CHAPTER – I
THE PROBLEM AND ITS CONCEPTUAL FRAME WORK

1.1 INTRODUCTION

*Education means all-round drawing out of the best in child, man, body, mind and spirit.*

Vivekananda

Education is the process by which an individual is developed individually and makes a person transformed into a personality. Education brings out, leads and manifests the inherent potential in a human being. By this, education can also be termed as an arena of experiences and wisdom that one acquires from the educational curriculum and the world living around.

In broader sense, education signifies the process of development from illiteracy to literacy, diffidence to confidence and inability to ability. It begins at birth and continues throughout life, till death and includes all the knowledge and experience, acquired from childhood to adulthood. Education means an act of acquiring knowledge, skills, and attitude.

Education is a triangular process involving the interplay of the educator, student and the social forces. It is the foundation on which the future of a country is constructed. It has a crucial contribution to make towards promoting national integration, understanding and a sense of togetherness and harmony. As far as India is concerned, the roots of education go to the Vedic period. Still, we rely a lot on the value of Vedic education. But with the changing times and circumstances,
various reforms were made in education. After independence, a new education policy was formulated keeping in view, the future development of the country.

1.2 IMPORTANCE OF EDUCATION

Education is a comprehensive term. Its implications are rich and varied. The requirement always grows with the ever growing society. Its importance has been realized since time immemorial and it continues right up to this day. It has been accepted as one of the primary needs of every civilized person. This is the only reason why philosophers and leaders of human thought, have so eloquently, sung its praises in all ages. Swami Vivekananda perceived education as ‘the manifestation of Divine perfection already existing in man and it should aim at “Man-making.”’

John Dewey adds, “Education is not a preparation for life, but life itself.”

Rabindranath Tagore remarks “Education means enabling to find out that Ultimate truth, which emancipates us from the bondage of the dust and gives us the wealth, not of things but of inner light, not of power but of love, making this truth its own and giving expression to it.”

One of the commonly agreed upon observations among most educationists about learning is that if the rudiments are taught effectively at the primary level, most of the problems can be easily solved. The rudiments that are taught include the three Rs, which stand for reading, writing & arithmetic. The methods teachers adopt to teach the rudiments to the sighted pupils do not help the sightless pupils. With one of the important gateways of learning shut, it becomes doubly difficult for the visually challenged to perform the task of learning the basics. This is so because 78% of knowledge and education is acquired only through vision. Psychologists
point out that the blind can overcome the visual implements with what they call compensation. They don’t seem to realize that it does not take place automatically. Compensation in blind children can operate only on the basis of motivation. At the primary level when the visually handicapped children have no access to basic information, most of which is possible only through vision, these motivation levels go down. This lack of motivation leads to what is called experiential deprivation. Therefore, these natural potential remains both unexpressed and un-nurtured.

1.3 INCLUSIVE EDUCATION

Inclusion in an educational approach and philosophy means to provide all children with community membership and greater opportunities for academic and social achievement. Inclusion is about making sure that each and every student feels welcome and that their unique needs and learning styles are attended to and valued. Inclusive schools put the values upon which America was founded (pluralism, tolerance, and equality) into action. It demands the teachers to provide appropriate individualized support and services to all students without the stigmatization that comes with separation. Research shows that most students learn and perform better when exposed to the richness of the general education curriculum, as long as the appropriate strategies and accommodations are in place.

At no time does inclusion require the classroom curriculum, or the academic expectations, to be watered down. On the contrary, inclusion enhances learning for students, both with and without special needs. Students learn, and use their learning differently; the goal is to provide all students including those with special needs, the instruction they need to succeed as learners and achieve high standards, along with the society.
1.4 CHILDREN WITH SPECIAL NEEDS

Research points to the following:

Who are Children with Special needs? Children who require special attention, methods and tools to assist their education are termed as ‘Children with Special needs’. Children with disabilities and their families constantly experience barriers to their basic human rights and inclusion within society. Their abilities are overlooked, their capacities are underestimated and their needs are given low priority. Yet, the barriers they face as a result of the living environment are harder to break through than the hardships they face as a result of their impairment in daily life. While the situation of these children is changing for the better, there are still severe gaps. On the positive side, there has been a gathering global momentum over the past two decades. Persons with disabilities are being increasingly supported by civil society and governments. In many countries, small, local groups have joined forces to create regional or national organizations that have lobbied for reform and changes to legislation. As a result, one by one the barriers to the participation of persons with special needs as full members of their communities are being broken. Progress has varied, however, both between and within countries. Many countries have not enacted protective legislation at all, resulting in a continued violation of the rights of persons with special needs.

At this point, it would be valid to discuss on the different types of impairments commonly known and experienced by the people. The definition of a disability or impairment, however it is defined, is relevant in this discussion only because we discuss technology solutions that help person with different types of
impairments in their education. Before determining how technology can benefit in education, it is beneficial to understand the types of impairments.

1. **Learning Impairments**: Learning impairments can range from conditions such as dyslexia and attention deficit disorder to retardation. Processing problems are the most common and have the most impact on a person’s ability and interfere with the learning process.

2. **Mobility and Dexterity Impairments**: Mobility and dexterity impairments can be caused by a wide range of common illnesses and accidents such as cerebral palsy, multiple sclerosis, loss of limbs or spinal cord injuries, and repetitive stress injury, among others.

3. **Hearing Impairments and Deafness**: Hearing impairments encompass a range of conditions — from slight hearing loss to deafness. Hearing impairments include:

   a. **Hearing loss and hard-of-hearing**: Students who have hearing loss or are hard-of-hearing may be able to hear some sound, but might not be able to distinguish words

   b. **Deafness**: Students who are deaf may not be able to hear any sound or word spoken.

   c. **Deaf and Blind**: Students who are not able to see as well as hear.

4. **Visual impairment**: Visual impairment is the consequence of a functional loss of vision, rather than the eye disorder itself. Eye disorders which can
lead to visual impairments include retinal degeneration, albinism, cataracts, glaucoma, muscular problems that result in visual disturbances, corneal disorders, diabetic retinopathy, congenital disorders and infection. The visually impaired can be classified into the following categories:

a. **Partially sighted:** It indicates certain types of visual disorders that limit access to printed or smaller sized texts / images in media.

b. **Low vision:** It generally refers to a severe visual impairment, not necessarily limited to distance vision. It applies to all individuals with sight that are unable to read the newspaper at a normal viewing vision, even with the aid of eyeglass or contact lenses.

c. **Colour blindness:** Persons who are colour blind have difficulty seeing particular colours or distinguishing between certain colour combinations.

d. **Legally blind:** It indicates that a person has less than 2/200 vision in the better eye or a very limited field of vision.

e. **Totally blind:** Person with no eye sight, who could read only with assistive tools, special reading / writing methods like Braille or other non-visual media like audio, touch.

### 1.5 SPECIAL EDUCATION

**UNESCO** (1983) has provided the most comprehensive and appropriate definition of special education. “Special education is a form of education provided for those who are not achieving, or are not likely to achieve through ordinary
educational provisions, the level of educational, social and other attainments appropriate to their age, and which has the aim of furthering their progress towards these levels”.

Special education is the education of students with special needs in a way that addresses the students' individual ability and needs. Ideally, this process involves the individually planned and systematically monitored arrangement of teaching procedures, adapted equipments and materials, accessible settings, and other interventions. These are designed to help learners with special needs to achieve a higher level of personal self-sufficiency and success in school and community.

Special needs include challenges with learning, communication challenges, emotional and behavioural disorders, physical disabilities, and developmental disorders. Students with these kinds of special needs are likely to benefit from additional educational services such as different approaches to teaching, use of technology, a specifically adapted teaching area, or resource room. Intellectual giftedness is a difference in learning and can also benefit from specialized teaching techniques or different educational programs, but the term "special education" is generally used to specifically indicate instruction of students whose special needs reduce their ability to learn independently or in an ordinary classroom, and gifted education is handled separately.

In most developed countries, educators are modifying teaching methods and environments so that the maximum numbers of students are served in general education environments. Special education in developed countries is often regarded less as a "place" and more as "a range of services, available in every school".
Integration can reduce social stigmas and improve academic achievement for many students.

1.6 SPECIAL NEEDS IN EDUCATION FOR VISUALLY IMPAIRED

Educators and parents of students with visual impairments have pioneered special education and inclusive program options, for over 164 years. It is significant that the field of education of visually impaired students was the first to develop a range of special education program options, beginning with specialized schools. Experience and research suggest the essential elements which must be in place in order to provide an appropriate education in the least restrictive environment for students with visual impairments.

The majority of learning in infants and young children occurs through vision. Soon after the birth of an infant who is visually impaired, families may become aware that their child does not respond to them in the same way as an infant who is sighted. In order to ensure a healthy bonding process and emotional growth, early intervention is essential for both the child and the family. These strategies must be modified to reflect the child's visual, auditory and tactile/vision capabilities. A child with a severe visual loss can directly experience only what is within arm's reach and can be safely touched, and in most cases, what can be heard. To ensure an appropriate education, families and staff with special training must work together to bring the world of experiences to the child in a meaningful manner.

As the child grows, the absence or reduction of vision dramatically limits understanding of the world. No other sense can stimulate curiosity, combine
information, or invite exploration in the same way, or as efficiently and fully as vision. Students with visual impairments can and do succeed, but at different rates and often in different sequences. There must be significant intervention, coordinated by an educational team to ensure that appropriate development does occur.

It is important to remember that educational goals for students with visual impairments are essentially the same as those for other students. The goals are: effective communication, social competence, employability, and personal independence. In order to accomplish these goals, however, students with visual impairments require specific interventions and modifications of their educational programs. An appropriate assessment of these unique educational needs in all areas related to the disability and instruction adapted to meet these needs is essential to ensure appropriate educational programming.

Students with visual impairments will not be included unless their unique educational needs for access are addressed by specially trained personnel in appropriate environments. These students should be provided with equal access to core and specialized curricula through appropriate specialized books, materials and equipment. Technology in the form of computers equipped with screen reading or magnification software tools, low-vision optical, video aids enable many partially sighted, low vision, and blind children to participate in regular class activities. Large print materials, books in audio tape, CD / DVDs, and Braille materials e-Book readers are also available.

Students with visual impairments may need additional help with special equipment and modifications in the regular curriculum to emphasize listening skills, communication, orientation and mobility, vocation/career options, and daily living
skills. Students who have visual impairments combined with other types of disabilities have a greater need for an interdisciplinary approach and may require greater emphasis on self care and daily living skills. A student with a visual impairment, who does not have access to social and physical information because of the visual impairment, is not included, regardless of the physical setting.

The more intensive and unique needs associated with visual impairment must also be addressed in educating students who are visually impaired and have one or more additional disabilities, including specialized health care needs. The education of students with multiple disabilities or other special needs must involve a team approach, combining the expertise of specialists to competently address the complex needs of these students. Educators of students with visual impairments possess unique competencies needed by the team. Therefore, to achieve quality education for students with multiple disabilities or other special needs, services must be provided using a team approach, including members with disability-specific expertise in educating students with visual impairments. The unique educational needs of all students with visual impairments cannot be met in a single environment, even with unlimited funding. It is critical that a team approach be used in identifying and meeting these needs and that the team must include staff who have specific expertise in educating students with visual impairments.

In order to meet the individual and disability-specific needs of students with visual impairments, there must be a full array of program options and services. Educational needs that are specific to these students must be addressed throughout their school experience. Educators of students who are visually impaired recognized long ago that the only manner in which the unique, individual needs of students could be met was to provide choices for delivering specialized services. Efforts
throughout the history of education for students with visual impairments have been focused on the right of these persons to full participation in an inclusive society. Programs that prepare teachers of students with visual impairments contain a curriculum that is not found in general teacher preparation or generic programs in special education.

Another important unique need area is orientation and mobility which must be provided by trained and qualified orientation and mobility specialists. The teacher of students with visual impairments may share in the responsibility for reinforcing learned skills in orientation and mobility, but educational programs must offer instructional services of appropriate frequency and duration from both a specially trained teacher and an orientation and mobility specialist.

In an integrated setting, the vision teacher often has limited time that can be spent with a student who is visually impaired. This necessitates the development of a support team which includes professionals, paraprofessionals, peers, and parents with a unified philosophy and strategies for assisting the student to learn and develop. Therefore, it is important that all individuals who will be interacting with the student who is visually impaired receive specialized in-service training.

1.7 PROBLEMS OF VISUALLY IMPAIRED CHILDREN

The visually challenged are not psychologically or mentally different from sighted. They are neither specially blessed nor specially cursed. They need education, employment, opportunity, social acceptance & casual treatment; not pity & custody. Blindness is a disability, not an inability. Blind people should have the right to be treated at par with normal persons. They should not be ridiculed,
embarrassed or looked down as lesser persons due to their disability. It is a fact that half of the population of our country is illiterate and though the directive principles of state policy enshrined in our constitution envisage free and compulsory education for all children up to the age of 14. It has taken as many as 6 decades for our Government to enact the Right To Education (RTE) act. In the case of the visually challenged population, the percentage of illiteracy is sure to be more than 80%. Most of the scholars and social activists, who have tempted to analyze the reasons for such a vast gap between the sighted and the sightless in the literacy rate have identified not only poverty & ignorance, but all the lacunae in the implementation of government welfare schemes as chiefly responsible factors.

Various Governments have started so many initiatives for the education of the special children, at various levels, viz, Primary, Secondary, and Higher Secondary and Higher levels. The following sections discuss the initiatives elaborately.

**Primary Level:** At the primary level, there are many special schools in each district to overcome the problems related to the special needs of the visually challenged children. The number of students to be educated in each classroom should not exceed eight as per the guidelines laid down. But there is a lack of awareness among parents about the existence of such special schools for the blind. Another reason cited by many special school teachers for such low strengths in their schools is the introduction of the inclusive educational scheme by which visually impaired children can study in regular schools along with their sighted counterparts. There is a provision in the scheme for appointing special teachers called resource teachers to address the special needs for the children including teaching Braille Mathematics and other life skills. Unfortunately this scheme in the last 10 years had not produced
any positive results. The appointment of insufficient and inefficient resource teachers, non-availability of special teaching aids, non-payment of salary to the existing resource teachers and above all, the merger of the scheme with SSA plan are some important reasons for the failures.

The failure of inclusive education scheme has been highlighted only to reiterate that the inclusion of sightlessness with the sightedness is possible only if the special needs are fulfilled. The fulfillment of such needs at initial stages of education of the special students in the elementary classes is not feasible in intergraded schools than in special schools. However, one should not come to the conclusion that the latter function better than the former. It only means that at the primary level, the special schools have to teach the children with basics without much deprivation.

Despite these facts, it must be admitted that the special schools too do not do enough justice. The knowledge of the Braille acquired by the students of special schools from classes I to X in both English and vernacular is found to be below average in the recent survey conducted jointly by organizations for the VI in Tamil Nadu. Therefore if the education of the blind is to be improved, first of all, the quality of primary schools for the blind has to be strengthened.

**Secondary Level:** At the secondary level, the learning process of the blind students becomes merely mechanical. The performance of the student is assessed only on the basis of marks obtained in the examinations. Moreover the students, who study in boarding school, have no parental care. Their parents who are ignorant and illiterate neglect their children totally. In addition, there is no scope for the students to take part in curricular activities either on campus or outside the school. Thus, in the next
stage of their life, the visually impaired students are left with no visible progress in
their learning process.

**Higher-Secondary Level:** At Higher Secondary level, students have very little
optional subjects to study on their choice. What is even more pathetic is that there is
no opportunity at all for them to learn either Maths or any branch of science after the
standard X. So, most of the students with the exception of the few, who choose
commerce and accountancy opt for arts subjects, which have no scope than teaching.
Above all, computer literary accessible to the sighted students right from the early
days is not taught in any school for the blind.

**Higher Level:** The availability of screen reading software remains unknown to the
majority of the sightless. It does not reach out to them for two reasons; first it
requires basic knowledge of English; second it remains a costly affair. In short, the
blind students’ entry into collage studies with all these challenges is bound to be
difficult and therefore limited. With the heavy dependence on voluntary service
rendered with dedication by some individuals and organizations, the blind are able
to pursue higher studies with some success. The point to be noted is that such
services to the students are available mainly in cities; nevertheless to say that
students pursuing higher studies elsewhere cannot be equally successful. The degree
of dependence on volunteers in doing B.Ed. which is the only professional course
available to them is higher. Since English and some other languages are the subjects
chosen in their graduation for the reason already cited above, teachers who teach
such subjects in colleges where the Visually Impaired students study, should be
qualified to record certain observations about their teaching as well as learning
process. Teaching English to visually challenged students at the college level has
been an interesting as well as a challenging job. Teaching English to VI students by the lecturers in a mixed classroom, most of the VI students find it odd to interact with both the teachers and near group. This is primarily due to the fear of making mistake in grammar; the reason for their fear seems to be their obsession with prescriptive grammar.

1.8 BRAILLE IN THE EDUCATION OF THE VISUALLY IMPAIRED

The Braille system is a method that is widely used by blind people to read and write, and was the first digital form of writing. Braille was devised in 1825 by Louis Braille, a blind Frenchman. His “Braille System” was based on a method called “Night Writing”, designed by a French army officer, Charles Barbier so that the military could be able to read and write messages in the dark. He later developed this system for the blind and called it “sonography”. After three years of working with sonography Louis Braille developed his own system using only six dots. Each Braille character, or cell are made up of six dot positions, arranged in a rectangle containing two columns of three dots each.

It is the best system ever developed for the blind to both read and write. It includes a device, slate and stylus, by which they could write with. It is outstandingly versatile, equally able to express the languages and scripts of Europe, Asia, and Africa and readily adaptable to mathematics, music and even computer language. Braille was the first technical advancement of blind in Education.
The invention of Braille gave blind people a universally accepted system for education. The development of Braille writers made it possible for the blind to write Braille in nearly the same way as they used a typewriter. Braillewriter made possible speedy transcription of Braille books and other materials. Thin brass sheets of Braille were then used by printing presses to mass-produce Braille books. It replaced the prior slower ways to write Braille. Later Braille Typewriter known as Perkins Brailler was invented. The Braille system has the following objectives:

- Education from the content material
- Self study of basic information from the books
- Learning and remembering from the scripture
- Refinement in language through Braille and
- Reception of new thoughts
Schools and other educational institutions for the blind developed many programs and educational aids for the education of the blind. They also developed in-service training programs for their teachers and staff, which were often incorporated later into university programs. They also were often quick to pick up on new technology and adapt it for the needs of their students.

1.9 ICT IN THE EDUCATION OF THE VISUALLY IMPAIRED

The use of computer with screen reading software can provide a solution to the problems of visually challenged students. Computer literacy in the case of visually challenged students serves a main purpose; it makes them linguistically efficient and technically proficient. It must be noted here that universally recognized software are available only for the English language. The use of blackboard or Braille alone can be an impediment to the blind people. They must be supplemented with latest ICTs.

Assistive technology products with different capabilities are available to help people with vision impairments. Some products provide a combination of capabilities that help specific individuals. There are Stand-alone products designed specifically for people who are blind or visually impaired, including personal digital assistants (PDAs), electronic book, players that provide portable access to books, phone numbers, appointment calendars, and more. Optical character recognition systems scan printed material and speak the text. Braille embossers turn text files into hard-copy Braille. Assistive Technology products useful to students with vision impairments can be classified as Devices or Hardware and Software.
**Magnifiers:** Magnifiers are available as Hardware devices as well as Software. They work like a magnifying glass. Screen Magnifiers which are primarily software, enlarge a portion of the screen as the user moves the focus from 2 x – 20 x magnifications. They magnify the full screen, parts of the screen, or a magnifying glass view of the area around the cursor or pointer. Eg. Magic, Super Nova, etc.

**Screen Readers:** Screen readers are software programs that present graphics and text as speech. They speak everything on the screen including names and descriptions of control buttons, menus, text, and punctuation. The user sends commands by pressing different combinations of keys on the computer keyboard to give instructions to the speech synthesizer. They allow users to perform locating text displayed in a certain colour, reading pre-designated parts of the screen on demand, reading highlighted text, and identifying the active choice in a menu. Users may also use the spell checker, or read the cells of a spreadsheet with a screen reader. Screen readers using speech synthesizers are currently available for use with personal computers running different Operating Systems. Eg. JAWS (Job Access With Speech), NVDA (Non-Visual Desktop Access), Window-Eyes, Arca, VoiceOver, Thunder and Others.

**Scanning and Reading Software:** A Scanning and reading software first scan paper documents and then translate them into digital format so that they can be read and edited. This process is called optical character recognition (OCR). It saves the student time and effort in creating, editing, converting, exporting, and using them with a variety of word-processing, page layout and spreadsheet applications. Kurzveil, ABBYY Fine Reader with JAWS and Open Book are few Screen Reading Software that help Visually Impaired students.
Scanning and Reading Devices: They allow the students to scan text and hear it read back to them. It's easy to learn and offers the highest level of accuracy along with outstanding sound quality. The student simply places the printed document on the flatbed scanner, and the Scanning and Reading device takes approx. 10-12 seconds to capture and begin reading it. Voice volume is adjustable using a control for audibility. Eg. SARA, ClearReader, ReadEasy+ and others.

Refreshable Braille displays: They are electronic devices used to read text with tactile typically displayed for the visually impaired person on the computer monitor. The refreshable Braille display is connected to the computer by a serial or USB cable and produces Braille output (with small plastic or metal pins that move up and down to display the Braille characters) for the reader. They can show up to 80 characters from the screen and is refreshable. Commonly used Braille Displays are ALVA, Metec, Braille Star, Brailliant, PAC Mate, Braille Mitra and Seika.

Braille Note Takers: They enable a blind student to capture notes and then transfer them to a PC. They take advantage of refreshable Braille technology. In some cases, they replace or supplement a standard keyboard. Electronic Braille note takers are small, portable and battery operated devices with Braille keyboard for entering information. They use a speech synthesizer or Braille display for output. It allows the user to write, review and edit data, keep a virtual address book, and store many pages of Braille or print. User options include a talking clock, calendar, telephone directory, scientific calculator, and stopwatch. It can be used as the speech synthesizer and provide access to mainstream programs such as e-mail, and Internet. A regular ink-printer will produce typewritten output when the built-in Braille-to-
print translation feature is available. Eg. Eurobraille, Esys, Braille Sense, Braille Note and Others.

**Braille Translators:** Braille translator software takes a document and converts it into a Braille file and then be sent to a Braille printer or read on a Braille display or a personal digital assistant for a visually impaired student. Firstly the type of Braille required should be chosen. Braille consists of letters, numbers, punctuation marks, etc. Contracted Braille includes contractions of common combinations of letters and words. To create a contracted Braille file, a Braille translation program takes the computer text file, inserts the proper contractions, and formats the document properly for the Braille page. Eg. Duxbury, Shree-lipi Braille.

**Braillers and Brailler Embossers:** An electronic Brailler integrates modern computer technology and has applications to support embossing, reading and file storage - and it has audio support for all its operations. It has been designed to meet the needs of blind students. A Braille embosser renders text as tactile Braille cells. A document can be embossed with relative ease, making Braille production much more efficient and cost-effective. Smaller and slower Braille embossers are more common and can be used for visually impaired students. They usually need special Braille paper. Some high-end embossers can print on normal paper. They are used on maps, floor plans, routes, graphics, geometry, art, geography, charts, or other tactile information. Eg. Index 4x4, Basic D, Romeo, Juliet and Norway Braille.

**Digital Talking Book Players:** Talking Books were played on records, then, on cassette tapes on specially adapted machines. They may become digital files on CDs or another device. These books allow users to skip directly to specific places in the
book, insert bookmarks, and more. The stand-alone machines are small and portable, and easier to use. They are also the most affordable players for students who do not own a computer. MP3 files and commercial music CDs can also be played on these players. Eg. EasyReader, eClipseReader, FS Reader, AMIS and devices like Buddy Player, Angel Reader, GH Player and Victory Reader.

**Talking Calculators:** Talking Calculators recite numbers, symbols or functions as keys are pressed by low vision and totally blind students. They also can read back answers to completed problems. Every button and edit area talks. It is easy to use, with large keys and contrasting colours. It has multiple display areas so one can see the numbers begin entered, the current total, any numbers in memory and the history of your calculations for the current process.

**Large Print Keyboards:** They have been designed specifically for those with conditions that cause visual impairment or low vision. With a bigger and bolder typeface, the keys are easier to see for low vision students.

![Large Print Keyboard](Fig. 1.2)
1.9.1. Other Assistive Technology Software and Tools

**MathType:** It is an add-on to Microsoft Word which enables students to insert math equations into Word documents that can then be turned into large print, Nemeth Braille code, DotsPlus math Braille, or simply exported as accessible web documents with embedded MathML equations that can then be read with Internet Explorer plus MathPlayer by a screen reader..

**Remote Braille Education System and Device:** It includes a first computer system at a first location, second computer system inputted by visually impaired individuals at a second location, and a server. The first computer system includes an input device, and a display device, and each of the second computer systems includes an electronic Braille device(s). The input device is configured for communicating a first set of characters to the electronic Braille device via the server. The electronic Braille device is configured for embossing the first set of characters on a printing medium. Furthermore, the electronic Braille device is configured for transmitting a second set of characters inputted by the visually impaired students via the server. The display device is configured for displaying the second set of characters received from said one or more of the second computer systems..

**Large monitors:** They are an essential piece of equipment for the visually impaired students. They are particularly useful if the user is working with screen magnification software, as the larger screen size will display more information than a standard monitor at any one time.

**OBR - Optical Braille Recognition** – It is Windows software that allows “reading” single and doubling sided Braille documents with a standard scanner. The retrieved
information is presented as the text that can be used in all types of Windows applications for low vision, magnification required but students not knowing Braille.

**Accessible PDA:** It uses a text-to-speech technology adapted application and a tactile keyboard membrane over the PDA's touch screen. It is compact and provides essential functions through text and vocal means for the students.

**Speech Recognition (SR):** This software can translate spoken words into text. It helps blind students to dictate their text requirements to the computer and get them translated into texts on the screen. Some SR systems use "training" where an individual speaker reads sections of text into the SR system. These systems analyze the person's specific voice and use it to fine tune the recognition of that person's speech, resulting in more accurate transcription.

**Enhanced Web Finder:** It allows the students to search web pages for specific words or phrases, or skim through pages to find items of interest. As the student navigates through the page each item he or she comes to is highlighted and announced. When an item of interest is found, Web Finder starts reading aloud from that location. If the item is a link to another page Web Finder executes the link and continues the search on the new page.

**Zoom Text Recorder:** It allows a low vision student to convert text from documents, web pages, email, etc. into audio recordings and transfer to mobile device and listen to at convenience. Recordings can be saved directly to a Zoom Text Recorder playlist in iTunes or Windows Media Player and automatically synchronized to the mobile device.
**Braille Note Global Positioning System:** This software uses a cell-phone size GPS receiver to relay information from GPS satellites. It calculates where the visually impaired student is and plots a route to a destination he or she chooses on Braille Note in Braille.

**Tactile Braille Systems:** They are a sophisticated teaching tool for all ages based on LEGO-type blocks. These Braille blocks provide a unique bridge, a smoother, shorter, more interesting path to Braille literacy for students.

### 1.10 ENVIRONMENTAL EDUCATION

Due to man's interaction with nature on a large scale, the balance of nature has been upset and environmental degradation has occurred in most parts of the world, because of environmental pollution, improper and unscientific exploitation of natural resources etc. It has posed a great danger threatening the very existence of man, plant and animal life on the earth. So, there is a need to increase awareness and understanding of those environments and man's impact on them and to find out the effective ways to manage them. To achieve the above goal, environmental education is the need of the day. Nature can be divided into two entities viz. living and non-living, which interact mutually to reach equilibrium. At this stage both entities are at delicate, balance. Even a small change in one of them will lead to loss of stability of the living (biotic) and non-living (abiotic) systems. The biotic system lives in an environment that favours it. Since we, the human beings belong to the biotic component it is our concern and duty to study, understand, use and protect the environment.
At present the environment is at bad shape, chiefly due to the over exploitation and mismanagement by us. Hence, we have to conserve the biodiversity by understanding the environment and motivating the present generation to take care of it. Environmental studies deals with every issue (factor) that affects a living organism. It is essentially a multidisciplinary approach that brings about an appreciation of our natural world and human impact on its integrity. It is an applied science, as it seeks practical answers to the increasingly important question of how to make human civilization sustainable on the Earth's finite resources. Its components include Biology, Geology, Chemistry, Physics, Engineering, Sociology, Anthropology, Economics, Statistics, Philosophy, Computers and Health.

1.10.1. Importance of Environmental Education

Environment refers to the sum total of conditions which surround man at a given point in space and time. “The term environment is used to describe, in the aggregate, all the external forces, influences and conditions which affect the life, nature, behavior and the growth, development and maturity of living organisms”. If we study the natural history of the areas in which we live, we would see that our surrounding were originally a natural landscape, such as a forest, a river, a mountain, a desert, or a combination of these elements. Most of us live in landscapes that have been profoundly modified by human – beings, villages, towns or cities. But even those of us who live in cities must get our food supply from surrounding villages and these in turn, are dependent on natural landscapes such as forests, grasslands, rivers, seashore for resources such as water for agriculture, fuel wood, fodder and fish. Thus, our daily lives are inextricably linked with our surroundings and inevitably affect them. Our dependence on nature is so great that we cannot
continue to live without protecting the Earth's environmental resources. Thus, most traditions refer to our environment as 'Mother Nature' and most traditional societies have learned that respecting nature is vital to protect their own livelihood.

Man's quest for improvement and progress is eternal. In order to meet his natural and acquired needs, he started utilizing the planet's resources indiscriminately. The stress of these efforts increased phenomenally due to the increase in population and industrial revolution. The environmental damage that we have done in the past 200 years is much more than the total damage done in the entire period of human existence in this planet. The stress on the resources became so acute that nature started reacting in an adverse fashion. The world populations work up to this scenario and started systematizing and controlling the indiscriminate use of natural resources. Our natural resources can be compared with money in a bank. If we use it rapidly, the capital will be reduced to zero. On the other hand, if we use only the interest, it can sustain us over the longer term. This is called sustainable utilization or development.

1.10.2. Objectives and Importance of Environmental Education

Objectives of Environmental Education

- Awareness, i.e. to acquire sensitivity to the total environment and its allied problems.

- Skill i.e. to acquire skills for identifying environmental problems.

- Knowledge, i.e. to acquire basic knowledge of conservation of natural resources.
Attitude i.e. to help social groups and individuals acquire a set of values and feelings of concern for the environment and the motivation for actively participating in environmental improvement.

Evaluation ability i.e. to evaluate environmental measures and educational programmes in terms of social, economic, ecological and aesthetic factors.

Participation i.e. to provide social groups and individuals with opportunity to be actively involved at all levels in working towards revolutionary changes in environmental problems.

In order to achieve these objectives, the environmental education should be continuous process and should be provided for all age groups at all levels, both in and out of school/college education.

**Importance of Environmental Education**

- It is essential for the self-fulfillment and social development of the child and the adult.
- It is essential for understanding the different food chains and the nature's ecological balance.
- It plays an important role in understanding and appreciating how the environment is used for making a living.
- It enables one to appreciate and enjoy nature and society

**1.11 NEED AND SIGNIFICANCE OF THE STUDY**

The society is fast changing with technological advancements. Special children cannot be left behind. Mastery over the content matter alone is not
sufficient. The academics should have a sound knowledge in various educational
technologies available for the people with disabilities and the necessary skills in
using them in the teaching – learning process. They should combine together their
resources and expertise to make teaching effective. The researcher analyzed various
technologies used for visually challenged students and their limitations. In Tamil
Nadu most of the schools use Braille. Very few schools use some other
technologies; in particular JAWS for teaching visually challenged students.

One study found that Braille readers may be better able to process oral
information than large print readers (Brothers, 1971). In two similar studies
conducted at various times, Miller found that poor Braille quality can slow down
reading rate and accuracy (Miller, 1977, 1987). This indicates that mere usage of
Braille alone can not guarantee quality in the education of visually challenged
students. Shapiro (1993) suggested that part of the literacy issue is related to a
growing reliance on technology. The National Reading Panel (2000) identified
speech access, the use of hypertext, and the use of word processors as promising for
the development of literacy. Two studies found that training in and use of low vision
devices increases oral comprehension reading speed (oral and silent), and the
amount of reading accomplished (Corn, Wall, & Bell, 2001; Smith & Erin, 2002).

A study was conducted to find out the use of Palm Pilots in a sixth-grade classroom.
Fifty percent felt that the handhelds were interesting and motivating. All participants
remained enthusiastic about using the Palm Pilots, while many teachers were
concerned about managing the new technology in the classroom setting. Bauer,
Anne M and Ulrich, Mary E. (2002). Another study reports that 97% of
kindergarten students and 98% of first graders with disabilities use computers
(Rathbun & West, 2003). It also reports that in the classroom, children use computers most frequently to read, write, spell, learn math, and for fun.

These studies indicate that the Information and Communication Technologies are very much useful for teaching visually challenged students. But, most of the studies are from foreign countries. So far very few studies had been conducted to find out the usage or effectiveness of the ICT in the teaching learning process of visually challenged students. Hence, the researcher feels the need of this study to find out the effectiveness of ICT in the education of visually challenged children.

1.12 STATEMENT OF THE PROBLEM

A major benefit of using ICT to teach visually challenged students is that it is possible to reach many students in a short time in an effective way. These technologies can be used to deliver instruction and information to these special children without much problems. This will benefit learners enormously. These technologies are useful to students in remote places also, as ICT access improves productivity and quality. Finally, as ICT reduces the need for travel, its use can reduce the burden of the visually challenged students to travel long distances for getting information. Studies show that ICT is a part of normal daily interaction for young students in foreign countries. Most of these visually challenged students are members of Social Media also. They are ‘always on’ and connected to geographically-dispersed friendship groups. The potential of ICT is already being demonstrated in hundreds of projects at higher studies. They have transformed the
delivery of education. They lead to new types of educational systems. They heighten both the effects and expectations of the advent of new pedagogies.

Information and Communication Technologies are the most effective and efficient strategy in teaching - learning process. So far very few studies have been conducted to find out the effectiveness of ICT in the education of visually challenged children in India. Hence the present study has been undertaken by the investigator and entitled as “EFFECTIVENESS OF ICT IN THE EDUCATION OF VISUALLY CHALLENGED CHILDREN”.

1.13 OPERATIONAL DEFINITIONS OF TERMS

For purpose of clarity, operational definitions of the variables and related variables/terms involved in the investigation are given below:

Effectiveness: It is the degree to which something is successful in producing a desired result. The effectiveness of an experimental treatment is gauged by the extent students involved in the experiment achieve, whether it is in cognitive, co native or psychomotor domains.

Information and Communication Technology (ICT): They are defined as a diverse set of technological tools and resources used to communicate, and to create, disseminate, store, and manage information. These technologies include computers, Internet, broadcasting technologies (radio and television), and telephony.

Achievement: Achievement may be defined as any desirable learning that is observed in the student. It is a value judgement.
Visually Challenged Children: Children having greatly reduced vision. Anyone with reduced vision not corrected by spectacles or contact lenses is called visually challenged.

1.14 OBJECTIVES OF THE STUDY

The objectives of the study are:

1. To identify a suitable ICT enabled method to teach visually challenged students at secondary level.

2. To identify content in Environmental Science suitable for the secondary class students studying with Braille method and ICT enabled method.

3. To examine whether there exist any significant differences between the mean scores of (a) Pre-test and (b) Gain in Achievement in Environmental Science of the Experimental and Control groups.

4. To examine whether there exist any significant differences between Mean Gain scores on Achievement in Environmental Science of the Subgroups of the Experimental group students w.r.t categorical variables.

5. To examine whether there exist any significant differences between Mean Gain scores on Achievement in Environmental Science of the Subgroups of the Control group students w.r.t categorical variables.
6. To examine whether there exist any association between Mean Gain scores on Achievement in Environmental Science of the sub groups of the Experimental group w.r.t categorical variables.

7. To examine whether there exist any association between Mean Gain scores on Achievement in Environmental Science of the sub groups of the Control group w.r.t categorical variables

1.15 HYPOTHESES OF THE STUDY

The hypotheses of the study are:

1. There exist no significant differences between the mean scores of (a) Pre-test and (b) Gain in Achievement in Environmental Science of the Experimental and Control groups.

2. There exist no significant differences between Mean Gain Scores on Achievement in Environmental Science of the Subgroups of the Experimental group students w.r.t the following categorical variables: (a) Age Group (b) Gender (c) Locality (d) School Type (e) Socio – Economic Status (f) Religion (g) Community (h) Nature of blindness (i) Type of blindness and (j) Technology Awareness.

3. There exist no significant differences between Mean Gain Scores on Achievement in Environmental Science of the Subgroups of the Control group students w.r.t the following categorical variables: (a) Age Group (b) Gender (c) Locality (d) School Type (e) Socio – Economic Status (f)
Religion (g) Community (h) Nature of blindness (i) Type of blindness.

4. There exist no significant association between **Mean Gain Scores** on Achievement in Environmental Science of the sub groups of the Experimental group w.r.t the following categorical variables: (a) **Age Group** (b) **Gender** (c) **Locality** (d) **School Type** (e) **Socio – Economic Status** (f) Religion (g) Community (h) Nature of blindness (i) Type of blindness and (j) **Technology Awareness**.

5. There exist no significant association between **Mean Gain Scores** on Achievement in Environmental Science of the sub groups of the Control group w.r.t the following categorical variables: (a) **Age Group** (b) **Gender** (c) **Locality** (d) **School Type** (e) **Socio – Economic Status** (f) Religion (g) Community (h) Nature of blindness and (i) Type of blindness.

### 1.16 LIMITATIONS AND DELIMITATIONS OF THE STUDY

1. The present study deals with only Achievement in Environmental Science. As far as the categorical variables are concerned, Age Group, Gender, Locality, School Type, Socio – Economic Status, Religion, Community, Nature of blindness, Type of blindness and ICT awareness are considered. The space and time constraints forced the researcher to limit the variables into a few.

2. The survey selects only 144 visually challenged students studying in various schools for the blind in Tamil Nadu as the sample. The number of schools
for the visually challenged is very few in number. They are also not
distributed uniformly throughout Tamil Nadu. More over, time, space and
financial constraint, the difficulties faced by the researcher in obtaining
permission from the management, travel problems etc made the sample
limited only to 144.

3. With regard to technology, the researcher used JAWS only for teaching
Environmental Science. There are numerous technologies available for the
visually challenged students helping them in various ways. But, in reality
only very few technologies are used in the teaching-learning process. JAWS
is one of the most popular technologies used by the visually challenged
students. Hence the researcher took it for his study. The future researchers
may take up other technologies such as GPS, Social networking, etc for the
teaching-learning process of visually challenged students.

4. The present study has compared the control group students studying with
Braille method with the experimental group students studying with JAWS.
The future researchers may take two ICT enabled methods and compare their
relative effectiveness rather than taking Braille for comparison.

5. The present study has taken Environmental Science for finding the
effectiveness of ICT enabled learning of the visually challenged students. As
far as visually challenged students are concerned, taking subjects such as
Science, Maths, Computer Science, etc for the research purpose needs more
expertise in Special Education. Teaching of Science and Maths need many
other high end technologies as well. On the other hand, Environmental
Science is somewhat common for the secondary classes (IX and X). It is easy to handle and there is a plenty of real life examples available in this subject. This has limited the researcher to take up Environmental Science for the present study.

1.17 CHAPTERIZATION

The thesis is organized into the following chapters.

In **Chapter 1**, the research problem is introduced with historical and current perspectives.

In **Chapter 2**, a review of related previous studies conducted in India and abroad is presented.

In **Chapter 3** deals with the tools developed for the experiment, experimental procedure and the data collection methodology.

In **Chapter 4**, a detailed discussion on the data analysis, statistical techniques used and the interpretation are presented.

**Chapter 5** presents a summary of the findings and recommendations for future studies.

1.18 CONCLUSION

The first chapter is chiefly concerned with conceptual overview of the problem chosen for the study. The discussion on ICT for the education of visually challenged students has been presented to highlight the conceptual positions, with
which this study has been planned and conducted. A review of the related literature, design of the study, analysis and interpretation of the data and summary of results are dealt in the succeeding chapters.