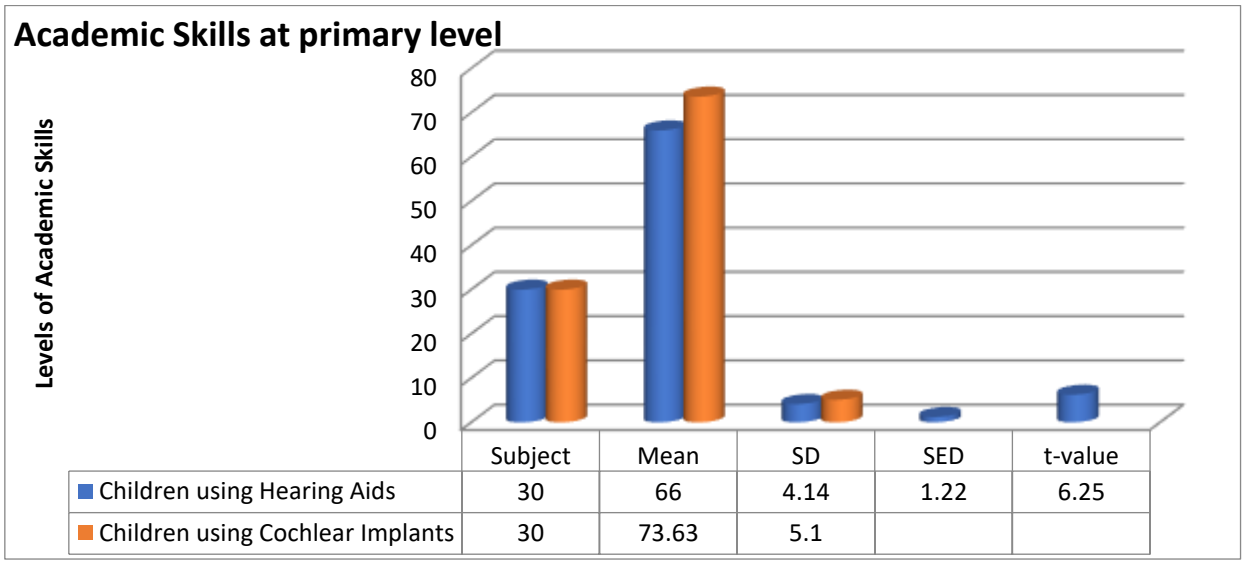

Figure No. – 6: Difference in the academic skills of Children using Hearing Aids and Children using Cochlear Implants.

The table and figure number – 6 reveals that the mean value of academic skills of Children using Hearing Aids is 66 and SD value is 4.14, whereas mean value of academic skills of Children using Cochlear Implants is 73.63 and SD value is 5.1. The 't' Test value between the mean of Children using Hearing Aids and Children using Cochlear Implants is 6.25, which shows significant difference at 0.01 levels. That means there is a significant difference between the academic skills of Children using Hearing Aids and Children using Cochlear Implants at primary section. However, when comparing the average levels, children with cochlear implants exhibit superior receptive language abilities compared to those using hearing aids. Children with cochlear implants demonstrate a greater capacity to perceive environmental sounds than their peers with hearing aids. As a result, they experience enhanced sound clarity. This auditory advantage plays a significant role in fostering better receptive language skills, which can, in turn, positively influence both cognitive and linguistic development.

6. Conclusion

The study emphasizes that although students using cochlear implants often exhibit stronger verbal communication abilities, those who rely on hearing aids tend to develop distinct strategies for social adaptation. Providing academic support, promoting inclusive educational environments, and initiating early intervention are crucial to help both groups effectively engage in social settings. Future investigations could examine how various rehabilitation methods influence long-term academic growth and emotional health among students with hearing loss.

7. Educational Implications

A comparative analysis of academic competencies among students utilizing hearing aids (HAs) versus those with cochlear implants (CIs) underscores significant educational considerations for promoting inclusive educational settings. Learners with CIs frequently exhibit more advanced verbal interaction abilities compared to their HA counterparts, calling for customized instructional approaches. Educational institutions should adopt personalized support frameworks, initiate early intervention efforts, and provide speech-language therapy to bolster communicative skills. Inclusive teaching strategies—such as programs to raise peer awareness, the use of assistive auditory devices, and collaborative learning models—can enhance students' academic inclusion. It is essential for teachers to be trained in adaptive communication methods and familiar with supportive technologies like real-time captioning and voice-to-text applications. Moreover, engagement from families and local communities is vital in reinforcing academic development beyond the school environment. Through these targeted strategies, schools can ensure a fair and supportive learning atmosphere that nurtures both the social and academic advancement of students with hearing challenges.

8. References

1. World Federation of the Deaf. (2019). About WFD. Retrieved from https://wfdeaf.org.
2. Brill, R. G., MacNeil, B., & Newman, L. R. (1986). Framework for appropriate programs for deaf children: Conference of educational administrators serving the deaf. American Annals of the Deaf, *131*(2), 65–77.
3. Quigley S. P. & Kretschmer R. E., The education of deaf children: issues, theory and practice. Baltimore: University Park Press/London: Edward Arnold, 1982.
4. Suzanne H Kimball (2010). A perfect knowledge of our own tongue: Language use and learning.
5. Katz, J. (2002). Handbook of Clinical Audiology, 5th Edition.
6. Northern, J. L., & Downs, M. P. (2002). Hearing in Children, 5th Edition.
7. Flexer, C. (1999). Facilitating Hearing and Listening in Young Children.
8. Dillon, H. (2012). Hearing Aids. Thieme Medical Publishers.
9. World Health Organization (2018). World Report on Hearing.
10. Lloyd, L. L., & Kaplan, H. (1978). Audiometric Interpretation: A Manual of Basic Audiometry.
11. Zeng, F. G., Rebscher, S., Harrison, W., Sun, X., & Feng, H. (2008). Cochlear implants: System design, integration, and evaluation. IEEE Reviews in Biomedical Engineering, 1, 115-142.
12. Marschark, M., Rhoten, C. & Fabich, M. (2007). The Journal of Deaf Studies and Deaf Education, Volume 12, Issue 3, Summer 2007, Pages 269–282, https://doi.org/10.1093/deafed/enm013.
13. Casto, G., & Mastropieri, M. A. (1986). The Efficacy of Early Intervention Programs: A Meta-Analysis, Vol 52, Issue 5, https://doi.org/10.1177/001440298605200503.
14. George, A., Joy, J.M. & Sreekumar, S. (2020). Academic outcomes and coping mechanisms of children using cochlear implants in mainstream schools in Kerala, India.

15. Choi, J.E., Hong, S.H. & Moon, J. (2020). Seoul Consensus on the Diagnosis and Management of Gastroesophageal Reflux Disease: National Library of Medicine, doi:10.5056/jnm21077.
16. Wilson, B. S., & Dorman, M. F. (2008). Cochlear implants: A remarkable past and a brilliant future. Hearing Research, 242(1-2), 3-21.
17. NIH Consensus Statement (1995). Cochlear Implants in Adults and Children.
18. Geers, A. E., Nicholas, J. G., & Sedey, A. L. (2013). Language skills of children with early cochlear implantation. Ear and Hearing, 34(5), 562-574.
19. Moeller, M. P. (2000). Early intervention and language development in children who are deaf and hard of hearing. Paediatrics', 106(3), e43.
20. Spencer, P. E., & Marschark, M. (2003). Cochlear implants: Issues and implications. Oxford University Press.