CHAPTER I

INTRODUCTION

The present thesis is aimed to examine Language or Linguistic Skills and Reading Comprehension in children with cochlear implants (CIs) studying in regular schools. A cochlear implant is an assistive technical hearing machine that facilitates individuals with severe or profound hearing loss to recognize variety of sounds. Children and adults with intense hearing loss who cannot get advantage from conventional amplification devices and have key problem in the inner ear are the most suitable candidates for implantation. In India, as per the estimate, approximately 3000 individuals are implanted as compared to 30,000 adults and 30,000 children implanted in United States in the year 2009 (Jeyaraman, 2013). The use of cochlear implant does not reinstate normal hearing but facilitates different way of auditory perception. It enables a different course of development. Consequently, it is important to understand genuinely how this device is helping children with hearing loss to study alongside hearing children in regular schools as well as to know are there any other benefits and concerns about the device use. Therefore, the present study is focused on examining three aspects of Linguistic Skills: phonology, syntax and semantics, and Reading Comprehension in children with cochlear implants as compared to standard norms. It also aimed to study the relationship and influence of factors on Linguistic Skills and Reading Comprehension. The results from this study have the possibility to add to the literature on linguistic skills and Reading Comprehension in children with cochlear implants studying in regular schools in Indian context, which is still one of the new areas of enquiry and is in its infancy stage.
1.1 The outline of the thesis

This thesis is divided into five chapters. The first chapter is “Introduction” gives a brief overview of importance of sound in life, hearing loss, and classification of hearing loss, Linguistic skills, Reading Comprehension, educational opportunities, and critical factors involved, cochlear implant functioning and candidacy. The second chapter is “Review of Literature” with an overview of recent research on Linguistic skills, Reading Comprehension in children with cochlear implants, and the relative factors influencing. The third chapter is directed towards “Method” used in the study, while the fourth chapter details about the results and related discussion with relevant studies and the last fifth chapter deals with “Summary of the study, findings, conclusions, limitations, and suggestions for future research”.

1.2 Relevance of Sound in life

“Caitanyam sarva bhutanam shabda bramheti me matihi”

“Shabda (Sound) is an integral part of our life” is the meaning of the statement from Hindu scriptures. According to Dandi,a Sanskrit scholar, “If sound is removed from the world, then the world becomes dark”(Prasad, 2011). Sound carries information and is given utmost importance in day to day life and spiritual development by the sages of Sanatana Dharma. Acoustics, the modern scientific inquiry of sound, has also emphasized sound as it plays a significant role in all aspects of life sciences, arts, earth sciences, engineering etc. Sound is a form of energy which produces a sensation of hearing in our ears due to the vibrations produced by a source namely, musical instruments, animals, human voice, machines, etc. They are heard by us with the help of the ear in the general audio frequency range of 20 to 20,000 cycles per second (Prasad, 2011). They travel through a medium like solid, liquid or gas. It
cannot travel in vacuum and air is the most common medium through which sound travels.

Sense organs are the channels through which we hear sounds or receive information from the environment. Ear, one of the five sense organs receives information in the form of sound. It is stated that the basic structure for ear develops during the second week of the foetus development stage in the womb (Northern &Downs, 2014). Hearing is an essential sense for human beings due to the dependence for safety, communication, education and social interactions. The sound is collected by the outer ear “pinna”, and then it passes through the auditory canal, vibrates the tympanic membrane (ear drum) transmits into the middle ear wherein it gets converted into mechanical energy due to the vibrations of the three bones (malleus, incus, and stapes), and also gets amplified, then it moves to the inner ear or cochlear wherein the amplified mechanical energy gets converted into electrical energy. Then this electrical energy is sent to the brain through the auditory nerve, and the brain construes them as different sounds. Basically, sound is produced by vibrations from a source. In a similar way, human voice is produced by vibrations of the vocal cords when the lungs force air through the slit. The two vocal cords are stretched across the larynx (voice box) leaving a narrow slit between them for the passage of air. The larynx is located in the throat which is the at the upper end of the wind pipe. According to Prasad (2011), “An individual (soul) with a desire to speak encourages the mind. The mind strikes the heat (fire) centre at the navel, which then pushes the air (wind). The sound (Naada) energy then gradually moves up through stomach, heart, throat, mouth as audible sound”.
1.3 The Effect of hearing loss on development

Sound sensation and production are astonishing processes that happen in human beings through which he/she makes the meaning of the world. Suppose, if a person is unable to hear the sounds and is unable to produce sounds how different he/she would be. That type of condition where a person is unable to hear majority of the conversational sounds is termed as “Deafness” or “Hard of Hearing” or “Hearing loss” or “Hearing impairment”. According to the Persons with Disabilities Act 1995, “Hearing impairment refers to hearing loss of 60dB or above in the better ear in the conversational range of frequencies”. Deafness is a serious concern to be identified and remediated as early as possible as it interferes with language development. It directly affects the speech development due to lack of auditory feedback. Hence, it is often seen that hearing impairment is associated with problems of speech production. It has adverse effects on a child’s potential for language, literacy and educational development (Dominguez & Algeria, 2010; Ruggirello & Mayer, 2010). It leads to problems in social integration, vocational choices, and personal achievements. The other great detriment of hearing impairment is that it is an invisible handicap and therefore more difficult to identify early in life, particularly in children. According to Northern and Downs (2014), the “Incidental reception” of sounds is attributed to 90% of young children’s learning and thus hearing loss hinders the learning process. Hearing loss results in a tragic waste of human potential, particularly when parents, teachers, and other professionals have not been provided information that will assist them in serving their child (Hull & Dilka, 1984). Therefore, it is important to treat the hearing loss as early as possible to improve both ‘functional and psychological’ contributions to quality of life (Francis et al., 2002).
1.4 Classification of Hearing impairment

Depending on whether it occurs before, during or after speech and language development, hearing impairment can be classified as Pre Lingual Hearing Loss: It is the loss of hearing sensitivity existing at birth or infancy before speech and language patterns are acquired. In such condition, development of speech and language, voice and articulation are affected. As an adult the individual is likely to continue to have limitations. It is also called congenital deafness. Post Lingual Hearing Loss: It is the loss of hearing sensitivity after birth and the development of speech and language. Language may not diminish; however since reception of high frequency sounds are affected there will be slight change in voice and articulation. In addition to this, hearing loss classified according to the site of damage. There are four types of hearing losses. Conductive Hearing loss: When the transmission of sound through the external ear or middle ear is interfered by any condition, then it is called conductive hearing loss. Sensory Neural Hearing loss: Any damage in the inner ear i.e. in cochlear or in the auditory nerves. Mixed Hearing loss: When the transmission of sound is interfered by problem in the external ear, middle ear, and also inner ear, then that condition is called as mixed hearing loss. Furthermore, hearing loss can also be classified into seven types based on the severity of the loss in hearing capacities termed as degree of hearing loss (Keith, 1996)

1. -10 to 15dB (normal) – Hardly has any impact on communication
2. 16 to 25dB (slight) – In noisy environments, soft sounds are difficult to understand.
3. 26 to 40dB (mild hearing loss)- Even in quiet environments, distant speech is challenging to hear.
4. 41 to 55dB (moderate hearing loss) - Conversational speech can be heard only from nearby distance. Group activities are challenging.

5. 56 to 70dB (moderately-severe hearing loss) – Clear conversational speech can be heard only when it is loud and speech is evidently impaired.

6. 71 to 90dB (Severe hearing loss) – Cannot recognize many of the words in the conversational speech even when loud. Speech is not intelligible.

7. 91dB+ (Profound hearing loss) – Only hear very loud sounds and primary mode of communication would be through non-verbal mode. Speech is very difficult to understand.

Early identification and intervention with appropriate education can bring out the potentials in children with hearing loss and with the invention of advanced amplification devices myths such as hearing impairment is equal to short of intelligence and articulatory capacity are diminishing slowly.

### 1.5 Linguistic Skills

One of the most critical components for development is access to language and it is one key area related to school achievement. Human language, when scientifically studied is termed as “Linguistics”. According to Adrian et al (2010), “Linguistics can be broadly classified into three types: language form, language meaning, and language in context. Language form or structure or grammar focuses on rules of a language including morphology, syntax, and phonology. The second type is the study of language meaning includes semantics and pragmatics. And the third type is very broad in context in which how the language is manipulated by cultural, historical, and social factors is studied”. Linguistics has many sub-branches related to
specific aspects of linguistic structure. They are as follows: Phonology, the study of sounds; Morphology, the study of sounds to form word; Syntax, the study of combination of words to form sentences; Semantics, the study of combination of words meaningfully to form sentences; Pragmatics, the study of language use during different communication situations; and many others.

1.5.1 Linguistic Skills in children with hearing loss

Children with normal listening abilities build language naturally from the surroundings. But in case of a child with hearing impairment, as they are commonly cut off from their surroundings due to their inability to perceive sounds, language must be ‘taught’ to them. Delayed language development is displayed in deaf children compared to their hearing peers and is a very typical feature noticed in them. According to Quigley & Paul (1984), language impairment is the biggest stumbling block during the education process of deaf children as they tend to commit syntactic errors i.e., with exclusion of case and tense markers, conjunctions, and prepositions etc. They are not capable to write complex and compound sentences. According to Watson (2002), through the elementary school, in normal hearing children, language and literacy skills develop stage by stage and they are mutually-dependent.

1.6 Speech and Language development

Speech is the capacity to express thoughts and feelings by producing sounds that take the form of vowels and consonants using the articulators in the mouth i.e., the throat, tongue, jaws, teeth, and lips. The method of using words in a structured and conventional way to communicate, either in spoken or written form is termed as Language. It sets humans apart from all other living creatures in the world. Through speech, using language, we communicate and develop our social life. Without communication, our growth and development is stymied. A child with normal hearing
abilities develops language naturally from his environment and uses to express his needs and thoughts. Early language acquisition in normal hearing children seems to take place without many efforts naturally but still the initiatives have to be taken by the child and stimulation has to be provided by the caregivers and when it comes to children with hearing impairment, the initiatives to be taken by their caregivers in providing appropriate inputs is with many efforts and is even more important (Bakar, 2010). By the age of two to three years, a child with typical hearing develop their vowel sounds (Northern & Downs, 2014). According to Nielson and Monson (1996), “Ninety-five percent of a child’s native language is acquired through auditory channel, an average normal hearing child entering school at age five will have a receptive vocabulary of six to ten thousand words, by age four, typical hearing child will be using 90 percent of the grammatical concepts correctly, and through interaction with the family and immediate environment, vocabulary and grammatical concepts have been learned”. But hearing impairment, robs children of speech production, language development and educational levels which they may have otherwise gained.

1.6.1 Speech and Language development in children with hearing loss

It is clearly documented in the literature that hearing impairment impacts speech development in children. Typically, children with hearing loss produce shorter utterances, smaller lexicons, few words per minute, less bound morphemes in their speech, and have delayed vocabulary development as compared to hearing children of a similar age (Toe & Paatsch, 2013). Research highlights children with hearing impairment have severe speech and language impediments that can impact their communication, cognitive, self-esteem and social-emotional adjustment in children (Percy-Smith et al., 2008). Strong and positive associations found between auditory
capacity levels, speech production, language comprehension, and communicative skills in children with hearing impairment, (Percy-Smith, 2010). “Overhearing” or “Incidental learning” is also limited in children with hearing loss whereas two year old typical hearing children learn novel words through overhearing (Akhtar, Jipson, & Callanan, 2001). Children with hearing impairment miss out on rules of language formation, world knowledge, and vocabulary development as they have limited opportunities to overhear information (Carney & Moeller, 1998). Speech and language development difficulties in children with hearing loss also results in low performance in school and more behavioural problems as compared to their hearing peers (Eichwald & Gabbard, 2008).

1.7 Reading

Recognizing the importance of reading and writing in school life and for understanding the growing demands for high literacy rates, it is important to know what constitutes the reading skill. Reading and writing are Literacy skills. Reading precedes writing. Reading is more of understanding. It is a dynamic process of constructing meaning in the mind. According to Brown and Brewer (1996), “reading is a complex process involving active construction of meaning from text by using linguistic knowledge, decoding of letters and words and metacognition strategies”. According to Leipzig (2001), “Reading is building meaning from print by identifying the words in print. For this, children need to learn: alphabetic principles, phonemic awareness, decoding, word study, sight vocabulary for word recognition. Children need to develop: how the language works, oral and print vocabularies, background knowledge, various kinds of texts, various purposes for reading, strategies for constructing meaning for comprehension. Children need to have accuracy in word recognition and comprehension automatically for fluency to be developed”. Reading
Comprehension basically refers to an understanding of the information. The ultimate goal of reading is to comprehend and express. If Reading Comprehension to happen, decoding of written or printed words has to be done correctly, and an understanding of the message underlying the words and sentences is required (Wass, 2009). For augmentation of educational achievement and for involvement in the society, reading is tremendously important.

1.7.1 Reading development in children with hearing loss

To examine the Reading Comprehension in children with hearing loss appear to be predominantly important as learning to read is challenging for deaf children. Numerous factors contribute to reading difficulties in children with hearing loss, one of which is the spoken language reception limitation that curbs learning of language orally. As what is written in the text form consists of what is spoken orally to a great extent, hence reading is more difficult in children with hearing impairment. Through print for accessing academic information at a later stage, good Reading Comprehension ability is critical (Nikolaraizi, Vekiri & Easterbrooks, 2013). The development of reading abilities is influenced by hearing loss because one of the basic rudiments for reading i.e., phonological processing takes place in the auditory region of the brain (Werker & Tees, 2005). Between phonological processing and reading skills, neural imaging has revealed a strong relationship (Gabrielli, 2009; Strickland & Shanahan, 2004). A key to success in an educated society is by accomplishing practical literacy. Previous year’s research conducted reveal that deaf children find literacy a challenge and in reading attain considerably lower than hearing peers (Dominguex & Algeria, 2010; Harris & Terlektsi, 2011; Park, Lombardino & Ritter, 2013; Parault & Williams, 2010). The task of reading with an imperfect verbal language approached by the deaf child augment the difficulty of the task because
reading is a speech based system (Geers, 2003). If children are to understand the variety of books, they need to have a large and rich vocabulary and children with hearing loss tend to have small vocabularies (Williams, 2012). A substantial amount of research related to reading and children with hearing impairment suggests that in early literacy skills, they progress on same level with hearing children but at soon after literacy development stages, several do not make the progress (Morere, 2012). It is found that the gap between hearing peers and deaf children have a tendency to expand with age and so problems become more obvious as children progress through school (Harris & Terlektsi, 2011). Deaf children have complications at more multifaceted reading levels. The cochlear implant device is reported to provide benefit of auditory perception and speech production (Phillips et al., 2009) as it enables to achieve two key components of literacy development: knowledge of spoken language and phonological awareness. In deaf children, cochlear implantation is anticipated to boost Reading Comprehension (Kant et al., 2010).

1.8 Academic Achievement

Academic Achievement refers to person’s level of skill, range of information and what he has accomplished in designated areas of learning and behaviour. Children spend most of their waking hours in school around an age of four years. In school much emphasis is placed on learning to use language, on learning to read and write, and in using language to gain knowledge. In fact, learning in school involves the transmission of meaning through language. The experiences in school challenge children to use their language abilities to comprehend, recall, remember, and to express information. Catts and Kamhi (1986) report that the language difficulties associated with school age children affect not only their social use of language, but also their academic performance. Children with hearing impairment are reportedly
performing below academically than their hearing peers of similar ability levels. Hull and Dilka (1984) observed that hearing loss that remains undetected even during the first years of life can cause dramatic alterations in a child’s potential for language and educational development. Their impaired language development may affect their ability to comprehend written materials, test questions, ability to speak, write and the ability to grasp abstract concepts in the learning environment. Ultimately, the presence of hearing impairment makes performance on even mundane academic tasks difficult and complex for any child (Rogers & Clarke, 1980). When the child with hearing impairment has to learn and perform on abstract academic concepts and skills, problem is more. It is reported that on an average, high school deaf student’s academic achievement and language levels are below compared to average fourth-grade normal hearing students, and also in reading scores they perform at the fifth-grade level which is very low (Ching et al., 2014).

1.9 Hearing in children with hearing loss

When a child is diagnosed with hearing loss, he is fitted with an appropriate amplification device like body level hearing aids, behind the ear hearing aids (BTE’s) or cochlear implant etc. Technological advancement has led to invention of cochlear implant as a boon to many children with hearing loss. But whether the child should be fitted with a cochlear implant (CI) or not is usually decided by cochlear implant teams based on child’s medical reports, observation reports in clinics, evaluation of hearing on a regular basis and communication development of the child after attending regular speech and language therapy as well as listening training. If a child is identified at an early age and has profound loss with inner ear problem, he may be implanted as it is a better option as compared to hearing aids. The acquisition of language and communication skills in individuals with deafness which is pre-lingual through
cochlear implant (CI) confers greater benefits compared to conservative hearing aids (Bittencourt et al, 2012). The decision regarding a child can be implanted or not depends on many factors. And also it varies from one child to another child. Generally, at the functional level, children with inner ear damage are considered for cochlear implantation. For cochlear implant to be effective, cause of hearing loss is to be cited in the inner ear (Socialstyrelsen, 2009).

1.10 Hearing with cochlear implants (CI)

A cochlear implant is an advanced amplification device. It consists of two main parts: an external part and an internal part. A speech processor which is an external part has a microphone which selects the sound and transforms the same sounds into electrical signals. These signals move to the receiver which is implanted and then they are transmitted to the cochlear wherein the electrode array is situated. The active electrode in the array stimulates the auditory nerve cells and then they are transmitted to the brain. Perception of sounds and related interpretation is done in the brain (Arlinger, 2007).

Source: Google images retrieved on 12.02.2013

The listening from a cochlear implant of a child is not the same as normal listening. One strong reason being cochlear implant is a device. These signals from the cochlear implant do not possess the similar fine acoustic signals as the speech-
signal in normal hearing. Thereby, a degraded signal is received by the brain affecting speech sounds and the development of spoken words symbols in the long-term memory (Harnsberger et al., 2001; Pisoni et al., 2008). To facilitate spoken language development is the primary goal of paediatric cochlear implantation (Yanbay et al., 2014). Early exposure to word-learning opportunities is severely restricted in persons with profound hearing loss. But the experience is reflected as different in most of the children with cochlear implants. It is reported that there are numerous benefits of the cochlear implant, most notable improvements are access to more fine sounds, spoken language, social skills, and greater confidence (Bosco et al., 2005; Archbold, 2008; Spencer, Tomblin, & Gantz, 2012). This suggests that the improved access to speech from a cochlear implant helps in achieving better sense of well-being, quality of life, and increase in confidence and social activity (Francis et al., 2002). Furthermore, it is noted that many children with cochlear implants develop language skills that enable to function in mainstream environments along with hearing peers (Geers et al., 2009).

1.11 Factors influencing development of children with cochlear implants

The language outcomes in children with cochlear implants has been accounted to be inconsistent across children (Bell et al., 2001; Boons et al., 2012; Castellanos, 2014; Chilosi et al, 2013; Francis & Lam ho et al., 2003; Guo, Spencer, Tomblin, 2013; Kronenberger, 2014; Nittrouer et al., 2014; Spencer & Guo, 2013). This inconsistency in language performance in children with cochlear implants can be endorsed to several factors such as age at diagnosis, duration of deafness, age at implantation and duration of implant use etc., and other factors which might have greater or equal influence are: family involvement; socio-economic status; type of training the child receives, and mode of communication, parent’s education (Dunn et
al., 2014; Harrington et al., 2009; Yanbay et al., 2014). An understanding that cochlear implant is a device and improvements in communication are dependent on many additional factors is crucial (Harrington et al., 2009; Wang et al., 2014; Yanbay et al., 2014). Features like age at diagnosis of deafness, duration of auditory deprivation, implantation age, duration of implant use, main mode of communication and school setting etc., are critical to study as these variables classify their input to the benefit of implant. Deconde (1984) highlights apart from the amount of residual hearing having a direct impact on child’s speech and language development, social-emotional stability, and academic performance, there are several other factors, such as intelligence, age of identification, economic factors, and parental support, which may lessen or increase the impact of hearing impairment. Therefore, the present study will focus on the following main variables: age at diagnosis of hearing loss, age at hearing aid, duration of hearing aid, age at implantation, duration of implant use, main mode of communication and type of training etc.

1.12 Education of Children with Hearing Loss- A Historical Perspective

‘Persons with hearing impairment’, addressed as ‘Deaf’ earlier, have been an integral part of the society. Their existence must have been even in the pre-historic time. When mankind started using speech and written symbols for communication, their categorization as ‘Deaf-mutes’ might have come at a later stage.

Hearing impairment being a hidden handicap, the common attitude initially towards them was of ‘Forget and Hide’. Hence their education took a back seat. There was no education provided to them in olden times and they were generally neglected and abused. From 1960’s onwards, the attitude towards them had a sudden change of ‘Screen and Segregate’ and then slowly the society started realizing the importance of educating them. Hence, programs were started to educationally
rehabilitate them. Though on one side it was a good move, segregation narrowed the possibility of mingling and sharing of hearing-impaired persons with the mainstream society. During 1980’s, there was a significant, positive and constructive change in the attitude. The approach was to ‘Identify and Intervene’. This significant approach was the result of the research findings in identification of hearing loss and technological advancements in terms of equipments for identification and rehabilitation. And it was also realized that the interventional services should start for them very early, i.e. during the critical years (0-5 years). Results of early identification and intervention established a fact that even these children can achieve standard of education like the hearing children through integration. Recent years have witnessed a further change in the attitude of the education of the children with hearing impairment by bringing in the philosophy of inclusion. This approach is to consider the special education as ‘service rather than a place’. The trend at present is to include children with hearing impairment in the regular school system and modify the system to suit the individual requirements.

1.13 Educational opportunities for Children with Hearing Loss

Broadly educational options available to children with hearing impairment are classified as: Special schools and Regular schools.

Special schools: Special schools are generally the most restrictive but up to recently regarded by many as perhaps the only really viable, realistic placement option regularly offered to students who do not benefit from inclusion and integrated education. A Special school permits the centralization of specialized services, psychologists, and social workers, to assist special educators in meeting the special educational needs of these students. Special education is specially designed instruction. As few students have trouble in learning in a regular classroom, they
require special education in school that have specialized teachers with special aids,
appliances and teaching techniques. The Kothari Commission (1964-65) stressed and
recommended the establishment of special schools for special children in every
district of our country.

*Regular Schools:* They refer to schools catering to so called typically
developing normal hearing children i.e. children who have not been identified as
having a disability that requires special attention. With increasing awareness about
the rights of persons with disabilities and about the need to provide equal
opportunities to children with disabilities many regular schools today have opened
their doors to children with disabilities including deaf children. Needless to say,
nearly age appropriate communication skills and a fair level of academic preparedness
is expected from the children who are integrated into ‘regular schools’. Integrated
education is a viable option for the education of the hearing impaired thereby
providing educational opportunities to those with mild to moderate hearing
impairment along with their hearing peers. Government of India in 1974 under the
Department of Social Welfare launched a scheme of Integrated Education for the
Disabled Children (IEDC) and then transferred it to the Department of Education in
(1976) states that candidates for admission to or continuation in regular classes have
certain characteristics in common such as follows:

1. Active utilization of residual hearing
2. Full-time hearing aid use if prescribed
3. Social, academic, cognitive and aural-oral communicative skills within
   the normal range of behaviours.
4. Competence in understanding and exchanging ideas with others by use of speech, reading and writing.

5. Self-direction in completing tasks at hand.

Inclusion though is the most preferred option still it is in the emerging state in India. Special schools are still playing a major role in the education of the children with hearing impairment in integrating them in the mainstream regular schools in our country.

1.14 Context, Need and Importance of the Study

In recent times, with widespread implementation of universal neonatal screening programs all over the world, the awareness of hearing impairment has drastically improved as compared to olden days. This means that it is increasingly possible to identify the problem early and offer appropriate solutions to the problems of children with hearing loss. The major problem of hearing impairment is loss in sound sensation. A wide number of children with hearing loss have the residual hearing or some amount of hearing capacity. Accordingly, appropriate assistive listening devices can be fitted and listening training can be provided as a part of intervention program. Furthermore, early training can be provided to these children for meaningful sound production (speech), language development and educational achievement. According to Census of India 2001, there are over one million people in India with hearing loss which accounts for 0.1%. Within the age range of 0-14 years, there are 16.7% children with hearing loss (Government of India, 2001). As per National Sample Survey Organization (NSSO) report of 2002, in India there are 30.62 lakhs individuals with hearing loss and they are located more in rural areas than in urban areas. According to the WHO project “Prevention of Deafness and Communication Disorders” undertaken at All India Institute of Speech and Hearing,
Mysore, in the year 2001 and being continued by the Institute research funds, the extrapolated estimates of the incidence of hearing impairment from 1996 to 2007 was between 3.29% to 7.67% in infants and 9.07% to 38.1% in school going children (Basavaraj, 2007). In recent times, there are many options available for individuals with hearing impairment with the advancement in technology. One of the noteworthy advances in amplification technologies is a cochlear implant which has become popular in both paediatric and adult persons with hearing impairment. A vast amount of literature highlights the benefits derived from cochlear implants in most of the areas: spoken language, language, communication, and in social context (Archbold, 2008; Bosco et al., 2005; Fortum et al., 2007; Hess et al, 2014; Phillips et al, 2009; Spencer, Tomblin & Gantz, 2012;). By December 2010, the number of people wearing cochlear implant worldwide was 2,19,000 of which more than half are children (Raeve et al., 2012). However, in spite of the large benefits, cochlear implants still remain a challenge for many persons with hearing impairment in India. For this, there are variety of reasons such as majority of the population are located in rural areas (i.e. 72%), low literacy rate, limited access to medical technology, and high birth rate (Vaid et al., 2009), and the cost. In majority of cases, the cost of implant is borne by the families of cochlear implant receiver. In India, as per the estimate, approximately 3000 individuals are implanted as compared to 30,000 adults and 30,000 children implanted in United States in the year 2009 (Jeyaraman, 2013).

India is a country of 1.14 billion with a cultural and linguistic diversity which stands as another important challenge for cochlear implantation in children. Majority of the clinics involved in cochlear implant habilitation programs preferred only the caregiver’s language as the choice of language for therapy (Jeyaraman, 2013) which would be a regional language in most of cases other than English language despite the
fact that most of the parents of children with cochlear implants would prefer their children to get enrolled and study in English medium schools. Even though in India for majority of them English is not the caregiver’s language, children are being enrolled in English medium schools.

Considerable research has been carried out in early screening of children with hearing loss and children with cochlear implants, majority of these studies were on speech development, audiology and related technological aspects. But very few studies have examined the educational related aspects as to how parents work with these children in home how these children exist in regular schools etc. Even though the rate of cochlear implantation in young children with severe and profound hearing loss have been rising due to the reported success rates in speech and language acquisition, questions remain about the long term benefits of this device in terms of educational related benefits for these children in India. Very few studies have been conducted that examines and highlights the educational support required for these children with cochlear implants in mainstream schools. It is well known fact and many research studies have highlighted that children with hearing impairment have linguistic and literacy problems which might not be a new area to be investigated but the main purpose or the uniqueness of the present study is to understand in Indian context whether the advancement in amplification technology i.e., use of cochlear implants could in anyway remediate linguistic and reading difficulties of children with severe or profound hearing loss. Consequently, not many studies have been conducted in these areas for children with hearing impairment. Review of literature in Indian context in these terms needs further investigation. Hence, a need was felt to undertake the present study. In simple terms, as explained earlier, mostly children with hearing impairment tend to have language difficulties then -Is it that the cochlear
implant device is enabling the child to overcome the language difficulties? Is it that they have achieved a very good strong foundation in the caregiver’s language? Is it that this strong foundation in caregiver’s or native language is helping them to learn a new language? Are they really able to cope on par with hearing children in the regular classrooms? Is it that they are facing some problems in English medium schools? These are some of relevant queries which the researcher intended to find answers through the following study.

1.15 Statement of the problem

The present study is proposed to investigate Linguistic Skills and Reading Comprehension in Kannada children with cochlear implants between the age range 6 to 11 years, living in and around Mysore and Bangalore cities. They are unilaterally implanted, reported to have no other additional disabilities, and were studying in regular English medium schools along with normal hearing children. The influence and the relationship between Linguistic Skills and Reading Comprehension in children with cochlear implants with respect to child and family related factors, clinical related factors and educational related factors was also proposed to be examined.