CHAPTER – V
SUMMARY OF THE STUDY, FINDINGS AND CONCLUSIONS

5.1 INTRODUCTION

Today’s children are the architects and the human capital of the future nation. This human capital contributes to social and economic development of a nation. The children of today are the citizens of tomorrow, whether they are normal or disabled. Every individual child is unique and every soul is potentially divine. Every child - normal or with special needs is born with inner potentialities which needs to be drawn out and this rudimentary role is played by the education system in the society. Education helps to develop the inner potentials in a child and contributes to generate an advance community.

Around fifteen percent people, or estimated one billion of the world’s population, live with disabilities. A WHO study states that 80% of disabled people live in developing countries and India is one of them. 2.21% of total population of Persons with Disabilities lives in India. An estimated 26.8 million population experience some form of disability or impairment (Census of India 2011). Approximately six percent population of India suffers from some hearing impairment, making it one of the countries with the highest number of hearing impaired.

The ability to hear sounds and convert it into meaning is an supposition of life to many living organisms - an ability often take for granted. The ear which is the organ of hearing is a stunning gift of God. The sense of hearing is very essential because it is the elementary means through which a child learns the ideas and feelings of others by listening to their verbal expression. Hearing impaired children are deprived of this crucial ability of hearing. Hearing impaired children can carry out any task as equally as their hearing counterparts do, except ‘hear’ as the latter do. As there are differences in
performance of a task when a normal child does, discrepancies do exist in task performance, learning styles and achievement of hearing impaired children.

Every child should be given equal opportunities to learn in general and the impaired children in particular. Certain provisions to enable them can facilitate equal or greater opportunities for participation of these children in educational programmes and make the educational programmes more beneficial to them.

The Right to Free and Compulsory Education Act (2009) has made it mandatory to provide education to all children up to the age of fourteen years of age. This puts a major responsibility on States which calls for trained teachers and appropriate curricular adaptations to make education accessible to children with disabilities.

As per the most recently published District Information Education System (DISE) data, the proportion of children with disabilities enrolled is only 0.84%. A study by MHRD has revealed that 12.12% of all out-of-school children are with special needs. Even after the implementation of RTE Act more than 50% of CWSN are out of school in Delhi (Source: The Times of India, October 2013).

A recent World Bank report, however has reiterated that education and employment of disabled people are last on the list of government expenditure. Over 75% of disabled children are out of network of services (Alur, 2008).

School is a formal agency of education. It plays a vital role in molding the habits and attitudes, personalities- which are mentally alert, physically strong, culturally sound, socially efficient, and emotionally stable personality. Schools for special children need to concentrate on developing such balanced personality characteristics among the differently-abled children.

Modern technology has taken a vital place in the life of all disabled individuals. Nowhere are the effects of today’s technological advances more
evident in working with special needs students than in the area of hearing impairment. Sophisticated hearing aids, computers, alerting devices, cochlear implants, captioned media and adaptive equipment are a few of the items whose use revolutionized education of the hearing impaired child. The field of education too has been revolutionized due to advent of technology. Schools have reiterated the significance of technology and are adopting it in their classrooms. Technology has made it easier for teachers to teach and for learners to learn. It has made teaching and learning more motivating, easier and effective for the student as well as teacher population.

The use of technology in education has proved to be a means which has the latent energy to enhance the education of the hearing impaired. As use of technology has continued to increase in all fields, its imperative for education to also make adequate use of technology to ease learning process for the hearing impaired.

Individuals with Disabilities Education Improvement Act (IDEIA) 2004 recommends the use of assistive technology and suggests that AT be integrated and made a necessary part of education for every student with disability and made it mandatory during development of educational programs and plans for disabled students.

While AT is nothing positive impacts, it is also important to prepare special education teachers for AT use. Special education teachers play a large role in AT, ranging from identifying the AT that a hearing impaired student may benefit from to supporting their use in the classroom.

In fact, teachers have to face the typical problems generated by the hearing impairment of their students. Thereby they are the better persons for the detection of the suspected hearing loss of their students by resorting to systematic observation of their hearing and hearing behavior.
A child with a permanent hearing loss should be provided with sensory support service by the education authorities. Skilled support should be given so that the child is helped to develop communication and language skills. In India special schools have been established for education of hearing impaired children.

Technology is increasingly becoming an indispensable part of modern life and has also reached our today’s classrooms. Technology is useful to hearing impaired children and helps them to overcome the restrictions experienced by them due to their impairment. Hearing impaired students are expected to obtain good grades, have access to technology and do well in an academic course, and get occasions in which they can apply what they have learnt in school and attain success in standardized examinations conducted by the school.

Academic Achievement of students with HI may be significantly delayed in comparison to that of their hearing peers. Students who are deaf or have a partial HI have considerable difficulty succeeding in an educational system that depends primarily on the spoken word and written language to transmit knowledge. Reading and Literacy skills are the most affected area of academics for the hearing impaired. This Literacy competency is the core of academic success in an educational center like the school.

This provision given to them should be taken as the index of a socially just society. Hearing impaired students would certainly pose challenges to the educational system, teachers and individual schools. Providing them with quality education to which they are equally entitled poses a severe challenge. Very often, children with special needs are underachievers when compared to their hearing peers. The lack of understanding among the teaching force about this constraint and lack of specialization in SEN and teaching expertise is the chief cause for underachievement of such children. A hearing impairment
student’s academic level must be given special consideration, particularly if it is below expectations for standard grade-level achievement.

Literary writing skill is a potent means of expression and once a hearing impaired student acquires a hold on it, he would gain higher academic achievement. This is possible when assistive technology is used and the hearing impaired child is able to use print for his expression. Research studies have illustrated this in their reports concerned with the use of assistive technology and would also further literacy an academic achievement.

In this technological era, hearing impaired students could be enormously benefitted by the use of assistive technology which have far reaching impact. AT enables hearing impairment to be compensated by assisting them with the necessary learning skills by overcoming their deficiencies. Access to AT allows hearing impaired users to become more independent, experience greater feelings of security, autonomy, have higher social, economic and educational aspirations.

AT can be a fundamental tool in special education because many students with disabilities require instruction that can be tailored towards their needs, and AT can afford them that type of instruction. AT has great potential to assist deaf students at hearing schools. AT benefits classroom learners by providing them with access to concrete information.

The benefits of providing AT to students with hearing impaired are vast. The use of the AT makes, these children able to engage in play activities and gain independence in their daily living activities. The greatest advantage of AT in the lives of students has been gain in their ability to make their own choices. In addition, students are found to report an increase in positive social interactions, self-esteem and motivation.

Though there are AT invented for the benefit of the HI they must be made available and used in educating the hearing impaired. The availability of AT is
an effective strategy for educating the hearing impaired child and enhance his learning.

The use of technology as a tool for learning can help students increase their problem solving and higher-order thinking skills. Once the Hearing impaired students adopt assistive technology, they no longer need to lead a disadvantaged school and community life as they could hear lessons, instructions and information and perform better in academics and general tasks outside the school too.

Teacher is the pivot around the success of implementation of assistive technology revolves. Hence the teachers need to enhance their competencies in the use of assistive technology by enhancing their awareness in this area. Teacher’s awareness is one factor determining the success of usage of assistive technology.

Teachers of special education schools for hearing impaired need to be empowered with provision of assistive technology so that they evolve various ways of effective teaching. Teacher’s skill and training are the important components of the whole educational process, which can be effectively be used for improving the educational status.. Teachers’ must be aware of the technological inventions and changes happening around the world.. She/he should accept the new technological inventions and related sources in his/her professional life.

It is important that the teacher should be aware of certain strategies of use of assistive technology and is particularly important if the student is using an interpreter, lip-reading, relying on visual clues or using a hearing aid which has a limited range.

The right type of teacher with right type of awareness does better to contribute to the academic achievement for hearing impaired. It is important that the teachers require specific abilities and deep awareness about the AT and
use different types of AT for hearing impaired. The multidimensional roles to be played by the teachers warrant wide awareness about AT. It helps the teacher to be a successful teacher in dealing with education of children with HI. To handle children with HI teacher should possess some specific competencies other than the competencies possessed by a normal teacher.

Teachers awareness of AT, their level of access and success with the AT use, the level of expertise and training of the teachers regarding the technology use and application; student perception, training, acceptance, the curriculum adaptation and technology integration in the schools for hearing impaired are some of the major challenges and decisive factors in the efficient use of AT in special schools.

Teachers must be skilled in the selection, utilization, and production of instructional materials coherent with the assistive technology adopted. The use of assistive technology to enhance learning has proved to be an effective approach for hearing impaired children.

5.2 NEED AND IMPORTANCE OF THE STUDY

Indian constitution has made provision for universal education up to the age of fourteen years. If we do not make provision for their education, their potentialities will remain undeveloped resulting in great wastage of human resources. Therefore, it is necessary to make separate arrangement for the education of exceptional children. The challenged children need equality of educational opportunity but challenged children experience problems of access to and success in educational institutions.

Assistive technology has proved to be a boon to millions of children with special needs and has helped educators and teachers to achieve aim of universalization of school education. Technology is an integral part of our lives in the 21st century. Today’s children are the first generation of the “digital age.” They are being raised in a society that is changing rapidly as a result of the
influx of new computer-based technologies that provide more pervasive and faster worldwide links to commerce, communication, and culture. Many schools have implemented technology that improves access to all students and especially specially abled children with special education needs, assistive technology can have impacts that are far reaching and have the potential to yield enormous benefits. The aim of the assistive technology service is to ensure that the right students have the right technology at the right time to remove barriers to learning and raise achievement.

Teacher can use assistive technology to motivate and instruct students while increasing their own classroom productivity. Within each main category of assistive technology there are subcategories based on different purposes or intended audiences when utilizing the technology. This technology provides the hearing impaired with enhance accessibility to education. At times these assistive technologies may be used simultaneously.

Awareness of this assistive technology for hearing impaired can enable teachers to open their eyes more to the ways of helping them. Teacher’s Awareness of Assistive Technology is effective in enhancing of students skill, attitude and developing of interest in education.

Nowadays numerous assistive technologies are available for HI students, usage of these assistive technologies depends upon teachers awareness of AT so teachers play a vital role the education of HI. The investigator felt that it is necessary to find out teachers awareness of AT and its relation to academic achievement.

The review of related literature has revealed that there are no studies in educational setting which study the influence of Availability in relation to Usage of Assistive Technology and Teacher’s Awareness of Assistive Technology its relation to Academic Achievement of Hearing Impaired students. Hence this investigation is a modest venture in this direction.
5.3 REVIEW OF RELATED LITERATURE

This research study is based on all of the relevant thinking and research that has preceded it, and hence contributes to thinking and research in the field.

A detailed review has been presented under the following headings in four sections namely:

- Studies related to special education of Hearing Impaired.
- Studies related to Educational Facility and Availability and Usage of Technology in Special school.
- Studies related to Academic Achievement of Students with Hearing Impairment.
- Studies related to Teacher’s Awareness of Assistive Technology

An overview of related studies is presented in table.

Table showing an overview of the related studies reviewed with respect to the variables.

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<th>Sections</th>
<th>Variables</th>
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<td>3.2</td>
<td>Studies related to Educational Facilities and Availability and Usage of Technology in Special Schools</td>
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| 3.4 | Studies related to Teacher’s Awareness of Assistive Technology and Educational Technology. | Golani T. P (1982); Lesar Sharon (1998); Nancy J. Maushak et. al., (2000); Anderson L Cindy (2001); Michaels A. Craig et. al., (2001); Michaels A. Craig and McDermott (2003); Ashton M. Tamarah (2004); National Center for |
The review of related literature reveals that researches have been conducted on developing instructional strategy for the impaired and studying its effectiveness. Review of research indicates that AT has had a positive impact on students’ learning (Kober, 1991); Sivin –Kachala and Bialo, 1993). Studies also reveal that it is how teachers adapt and utilize the technology that makes a difference and not the technology itself. The effect of AT on student with disabilities were positive, reaching the potential requires knowledge on the part of the user (Merbler, Azar and Ulman, 1998). As demonstrated in this review, more people use AT to compensate for mobility than any other type of impairment. Other AT in wide use are hearing aids and back braces.

Studies have also been conducted on the Availability and Usage of Technology in schools for special children. The review of the literature indicated paucity of research effort to link these variables with the education of the hearing impaired children in the Indian context. The studies point to special needs but do not specify for classroom practice.

A bulk of studies reviewed in the earlier pages reveals that a few researchers have focused on the field of Assistive Technology as a major area for research. However, many of the studies were focusing on knowing the effectiveness of the newer AT and their application to the field of special education. The review reveals that there were no studies reported on the
Academic Achievement of Students in relation to Teacher’s Awareness of Assistive Technology, it’s Availability and Usage in Schools for Hearing Impaired Children. This is true in the case of India and other foreign countries as well. Thus, the present research is a humble attempt to fill the existing research gap.

5.4. STATEMENT OF PROBLEM

The statement of the problem is as follows

“Academic Achievement of Students in relation to Teacher’s Awareness of Assistive Technology, it’s Availability and Usage in Schools for Hearing Impaired”.

5.5 OBJECTIVES OF THE STUDY

The following are the objectives of the study:

1. To prepare a list of Assistive Technology available for hearing impaired students.

2. To assess the Availability of Assistive Technology in schools for hearing impaired.

3. To assess the Usage of Assistive Technology in schools for hearing impaired.

4. To assess the level of teachers awareness of assistive technology.

5. To assess the level of academic achievement of hearing impaired students.

6. To compare the Availability of Assistive Technology in hearing impaired schools belonging to the following categories

(i) Government, Private–aided, Private–unaided, Schools Managed by NGOs
(ii) Rural and Urban

7. To compare the usage of Assistive Technology in hearing impaired schools belonging to the following categories

   (i) Government, Private–aided, Private–unaided and Schools Managed by NGOs

   (ii) Rural and Urban

8. To study whether there is a significant difference in Teachers’ Awareness of Assistive Technology with respect to the following categories

   (i) Male and Female

   (ii) Government, Private–aided, Private–unaided and Schools Managed by NGOs

   (iii) Rural and Urban

9. To study whether there is a significant difference in academic achievement of hearing impaired students with respect to the following categories.

   (i) Government, Private–aided, Private–unaided and Schools Managed by NGOs

   (ii) Rural and Urban

10. To study whether there is a significant relationship between Availability of Assistive Technology in hearing impaired schools and Academic Achievement of hearing impaired students.

11. To study whether there is a significant relationship between Availability of Assistive Technology in hearing impaired schools and Teachers’ Awareness.
12. To study whether there is a significant relationship between Teachers’ Awareness of Assistive Technology and Academic Achievement of hearing impaired student’s.

13. To study whether there is a significant relationship between Usage of Assistive Technology in hearing impaired schools and Academic Achievement of hearing impaired students.

14. To study whether there is a significant relationship between Usage of Assistive Technology in hearing impaired schools and Teachers awareness.

15. To study the problems faced by teachers and students of hearing impaired schools in adopting assistive technology.

5.6 HYPOTHESES OF THE STUDY

In pursuance of the objectives of the study the following null hypotheses are formulated:

1. There is no significant difference between following categories of schools for hearing impaired in Availability of Assistive Technology

   (i) Government, Private–aided, Private–unaided and Schools Managed by NGOs

   (ii) Rural and Urban

2. There is no significant difference between following categories in Usage of Assistive Technology in schools for hearing impaired

   (i) Government, Private–aided, Private–unaided and Schools Managed by NGOs

   (ii) Rural and Urban
3. There is no significant difference in Teacher’s Awareness of Assistive Technology among those belonging to the following categories

   (i) Male and female

   (ii) Government, Private–aided, Private–unaided and Schools Managed by NGOs

   (iii) Rural and Urban

4. There is no significant difference in Academic achievement of students belonging to the following categories

   (i) Government, Private–aided, Private–unaided and Schools Managed by NGOs

   (ii) Rural and Urban

5. There is no significant relationship between availability of Assistive Technology in hearing impaired schools and Academic Achievement of hearing impaired students.

6. There is no significant relationship between availability of Assistive Technology in hearing impaired schools and teachers awareness of assistive technology.

7. There is no significant relationship between teachers awareness of Assistive Technology in hearing impaired schools and Academic Achievement of hearing impaired students.

8. There is no significant relationship between usage of Assistive Technology in hearing impaired schools and Academic Achievement of hearing impaired students.

9. There is no significant relationship between teachers awareness of Assistive Technology in hearing impaired schools and teachers awareness.
5.7 VARIABLES OF THE STUDY
The following are the variables of the study:

Main variables:

- Availability of Assistive Technology in hearing impaired schools
- Usage of Assistive Technology in hearing impaired schools.
- Academic Achievement of hearing impaired students
- Teacher’s Awareness of Assistive Technology

Background variables

- Gender: Male and Female
- Type of schools: Government, Private–aided, Private–unaided and Schools Managed by NGOs
- Locality: Rural and Urban

5.8 OPERATIONAL DEFINITIONS OF THE KEY TERMS

Assistive Technology: The term assistive technology refers to any item of equipment that can be used to improve the functional capability of a pupil with special educational needs that is of direct educational benefit to them. Assistive Technology is any product or service to designed enable independence for the hearing impaired. It allows students to hear, to see, to access and participate in the environment they learn in. It is any object, piece of equipment or product system, whether acquired commercially off the shelf, modified or customized that is used to increase, maintain or improve functional capabilities of a child with hearing impairment.

In this study Assistive Technology devices are listed under four categories.

1) Hearing Technology: Hearing Technology refers to any device utilized for improving the level of sound available to a listener. Hearing technology
devices are further divided into two general subcategories viz., (a) assistive listening devices (ALD) and (b) personal amplification devices.

a) **Assistive Listening Device (ALD):** These devices typically are used to improve the signal-to-noise ratio in any given situation. In addition to increased volume, ALDs provide the listener with a direct connection to the sound source and help minimize the effects of background noise, distance and room acoustics. All ALDs utilize a transmitter that sends a person’s voice or other sound source to a receiver that distributes the sound evenly throughout a room or directly to an individual. Sound is transmitted in four primary ways: Frequency Modulation (FM); Infrared (light); Induction Loop (electromagnetic); or through a direct connection.

In the present study ALDs refer to FM, Infrared system, Induction loops and Audio loops.

b) **Personal Amplification Device:** These devices are designed to provide an individual with increased access to sound across all environments. They are chosen based on an individual’s preferences, degree and configuration of hearing loss, and special features. Devices in this category must be obtained and fitted through an audiologist. Personal amplification devices include Behind-The-Ear Hearing Aid, In-The-Ear-Hearing Aid, In–The–Canal Hearing Aid, Completely In-Canal Hearing Aid, Pocket model of Hearing Aid, Bracelet type of Hearing Aid and Watch- What-You-Say-Revolutionary Visual Hearing Aid.

2) **Alerting Devices:** Alerting devices allow individuals who are hard of hearing or deaf to be aware of many environmental sounds and situations in the school. Such devices make use of visual, audible or vibrating signals to alert them. Alerting devices include Alarm clock, Door Bell, Smoke Alerting Devices, Light Alerting Devices and Vibration Alerting Devices.
3) **Communication Supports:** Hearing impaired children need communication supports because they need assistance with understanding, expressing themselves or interacting with others. These give the hearing impaired the chance to express themselves in a way which suits them. Communication supports include Telecommunication devices, Person to Person devices and Assistive Devices that could be used for group activities.

a) **Telecommunication devices:** Special devices that help the deaf and hard of hearing to make and receive phone calls are called Telecommunication Devices. This device is connected to a telephone line with a modem allowing it to transmit and receive information over a telephone network. Telecommunicating devices include Cell Phone, Captioned Telephone and Video Phone.

b) **Person to Person Communication Devices:** These devices give the deaf or hard of hearing options to communicate directly with a hearing person. Their number has exploded with the increased use of cell phones with text capabilities, computers with internet service and overall public awareness. Person to Person Communication Devices include Ubi Due Face to Face Communicator as Person to Person.

c) **Assistive Devices for Group Activities:** Communicating and accessing information within group environments such as lectures, discussions, programs and community events can be especially challenging for deaf or hard of hearing individuals. Devices like Note taking devices help the hard of hearing to take notes in a group learning environment when the teacher presents the information through group transaction approaches.

d) **Note taking Devices:** Often deaf or hard of hearing individuals find it difficult to watch the speaker or interpreter and take notes at the same time. Each time they look to their paper, they miss the information that continues to be presented. There are several options for assisting with note taking and they include Photo Copies, Computer Assisted Note
Taking and Handwriting Recognition Devices in hearing impaired schools.

(4) Voice to Text/Sign Software: There are several available software products that utilize voice recognition software to convert voice to printed text or computer-generated sign language. These devices are seeing increased use for a variety of situations. The speaker needs to work with the specific device to train it to recognize their voice. Some allow only one user, but others are beginning to recognize multiple speakers. They include Caption Mic TM, iCommunicator and Video Remote Interpreter.

(a) **Real Time Captioning:** Real time captioning provides a typewritten account of all verbal information presented within a lecture, meeting, discussion or presentation. This requires the skills of a trained captionist and specialized software or equipment such as a computer. They typically vary based on the amount of information represented within the visual display of information ranging from summaries to word for word transcription. It includes Communication Access Real Time Captioning (CART), C-Print, Remote Captioning and Subtitling.

ii) **Availability of Assistive Technology:** A range of technological solutions could be used to support student performance, achievement and independence in the following areas: academics, learning aids, aids to daily living, leisure and recreation. In the present study availability of assistive technology refers to the presence of the devices which help the hearing impaired in hearing, alerting, noting and comprehending and interacting with others in the hearing impaired schools.

In the present study availability of assistive technology is represented by scores on checklist on Availability of Assistive Technology for Head of the Institutions and Teachers constructed by the researcher. Hearing impaired schools are categorized on this variable as schools with high and low availability of Assistive Technology.
**High:** High Availability of Assistive Technology indicates those schools which obtain a mean score higher than M+1SD on Availability of Assistive Technology scale.

**Moderate:** Moderate Availability of Assistive Technology indicates those schools which obtain a mean score between M+1.SD and M-1S.D on Availability of Assistive Technology scale.

**Low:** Low Availability of Assistive Technology indicates those schools which obtain a mean score less than M-1S.D on Availability of Assistive Technology scale.

**Usage of Assistive Technology:** Assistive technology in hearing impaired schools becomes meaningful only when teachers use and allow children to use AT to collaborate with each other to create and communicate and in the process learn. The usage of AT could enhance learning effectively for hearing impaired children. In the present study usage of assistive technology is represented by scores on rating scale for Usage of Assistive Technology for Head of the Institutions and Teachers constructed by the researcher. Hearing impaired schools are categorized on this variable as schools with high and low usage of Assistive Technology.

**Teacher’s Awareness of Assistive Technology:** Teacher’s awareness of AT refers to the awareness of teachers with reference to the use and integration of assistive technological devices into everyday teaching of the curriculum and being conscious of their use by hearing impaired students.

**Hearing Impaired Students:** Hearing impairment is an impairment in hearing, whether permanent or fluctuating, that adversely affects a child’s educational performance. Children with hearing impairment will include children in the category of minimal, mild, moderate, severe and profound impairment. Such students who are learning in the schools for hearing impaired are considered as hearing impaired students in the present study.

**Hearing Impaired Schools:** Hearing impaired schools are Special schools which meet the needs of children with special needs with reference to
hearing impairment. They are special in terms of their infrastructure facilities, method of teaching, method of communication and have trained teachers who are competent to deal with hearing impaired children. These schools are special educational institutions which provide education from pre-elementary to secondary education to hearing impaired children. These schools require special materials, hearing aids, instruction in sign language, teaching techniques or equipments, technology and special facilities. In the present study, hearing impaired school refers to those schools run exclusively for children with hearing impairment.

**Types of School:** In this study the types of school refers to hearing impaired schools managed by Government, Private Aided, Private Unaided, and NGOs

(a) **Government Schools:** Hearing impaired schools managed and funded by Government of Karnataka are considered as Private-aided schools.

(b) **Private Aided Schools:** Hearing impaired schools managed by private, management and funded by Government of Karnataka are considered as Private-aided schools.

(c) **Private Unaided Schools:** Hearing impaired schools managed and funded by private institutes are considered as Private-unaided schools.

(d) **Schools managed by NGO:** Hearing impaired schools managed by Non Governmental Organizations and funded by philanthropists are considered as hearing impairment schools run by NGOs.

**Locality:** In the present study the place in which the schools are located was considered as the locality of the school and were categorized as urban and rural schools.

(a) **Urban Schools:** Hearing impaired schools which are geographically located in. Urban areas with a municipality, corporation or notified town area committee under Mysuru Division
with a minimum of 50,000 population were considered as urban schools.

(b) **Rural Schools:** Hearing impaired schools which are geographically located in rural parts of Mysuru Division with a population density of up to 5,000 where the panchayat takes all the decisions were considered as rural schools.

**Academic Achievement:** Academic achievement is successful accomplishment especially by means of exertion, skill, practice or perseverance, in relation to the prescribed syllabus of Government of Karnataka. In this study *academic achievement refers to a hearing impaired student's success in meeting the objectives of school education and* it refers to a hearing impaired student's performance in the academic subjects.

In this study the results of the previous annual examination was considered and the total score of a student in all the subjects was considered as the measure of his/her Academic Achievement.

(a) **Above Average Achiever:** Students are categorized as Above Average Achievers if they obtain a mean academic achievement score higher than M+1SD on previous annual examination.

(b) **Average Achiever:** Students are categorized as Average Achievers if they obtain a mean academic achievement score between M+1S.D and M-1S.D on previous annual examination.

(c) **Below Average Achiever:** Students are categorized as low achievers if they obtain a mean academic achievement score less than M-1S.D on previous annual examination.
5.9 METHOD OF STUDY

This study is a descriptive survey. The researcher personally visited the hearing impaired schools and informed about the purpose of this research study. The two tools were administered to the selected sample of teachers and heads of the institutions. They were instructed to fill in the two tools and necessary clarifications were made. Sufficient time was given to them to respond to the two tools. The scores of the hearing impaired students examination in the annual examination was also collected by the researcher.

5.10 SAMPLE

Eight districts viz; Mysore, Chamarajnagar, Chikkamagalur, Dakshina Kannada, Hassan, Kodagu, Mandya, and Udupi belong to Mysore division. Teachers, Head of the institutions and students of the twelve hearing impaired schools from these eight districts formed the population of the study. 113 teachers were working in Government, Private–aided, Private–unaided and Schools Managed by NGOs for hearing impaired from Mysuru division. There were six teachers working in one Government school, fifty eight teachers working in six Private–aided schools, thirty nine teachers working in four Private–schools and ten teachers working in Schools Managed by NGOs in Mysuru division. In total all the 113 teachers, and 864 students from four urban and eight rural schools formed the sample for the study.

5.11 TOOLS USED FOR COLLECTION OF DATA

Table showing tools used for collection of data with respect to the variables of the study.

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<th>Variables</th>
<th>Tool used</th>
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<tr>
<td>Availability and Usage of Assistive Technology</td>
<td>Check list of Availability of Assistive Technology and Rating Scale for Usage of Assistive Technology.</td>
<td>Investigator</td>
</tr>
<tr>
<td>Teacher’s Awareness of Assistive Technology</td>
<td>Test for Teacher’s Awareness of Assistive Technology.</td>
<td>Investigator</td>
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5.12. STATISTICAL TECHNIQUES USED TO ANALYZE THE DATA

To analyze the collected data SPSS package version 20.0 was used and all the hypotheses were tested at 0.05 and 0.01 levels of significance. For the analyses of the data following statistical techniques were used:

♦ **Descriptive Statistics:** Mean, Standard Deviation and Percentage Analysis were employed to study the level of Availability of Assistive Technology, Usage of Assistive Technology, Teacher’s Awareness of Assistive Technology and Academic Achievement of hearing impaired children.

♦ **Inferential statistics:**
  ◇ *t* test: *t* test of significance for difference between Means used to study the difference between various categories of Teacher’s Awareness of Assistive Technology in total, with respect to their components and also of different categories namely type of school, locality and gender of hearing impaired school teachers.
  ◇ ANOVA:
  ◇ Post-Hoc Mean difference test:
  ◇ **Chi Square:** was used to find the significance for difference between means among Availability and Usage of Assistive technology of different categories namely type of school, and locality of hearing impaired schools.
  ◇ **Tetra-choric correlation:** was used to find the whether significant relationship existed between Academic Achievement of hearing impaired children, Availability of Assistive technology and Usage of Assistive Technology, and Teacher’s Awareness of assistive technology.
5.13 LIMITATIONS OF THE STUDY

The limitation of the study is:

- Check list of Availability of Assistive Technology and Rating Scale of Usage of Assistive Technology and Test for Teacher’s Awareness of Assistive Technology was constructed by the investigator for this study and only reliability and validity was established.

5.14 MAJOR FINDINGS OF THE STUDY

- Majorities (58.33%) have low availability of assistive technology and 41.67% of the hearing impaired schools have high availability of assistive technology.
- Hearing impaired schools run by the government do not possess majority of the assistive technological device for hearing impaired. Majority of the assistive technological devices are available in hearing impaired schools managed by NGOs. Private aided hearing impaired schools possess most of the assistive technological devices. Few assistive technological devices were found to be available in private unaided hearing impaired schools.
- It is found that the government hearing impaired schools does not possess any of the assistive listening devices whereas; schools managed by NGOs possess all the assistive listening devices. 100% of the unaided schools possess frequency modulated system and induction loops. 64.1% of unaided schools are found to possess infrared system and also audio loops. 67.24% and 87.92% of the aided schools are found to possess infrared systems and induction loops respectively.
- 100% of the schools possess personal amplification devices irrespective of the type of schools. However, schools managed by NGOs and private aided schools were found to possess variety of personal amplification
devices. Schools managed by NGOs possess only door bell with amplified sound, all the private unaided school were found to possess door bell with amplified sound, smoke, light, alerting devices. Only 58% of the private aided schools possessed smoke alerting devices. Both Light and vibration alerting devices were available in 37.93% of the private aided schools.

- Cell Phone and subtitle visual screens were available in all the government, private unaided and NGOs managed schools. Caption telephone and video phones were not available in government schools. Video phone was available in all the private unaided and NGOs managed schools. Captioned telephone was available 31% of the private aided schools and 69.2% of private unaided schools. 79% of the private aided schools possessed cell phone and 43.1% of them were found to possess video phones.

- 100% of the government, private unaided and NGO managed schools were found to possessed Ubi-Due Face to Face Communicator and 79% of the private aided schools were found to possessed this device.

- 100% of government and NGO managed schools were found to possessed computer assisted note taking and digital pens for hand writing recognitions. All the schools irrespective of their types possessed interactive white boards. Computer assisted note taking devices and digital pens for hand writing recognitions were available in 64% of the private unaided schools and 87.9% of the private aided schools.

- 100% of the schools were found to possess atleast one of the voice to text software. Real time captioning was not available in government and private unaided schools, whereas, CART, C print and remote captioning were available 58.6% of private aided schools. Only CART were available in NGO managed schools.

- Rural schools were found to possess more number of devices for hearing technology than urban hearing impaired schools. Urban schools were
found to possess more number of Alerting and communication devices of assistive technology than rural hearing impaired schools.

- Frequency modulated systems were found in all the rural schools, 83.3% of the urban schools were found to possess frequency modulated systems, infrared systems and induction loops. Only 50% of the urban school were found to possess infrared systems. Infrared systems, induction loops and audio loops were available majority of the rural schools.

- All the schools possess personal amplification devices irrespective of the locality.

- Ubi-Due Face to Face Communicator was available in all the rural schools and 66.6% of the urban schools.

- Smoke, light and vibration alerting devices were available at only 20.7% of the rural schools and light and vibration alerting devices were available at 16.6% of urban schools. 50% of the urban schools were found to possess smoke alerting devices. Door bell with amplified sound were available in all the urban schools and 93.5% of the rural schools.

- Subtitle visual screens were available in all the urban and rural schools. Cell phones were available in 66.6% of urban schools and 100% of the rural schools. Caption telephone and video phone were available at 50% of the urban schools and 35.06% and 72.7% of the rural schools respectively.

- Computer assisted note taking, digital pen and interactive white boards were available in all urban schools. Digital pen as a hand writing recognition device were available in 59.7% of the rural schools. Interactive white boards were available in all the rural schools. 75.3% , 20.7% and 33.7% of the rural schools possessed Caption Mic TM, iCommunicator and Video Remote Interpreter respectively. 33.3% of the urban schools possessed all the three types of device text software.

- 50% of the urban schools possessed CART, C print and remote captioning. 36.6% of the rural schools possessed C print and 20.7% of
them possessed CART and remote captioning.

- Majority (58.33%) have high usage of assistive technology and 41.67% of the hearing impaired schools have low usage of assistive technology.
- Low usage of assistive technology was found in government hearing impaired schools. Usage of assistive technological devices was reported to be higher in private aided and private unaided hearing impaired schools.
- Majority of the private aided (79.3%), private unaided (64.1%) and 100% of the schools managed by the NGOs reported to have used frequency modulated systems very frequently and a very few of them have reported to be using it sometimes. Majority of the private aided (31%) and NGOs managed schools (100%) reported to have been using infrared systems sometimes.
- Majority of the schools irrespective of the types were found to make use of personal amplification devices and any one type of the alerting devices always.
- All the government, private unaided schools reported to have been using subtitle visual screen sometimes. Government and NGO managed schools have reported using cell phones very frequently.
- All the government schools and majority of the private aided, private unaided and NGO managed schools have reported to have been using Ubi-Due Face to Face Communicator very frequently.
- All the government schools have been using computer assisted note taking and digital pens very frequently. All the schools irrespective of the types have been frequently using interactive white boards. Majority of the private unaided schools (46.1%) have reported to have been using note taking devices sometimes.
- All the government and NGO managed schools have been using Caption Mic TM and Video remote interpreter always and the government schools have reported using i-communicator sometimes. Majority of the
private unaided (61.5%) and private aided (48.2%) of the schools have reported to have been using caption Mic TM very frequently.

- 48% of the private aided schools have reported to have been using C print and remote captioning very rarely.
- 50% and 33.3% of the urban schools have reported to be using all the assisting listening devices very frequently and sometime frequently. 81.8% and 51.9% of the rural schools are found to use frequency modulated systems and audio loops very frequently. Whereas, 49% and 59% of them have reported using infrared systems and induction loops sometimes.
- All urban and rural schools have reported to be using personal amplification devices very frequently.
- All the urban schools used alerting devices very frequently and majority of the rural schools used.
- Telecommunication devices are being used sometimes in both urban and rural schools. Video phones are rarely used in urban schools. Majority of the rural and urban school are found to use Ubi-Due Face to Face Communicator very frequently.
- 44.1% of the rural schools have reported to have been using digital pens and assistive note taking devices sometimes. 66.6% of the urban schools have been using note taking devices very frequently. All the urban schools and majority (87.1%) of the rural schools have been using interactive white boards very frequently.
- 16.6% of the urban schools and 67.5% of the rural schools are found to use caption MIC TM very frequently. 53.3% of urban and 20.8% of rural schools use i communicator sometimes. 50% of the urban 33.7% of the rural schools have reported using video remote interpreter rarely.
- Majority of the urban and rural schools have reported to be using C print and remote captioning rarely but majority of urban and rural schools have been using CART sometimes.
- Majority of hearing impaired school teachers have moderate level of
awareness of assistive technology (67.26%). Merely 19.47% of hearing impaired school teachers have high awareness of assistive technology. 13.27% of hearing impaired school teachers are found to have low awareness of assistive technology.

- Majority of hearing impaired students have average level of academic achievement (67.36%). Merely 16% of hearing impaired students have above average level of academic achievement. 16.55% of hearing impaired students are found to have below average level of academic achievement.

- There is no significant difference among government, private aided, private unaided and hearing impaired schools managed by NGOs with respect to availability of assistive technology.

- There is no significant difference between urban and rural hearing impaired schools with respect to availability of assistive technology.

- There is no significant difference among government, private aided, private unaided and hearing impaired schools managed by NGOs with respect to usage of assistive technology.

- There is no significant difference between urban and rural hearing impaired schools with respect to usage of assistive technology.

- There is no significant difference in awareness of assistive technology of male and female teachers.

- There is a significant difference in awareness of assistive technology among teachers belonging to government, private aided, private unaided and hearing impaired schools managed by NGOs.

- There is a significant difference in awareness of assistive technology among teachers belonging to government and private aided hearing impaired schools. Awareness of assistive technology among teachers belonging to government hearing impaired schools is found to be higher than that of their counterparts belonging to private aided hearing impaired schools.
There is a significant difference in awareness of assistive technology among teachers belonging to government and private unaided hearing impaired schools. Awareness of assistive technology among teachers belonging to government hearing impaired schools is found to be higher than that of their counterparts belonging to private unaided hearing impaired schools.

There is a significant difference in awareness of assistive technology among teachers belonging to government and hearing impaired schools managed by NGOs. Awareness of assistive technology among teachers belonging to government hearing impaired schools is found to be higher than that of their counterparts belonging to hearing impaired schools managed by NGOs.

There is a significant difference in awareness of assistive technology among teachers belonging to private aided and private unaided hearing impaired schools. Awareness of assistive technology among teachers belonging to private aided hearing impaired schools is found to be higher than that of their counterparts belonging to private unaided hearing impaired schools.

There is a significant difference in awareness of assistive technology among teachers belonging to private aided and hearing impaired schools managed by NGOs. Awareness of assistive technology among teachers belonging to private aided hearing impaired schools is found to be higher than that of their counterparts belonging to hearing impaired schools managed by NGOs.

There is no significant difference in awareness of assistive technology among teachers belonging to private unaided and hearing impaired schools managed by NGOs.

There is no significant difference in awareness of assistive technology among teachers belonging to urban and rural hearing impaired schools.

There is a significant difference in academic achievement hearing impaired students belonging to government, private aided, private...
unaided and hearing impaired schools managed by NGOs.

- There is a significant difference in academic achievement of hearing impaired students belonging to government and private aided schools. Hearing impaired students belonging to private aided schools have higher academic achievement when compared to their counterparts belonging to government hearing impaired schools.

- There is a significant difference in academic achievement of hearing impaired students belonging to government and private unaided schools. Hearing impaired students belonging to private unaided schools have higher academic achievement when compared to their counterparts belonging to government hearing impaired schools.

- There is no significant difference in academic achievement of hearing impaired students belonging to government and hearing impaired schools managed by NGOs.

- There is a significant difference in academic achievement of hearing impaired students belonging to private aided and private unaided schools. Hearing impaired students belonging to private unaided schools have higher academic achievement when compared to their counterparts belonging to private aided hearing impaired schools.

- There is a significant difference in academic achievement of hearing impaired students belonging to private aided and hearing impaired schools managed by NGOs. Hearing impaired students belonging to private aided schools have higher academic achievement when compared to their counterparts belonging to hearing impaired schools managed by NGOs.

- There is a significant difference in academic achievement of hearing impaired students belonging to private unaided and hearing impaired schools managed by NGOs. Hearing impaired students belonging to private unaided schools have higher academic achievement when compared to their counterparts belonging to hearing impaired schools managed by NGOs.
There is a significant difference in academic achievement of students belonging to urban and rural hearing impaired schools. Since, the mean value of students of rural hearing impaired schools (288.35) is greater than that of the mean value of students of urban hearing impaired schools (278.76), it is concluded that students from rural background have high academic achievement when compared to their urban counterparts.

Positive and high correlation exists between availability of assistive technology in hearing impaired schools and academic achievement of hearing impaired students.

Positive and high correlation exists between availability of assistive technology in hearing impaired schools and Teachers’ Awareness of assistive technology.

Positive and high correlation exists between Teachers’ Awareness of assistive technology and Academic achievement of hearing impaired students.

Positive and high correlation exists between usage of assistive technology in hearing impaired schools and academic achievement of hearing impaired students.

Positive but moderate correlation exists between usage of assistive technology in hearing impaired schools and Teachers’ Awareness of assistive technology.

46.90 % of teachers of hearing impaired schools reported to have facing problems in adopting assistive technology for hearing impaired whereas the rest of the 53.09 % of teachers did not report any problems in adopting assistive technology. 27.43% of teachers of hearing impaired schools reported students facing problems with Behind the Ear Hearing aid. 23.89% of teachers of hearing impaired schools reported students facing problems with Body worn hearing aid, 7.97% of teachers of hearing impaired schools reported students facing problems with Frequency Modulated System. 19.4% of teachers reported that students
complain of Head ache due to continuous wear of the hearing aid. 61.94 of teachers were facing interference due to the Battery draining off during its use during class hours. 1.76% of teachers reported that students complain of broken wires during the lessons. 7.97% of teachers reported that students complain of pain in the ear. 9.73% of teachers reported that they face problems due to reduced volume of the hearing aid and that this may have not come to the knowledge of the teachers. 2.65% of teachers reported that the students complain of irritation in the ear because of long use of the aid. 7.96% of teachers reported problems in using devices of AT due to frequent power failure.

5.15 EDUCATIONAL IMPLICATIONS

- In the present study, it is found that the majority of teachers’ awareness of assistive technology is of average level. Hence there is a need to organize assistive technology awareness programs for bringing the expected level of awareness on assistive technology among all the teachers of hearing impaired schools.

- Teachers’ awareness of assistive technology is found to be lower among those belonging to Private aided and unaided teachers and teachers in NGO managed schools for hearing impaired. Awareness of assistive technology can be enhanced through inservice training, booklets, and talks by technology experts. In this regard the existing institutions for hearing impaired at national, state, regional and district levels, Department of special Education have to assume a significant role in bringing awareness of assistive technology and inculcating positive attitude towards use of assistive technology among teachers of hearing impaired schools.

- Government teachers were found to have higher awareness in assistive technology but the availability and usage were found to be lower than. This is because they given adequate training. Hence more devices of assistive technology need to be provided to Government schools so that
the Government school hearing impaired students would benefit from the assistive technology.

- Today’s technological world is presenting the hearing impaired world with new and better devices which can be beneficial to them. Teachers need resources and personnel to guide them through the ever changing AT support services are important for both educator and student. Teachers and Students needed to be provided with continuous support to ensure that they are gaining maximal benefit from appropriate new assistive technological resources in their learning environments.

- Since highly positive correlation was found to exist between teachers’ awareness of assistive technology and academic achievement of hearing impaired students, Universities should also take necessary steps to incorporate a special core paper of ‘Assistive technology for children with hearing impaired’ in the curriculum at all levels of pre-service teacher education programs to equip the future teachers with the required skills to deal with the students of hearing impaired. Pre-service teacher training programs should include knowledge and skill development in assistive technology in its curriculum. Internship program should also concentrate on providing student trainees with opportunities for use of assistive technology by organizing practice teaching lessons at hearing impaired schools using assistive technology

- Professional development opportunities must be provided through partnerships among CTEs, University Departments of Education, NGOs, AT vendors and AT service providers to ensure that professionals stay abreast of emerging technology and have the opportunity to become proficient in the use of assistive technology that they will be using while teaching and communicating with hearing impaired students.

- Field trips to national level organizations providing education to hearing impaired students like Ali Yavar Jung National Institute for the Hearing Handicapped, Mumbai and All India Institute of Speech and Hearing, Mysuru could be organized so that the student trainees get adequate
exposure to assistive technology.

- Integration of assistive technology into lessons should be ensured in a purposeful in meaningful way. The necessary training and technical support should be provided to classroom teachers. Considering the initial fiscal and human resources as an investment professionals should avoid reinventing the wheel each year, preferring technology that is already in place whenever possible.

- The low self-concept, social-personal adjustment of the hearing impaired children may affect their learning outcomes in a negative way. Use of assistive technology can help them to feel more normal. Hence developing instructional strategies which can incorporate the use of assistive technology for the hearing impaired may help in removing their sense of inferiority. Teachers may supervise the learning of these students by giving them adequate attention, support and consideration through ample opportunities to participate in curricular activities by adopting assistive technology. A program of action in these lines may create an environment where teachers will have adopt assistive technology in turn rendering opportunities for the hearing impaired students for better social adjustment.

- Schools for hearing impaired should seek to meet the needs of all students by identifying the assistive technology needs, address and constantly review the perceptions and evaluations of each of its pupils as individual human beings.

- Integration of hearing impaired students to bring to mainstream education would be possible if assistive technology is adopted in schools. This would also help in mainstreaming these students in the society in which they have to live and compete with people with normal hearing.

- Interaction of the teacher in the classroom is significant factor affecting student’s academic achievement and the content the student learns during class hours. Assistive technology enhances the opportunities for adoption of interactive teaching strategies to make learning enjoyable.
Retention of learning will be higher if other senses like vision is applied in learning. Hence Communication Access real Time Captioning, C-Print, and remote captioning technology should be provided to hearing impaired schools so that verbal information could be made comprehendible through a visual display during a lecture, discussion or presentation in a group environment.

Computer assisted Note taking devices, handwriting recognition devices like a digital pen should be made available and used by teachers in hearing impaired schools managed by Government, private aided managements.

It was found that highly positive correlation exists between availability of assistive technology and academic achievement of hearing impaired students and also with its usage. Sign language is the chief means of receiving information for a hearing impaired student. Assistive technological software that converts voice to printed text or computer generated sign language like Caption Mic, iCommunicator and Video Remote Interpreter are found to be very few in hearing impaired schools. Government and school managements should take steps to procure these softwares to the schools, train and encourage the teachers and students in using them.

5.16 SUGGESTIONS FOR FURTHER STUDY

The following are the suggestions for further study:

1. The present study could be extended to higher educational levels.
2. Impact of training programs, orientation programs and refresher courses on Teachers’ Awareness is fertile area of research.
3. The same type of study could be taken up with special schools for different type of impaired children such as visual impaired, mentally retarded.