Chapter-2: Designing the research study

2.1. Introduction

To build up a house everybody has to prepare what is known in engineer’s languages a blue print. In the same way when we initiate or undertake any scientific study, one has to prepare a research design. The research design is nothing but a plan for carry out the research study. An eminent research methodologist Dr. T. K. Oommen [8] use to say that the research design is not a strict jacket. It is for the guiding the research study, it is a tentative plan for the scientific study. Research methodologist Jahoda[11] and others tell us that every scientific study needs research design. While travelling in the open sea mariner’s compass shows the way in the same way research design is for guiding the path for research study.

Following the footsteps of Jahoda and others [11], Dr. Ramnik Bhatt[9] an eminent and experienced research scholar wrote in his book. The research design needs seven decisions not only vital but essential for conducting the research study.

2.2. Decisions for designing the research study

For the research design, the first decision is about objective of the study.
2.2.1. Objective of this investigation

In this research study the following five objectives were kept in view:

1. **TO KNOW** the existing pattern of uses of modern technology in the field of education and rehabilitation of the disabled.

2. **TO UNDERSTAND** the type of difficulty occurs in the life of disable people while using current tools and technology.

3. **TO ASSESS** the usefulness and effectiveness of this technology in references to educational process and the rehabilitation of disabled.

4. **TO SUGGEST** changes according to current use of technology to make them more useful and effective in process of education and rehabilitation of disabled.

5. **TO RECOMMEND** technology that may be useful in speedy education and effective rehabilitation of disabled.

In short, these five major objectives were kept in view while preparing the design for this research study.
2.2.2. Area of study

No research is conducted in vacuum. Therefore we have to decide about the area of study. It is also known as “Universe of discourse”.

For the purpose of this study, we have focused on physically and mentally handicapped institutions of Gujarat, which were using the computer science and information technology. To find out institutions in Gujarat, we took all India social survey to know how many institutes in Gujarat use ICT and other modern technology in the field of education and rehabilitation of physically and mentally challenged people.

From this survey, we came to know that there are number of institutions in Gujarat that use modern technology for education and rehabilitation of physically and mentally challenged people. For that, we prepared questionnaires and send it by post to various institutions.

In the continuation of above mentioned information, we send small schedule to know the difficulty of instructors who are teaching this modern technology to physically and mentally challenged students and also another schedule for learners i.e. students who are facing difficulties in learning and using modern technology tools and techniques.
And above all these tools and techniques for data collection we used informal discussion with instructors and learners whenever we visited the institutions.

Chapter-3 of this research report is devoted to research methods and techniques used in this study.

2.2.3. Field work period

It is essential and most important data of the study. Primary data is collected through various research method and techniques which are mentioned in chapter-3 of this research report. While some secondary data is collected from survey, questionnaires, schedules and also from the office of the institution whenever visited the institutions. These secondary information was received from the institutions administrator and head of institution.

For collecting above mentioned filed data it took nearly 1-year or more time. (The all above these field data has been analysed in chapter-4).

Meanwhile we have studied earlier researcher study focused in the field of physically and mentally challenged and tried to linkup with our study.
2. 2.4. Review of literature

While writing about research studies focused on computer and modern technologies used for the education and rehabilitation of the physically and mentally challenged people, we also mentioned names of the modern technologies used for the education and rehabilitation of the physically and mentally challenged people.

Usually technology is defined as a systematic development of methods, machines or process that help in the achievement of a given objective. “Assistive technology as any item, a piece of equipment or product system that is used to increase, to maintain or to improve the functional capabilities of the individuals with disabilities”. Further, assistive technology can be broadly conceptualized as any technology with the potentiality to enhance the better performance of persons with disabilities. It includes both low technologies and high-tech devices and it incorporates technologies designed specifically for people with disabilities.

Advances in technology have always been technically better, faster and cheaper products which make life more convenient and organized. For people with disabilities, the promise is quite greater because, technology helps in turning their long cherished dreams into realities which may include a dream to play a game of chess with their friend, write a letter to their relatives or give a presentation in the annual corporate meeting without any
assistance from other people. The ultimate ratio is independence and self-reliance achieved by the physically and mentally challenged people. It is all about making the less fortunate people free from bonds of reliance and taking charge of their lives. Technology is receiving the attention of families, advocates, legislators and professionals due to its potential for enhancing the lives of individuals with disabilities. From computers to communication devices in the world of technology offer many children and adolescents with disabilities the tools necessary to be more successful in school, at work and at achieving independence in daily living. Indeed, opportunities which were unimaginable then years ago are now becoming an available reality to some children with disabilities. With the assistance of new technology, the emerging technologies are raising new hopes in the life of physically and mentally challenged people.

The computers were the beginning of the new information technology. Information (facts, knowledge, data, and news) technology (materials, tools, systems and techniques) is the key to economic growth. It is likely to bring about substantial changes in society and may change the lives for better or worse in very short time. It will improve the quality of life for many people by making information more accessible and opportunities available for all. The greatest gain will be for educationally disadvantaged among them students with physical and mental disabilities.
Emerging technologies help the disabled people with substantial gain not only as physical independence but also as the requisite skills to become an important part of the society and economy. Till recent time, people with certain disabilities could not fully exploit the potential of PCs. For instance, if they are unable to use a keyboard or mouse they can’t input information. But this has changed. Computer manufacturers and software developers are focusing on assistive and adaptive technologies. The traditional input devices such as keyboard and mouse require good dexterity and thus cause problems for most users with physical disabilities. Likewise, output tools such as standard screen displays are of little help to the visually impaired.

A computer aided tool meant for the mentally retarded, tries to assess their knowledge, using the visual media as a tool for training. It helps to make the children interact more effectively, to test and analyse their performance so that they develop self confidence and self esteem.

Deaf children can learn easily by seeing pictures. Teaching children with the help of computer and the visual media is an interactive and interesting process. Vagmi software for the deaf and dumb, being used for speech therapy has been found to be successful with the hearing impaired children. It helps them to understand and speak better[3].
Apart from physical disabilities like deafness and blindness, academic underachievement may be due to specific learning disability. Lessons and text could be made interesting to children with learning disability, if they are presented on a computer effectively. Assessment process can be made interesting with the help of computer aided tools. Remediation could also be done more effectively through the visual medium. The response of the children, who have been using the computer aided lessons, is very encouraging. Children love to click the buttons and see the pictorial representations. They welcome this kind of joyful method of learning.

According to Ambati Nageswar Rao study[19], it shows that people with disabilities have the right to expect the same standard of services and equitable access to information and knowledge as every other member of the society. The information and communication technology has paved the way for the challenged people physically or mentally to ameliorate their life by providing appropriate educational environment and equipments suitable for their development.

According to research conducted by Ted S. Hasselbring and Candyce H. Williams Glaser[25] use of computer technology for word processing, communication, research, and multimedia projects can help the students with specific learning and emotional disorders keep up with their non-disabled peers. Computer technology has also enhanced the development of
sophisticated devices that can assist the students with more severe disabilities in overcoming a wide range of limitations that hinder classroom participation from speech and hearing impairments to blindness and severe physical disabilities. However, many teachers are not adequately trained on how to use technology effectively in their classrooms, and the cost of the technology is a serious consideration for all schools. Thus, although computer technology has the potential to act as an equalizer by freeing many students from their disabilities, the barriers of inadequate training and cost must first be overcome before more widespread use can become a reality.

2.2.4.1. Assistive devices useful for physically and mentally challenged people

Various tools and techniques used for physically and mentally challenged people are as given bellow:

2.2.4.1.1. Independent living aids

A wide variety of products and appliances help people to perform “activities of daily living” i.e., eating, food preparation, bathing, and dressing.

Kitchen items include easy-to-grip silverware, high-lipped dishes and plate guards, specialized cutting boards and utensils, self-
opening scissors, reaching tools and jar openers: all these are most useful product for disabled people.

Many times bedroom items which include bed bars, bedside organizers, reaching tools, various orthopedic support cushions, hip pads for fall protection, bedside commode, transfer board, night lights and large-numeral alarm clocks.

Bathroom items include full-length tub mats, bathtub and shower seats, transfer benches, toilet riser or raised commode, night lights, long-handled scrub brushes, shampoo basins, lotion applicators, colored tape or mark for hot water controls and hand-held showerheads, are most help devices for the disabled persons.

2.2.4.1.2. Personal Care Products

A variety of personal care products are designed to help people with physical or cognitive limitations for dress, disrobe, groom and maintain good hygiene.

Dressing and grooming aids include dressing sticks, elastic or non-tie shoe-laces, buttonhooks, zipper pulls, velcro, easy-to-pull sock and panty-hose aids, long-handled combs and brushes, pumps for soap or toothpaste, and various reaching tools are helping tools for disabled people.
Adaptive clothing is designed for people who have difficulty dressing because of cognitive and/or physical disability, or who need frequent changing due to incontinence. The clothing is made to be both fashionable and convenient. They are helpful to persons with disabilities.

2.2.4.1.3. Medication Aids

People with chronic illnesses often take several prescription or non-prescription medications daily for which the following devices can be helpful.

Daily or weekly pill organizers can help ensure that correct dosages of medications are taken each day.

Timers and specialized mini-alarms can remind when the next dose is due. In same way pill crushers and splitters help when swallowing is difficult. Medication aids are available in many drug stores and hospital pharmacies can be useful to handicapped people.

2.2.4.1.4. Assistive Technologies for Improving Mobility

Anyone who needs assistance in walking, the following assistive technologies are helpful:
Canes are certainly simple but effective walking aid. Designs of this cane include folding canes, adjustable canes, double-grip canes and three- and four-pronged canes. In the same ways walkers provide more stability and should be tested to make sure they are sturdy, light-weight, at a sufficient height for the individual, and can be moved or rolled easily. Foldable walkers and those that double as a seat are also convenient. Many people like to attach a basket or pouch on the front to store things.

Wheelchairs come in many different varieties (both manual and electric). In case, you may want to consider getting removable footrests and/or a collapsible wheel-chair for loading into a car for added convenience. Other wheel-chair accessories such as rim covers, gloves, seat covers, cushions, security pouches and carry packs can also be handy.

Manual wheelchairs require the person to use some arm strength or leg strength and skill to move the chair unless there is someone to push. A lowered wheelchair, called a “semi-height” wheelchair allows a person’s heels to touch the floor and is recommended when a person uses their feet to move the chair.

Electric or “power” wheelchairs are useful for individuals who can move around on their own but lack the strength to wheel them. Electric wheelchairs require the ability to make decisions and maneuver the chair. They are often not recommended for someone with impaired judgment.
Three-wheeled scooters are a great option for individuals who are able to get in and out of the chair. Scooters are popular among individuals with Multiple Sclerosis or those who can walk very short distances and get around by themselves.

2.2.4.1.5. Assistive technology for communication

Advances in computer and telephone technology have greatly helped the disabled and frail elders to live independently while maintaining connections to family, friends and support services.

Modified telephones may use large buttons, headsets, speakerphone facility, or keyboard and visual displays to make telephones useable by disabled people.

Computer technology can allow people to stay in contact via email, while more sophisticated technology can employ modified keyboards or voice recognition software to enable disabled individuals to use computers effectively.

For people with communication difficulties due to stroke, ALS, aphasia, quadriplegia or other disorders, assistive technology can be very helpful in allowing them to communicate with others. Rapid advances in technology have resulted in products that dramatically increase the independence of people with very limited mobility, allowing them to “speak,” operate lights and
other controls, and remain active members of their families and communities.

Communication boards can be simple low-tech plastic boards with graphics and a keyboard-style letter display to convey messages. Automated boards with voice input or a computer screen are also available.

Voice-or eye-activated communication systems allow people with complex physical difficulties to operate a computer or a telephone to communicate with others.

Speech amplification and adaptation systems are automated speech processing systems which can correct garbled speech for improved communication.

2.2.4.2. Various tools for disabled people

The following tools can be helpful for disabled people:

**Track Balls:** It is an alternative to a mouse and allows users with limited hand movement to steer cursor and can be mounted on a mechanical arm from a wheel chair at head height for chin control and access.

**Screen Magnification:** This enables user (Visual impaired) to magnify the screen output as much as eight to sixteen times.
**Screen readers:** Targeted at visually disabled people screen reading software allow users to hear what is displayed on the screen, right from columns to text to graphics.

**Braille Display:** Working on the lines of Braille language, this assistive technology enables the visually impaired user to track a cursor and read the screen by moving fingers across the raised dots.

**Voice input:** Popularly known as speech recognition, it allows users to speak into a microphone connected to the PC. The computer obeys the oral commands.

**Alternative keyboards:** Similar to the traditional keyboard, they have larger keys or buttons for convenience and accessibility.

**Single switch scanning displays:** Large colorful switches to control a computer through an onscreen display that simulates a keyboard. Users can activate the switch with hand, foot and facial motion.

**Screen displayed keyboard:** Using any mouse alternative tool, disabled persons with little or no dexterity can activate keyboard function with an onscreen keyboard.
2.2.4.3. Assistive technology for mild disabilities

In their research study Lahm and Morrissette[44] outlined seven areas of instruction where assistive technology could assist students with mild disabilities. These areas include:

1. Organization of work.
2. Note-taking for the study.
3. Writing assistance in preparing write up.
4. Productivity enhancement.
5. Access to reference materials need for further development.
6. Cognitive assistance helpful in cognitive field.
7. Materials modifications to be used for helping the handicapped.

The detail is on how these seven areas are useful for mild disability.

1. **Organization**: This includes teaching the students to organize their thoughts or work using flowchart, task analysis, webbing or networking ideas and outlining. These strategies can be accomplished using graphic organizers to a visually assisted student in developing and structuring ideas.

2. **Note-taking**: A simple approach is for teachers to provide copies of structured outlines for student to use in filling information. A high tech approach might include optical
character recognition, which is a software that can transform type texted into computer readable text using a scanner.

3. **Writing assistance:** Word processing may be the most important application of assistive technology for student with mild disabilities. Computers and word processing software enable student to put ideas on paper without the barriers imposed by paper and pencil.

4. **Productivity:** Assistive productivity tools can be hardware based, software based or both. Calculators for example, can be the credit card type or software based which can be popped and use during word processing, spreadsheets, databases and graphics. Software also offers productivity tools enabling students to work on mathematics or other subject that may require calculating, categorizing, grouping and predicating events.

5. **Access to reference material:** Many students with mild disabilities have difficulty in gathering and synthesizing information for their academic work. In this arena telecommunication and multimedia are providing new learning tools to the student. A computer and a modem can transport students beyond their physical environment to access electronic information. Multimedia based tools are another way in which information can be made accessible to students. Multimedia use of text, speech, graphics, pictures and audio
video in reference based software is especially effective in meeting the heterogeneous learning needs of students with mild disabilities.

6. **Cognitive Assistance:** A vast array of application programme software is available for instructing students through tutorials, drill and practice, problem solving and simulations. Many of the assistive technologies described previously can be combined with instructional programmes to develop and improve cognitive and problem solving skills.

7. **Material modification:** Special educators are familiar with the need to create instructional materials or customize materials to meet the varied need of students with disabilities. Authoring software allows teachers and students to develop instructional software that incorporate video pictures, animations and text into hypermedia based instruction. Multimedia authoring software is very easy to learn and use.

IT has opened new avenues for the disabled people in the job market. More people are being hired in the IT sector despite their visual, hearing, mental or motor impairments. The logic being that most disabilities hamper physical environment, but not the grey cell. Armed with mobile computing technology, disabled people can stay at home and telecommunicate.
The web hosts a gamut of sites relating to information and assistance on disabilities. Search the database for medical help, attend a conference, discuss legal issues with law firm, look for a accommodating the disabled people.

The internet also provides emotional support and bonding to the fraternity. All major chat sites that have special room and channels where people with similar handicap can get together and talk.

2.2.4.4. Tools for working toward empowerment.

Nowadays, governments promote computer education among the disabled. Global IT giants including Microsoft, Sun, IBM and Apple are committed to advances in assistive technology. They are striving to make better IT products and software for the disabled. Microsoft has accessibility and disabilities sites which has exhaustive information technology and tools that can help the handicapped make their lives better. The Redmond Giant released the latest version of Accessibility of the technology software that developers use to make programs more accessible to people with special needs and use accessibility aid like screen reader. IBM is not far behind in its efforts. It recently launched homepage reader for spoken web access for the blind and visually impaired. The new talking browser orally communicates all the contents and information presented on the computer screen including graphics description, tables and columns. Digital Equipment Corporation, a
leading player in text to speech technology, has special DEC talk software which lets developers create and employ application that speaks electronically to user. The software can transform ordinary text into natural sounding speech. Intel too has special products for difficulty press two key simultaneously, intelli-key allows the user to press the shift key followed by a letter key to type capital letter, two key in succession, not two keys at one time.

2.2.4.5. Assistive technology for blind person

In this section, we have tried to show how assistive technology can be helpful to blind people.

2.2.4.5.1. Brail slates

This devices include slates and frames where each dot is embossed downwards by stylus, this necessitate writing Braille in mirror image from right to left. Some Braille slats are part of a frame such that a two, line slate can be stepped down a page to give a same page of Braille. Plastic slates are lighter than metal ones by the hinges tend to have a lower life expectancy. Frames without hinges only work with a fixed size of paper, but are very popular as a pocket note taking device. The design of the handle of the stylus significantly affects the ease of use, but the large handles are less convenient to carry in the pocket.
2.2.4.5.2. Braille writing devices

Braille writing devices permit a blind person to write Braille on paper or plastic. The best known Braille write is the Perkins, which has the advantage of being upward –writing. This is particularly important if the device is to be used in the classroom. However, it only uses one side of paper which is a disadvantage in terms of the cost of the paper and the bulk of the Braille. A good Braille shorthand can work at 120 word per minute, not all the machines can operate this fast.

2.2.4.5.3. Communication devices

The simplest form of communication device is a magnetic board with raised metal. Later, this has the advantage of simplicity but it is very slow. A faster device is one where a keyboard is connected to a single cell Braille display; the disadvantages are that the deaf-blind person must be able to read Braille, and the cost of the device.

2.2.4.5.4. Devices for Embossed Graphics

Embossed diagrams can be useful to some blind persons for communicating graphical information. There is a need for systems for producing maps and diagrams for the blind as well as systems for drawing by the blind.
The choice of method of production will depend on the ultimate use of the map or diagram and on financial considerations. Traditionally copies have been made on Manila paper, but this material imposes physical limitations on the design. There is a limited range of discriminable symbols, relatively low height of embossing and paper is not suitable for outdoor use in wet climates. Many of the systems developed in recent years have employed vacuum forming of plastic sheets, which are more durable and capable of better symbol definition.

It has been found desirable to use more than one height of embossing, but many production systems are limited to a single elevation. The optimum elevation of symbol will depend on whether the copies are monolithic, or the map is for outdoor use and the tactual sensitivity of the user. If the production system requires an accurate visual master for each elevation for embossing then the maps will be very expensive when only a few copies are required.

2.2.4.5.5. Screen magnification software

The main method of magnifying the image of visual display unit is conventional optical aids, enlargement of the display using a large monitor, enlargement of the characters using special software and closed circuit television. Nowadays, various screen magnification devices and software are available in market.
2.2.4.5.6. Screen reading software

A screen reading program will read text on the screen and output it as speech via a speech synthesizer sound card. Modern screen readers have been developed to interpret graphical user interfaces.

A supernova reader magnifier supports a combine feature screen magnification, reading and Braille output.

A Job Access With Speech (JAWS) is a computer screen reader program for Microsoft Windows that allows blind and visually impaired users to read the screen either with a text-to-speech output or by a refreshable Braille display.

2.2.4.5.7. Close Circuit Televisions (CCTV)

Closed circuit television confers certain benefits not available from conventional optical devices—greater magnification, ergonomic advantages of a normal reading position, variable magnification with zoom lenses, image reversal and an electronic window or underlining facility to assists in reading just one line of print. The disadvantages are that CCTV system are not readily portable compared with optical systems and they are relatively expensive. Some CCTV systems can be connected to a PC, which gives the user a choice to view full screen CCTV, full screen PC or split screen. An internal or external card will be required for the PC-
CCTV interaction to take place and the PC may require screen magnification software.

2.2.4.5.8. Computer Controlled Braille Embossers

A Braille embosser is the Braille equivalent of an ink printer. It embosses patterns on paper or thin card to produce tactile Braille symbols. These products vary according to whether they have been developed for use at home or as production level machines. As a consequence, the unit varies considerably in price and size. Braille embossers increasingly offer the option of embossing in 8 dots in addition to 6 dots Braille; some products can emboss graphics as well. Most embossers use continuous fan fold paper but a few allow the use of single sheet paper, thin card and plastic sheet. Paper densities vary and the option of adjusting the printer pressure is a useful features as are the ability to Braille on both sides of the page or sideway on a page.

Braille translation software is required by some machines in order to translate computer text and graphics to Braille; this software can be obtained from the manufacturer. Some machines can print Braille directly from an ASCII file.

2.2.4.5.9. Electronic Reading Devices

An electronic reading system is comprised of two main parts: input and output. The input component is made up of an image
scanner and optical character recognition (OCR) software. Output is mainly auditory but may also be tactual, enhanced visual or some combination of these modalities.

The image scanner, OCR software and output system can be purchased as separate components to be linked to a PC or as an integrated standalone system.

There have been considerable advances in optical character recognition in recent years and the trend is likely to continue; the accuracy is improving and the prices are coming down.

2.2.4.5.10. Braille Display

A Braille display is an electronic device that connects to computer by way of a serial or parallel cable. The display is made up of line of soft cell, each with 6 or 8 pins that move up and down to represent the dots of Braille cell. The display is used to represent a line of text on a computer screen. Each cell has 6 or 8 metal or nylon pins that are driven by electromechanical or piezo electric output – the latter having the advantage of lower current consumption. The user can read a line of Braille cells by touching the pins of each cell as they pop up. After a line has been read the user can ‘refresh’ the display in order to read additional lines.

Braille displays increasingly have a router button that allows control over the position of the text cursor. Pressing the router
button of a particular cell will move the cursor over that particular letter of the text. Extra ‘status’ cells are available in some displays to provide additional information such as the row and column coordinates cursors screen position.

The number of Braille cells in a display can vary. A full size display is 80 cells long which match the character width of a word processor screen. Smaller display read the same line of text in stages.

Braille displays are often combined with other hardware and software to make up an integrated unit. For instance, the Braille displays are connected to PCS to SERVER as the display unit and thus it may incorporate speech output of the screen prompts.

2.2.4.5.11. Braille Editing and Translation Software

In many countries, contracted Braille is commonly used in this system contraction and abbreviations are used and sometime the rules governing their use are dependent on pronunciation and meaning. Computer programs were developed originally because of the shortage of transcribers for translating text into contacted Braille. Such programs also handled the formatting of the Braille. Over the years these programs have become much more sophisticated and can access direct input from a range of inputs.
2.2.4.5.12. Web Browsers for non-visual output

Blind and partially sighted people will use one of three possible methods to read pages on the world wild web. User with some sight can use screen magnification software. For users with little or no useful sight, the options are speech synthesizers or sound card to convert into speech or a refreshable Braille display to convert text into Braille.

Since neither speech nor Braille can interpret images, the design of the web page should confirm to the accessibility guidelines for the visually impaired. In particular the body of the text on the web page should use a character-based and images should have text labels.

This page is devoted to the limited number of products specifically designed for blind or partially sighted users. Alternatively it is now possible for visually impaired users to use screen readers and speech synthesizers in conjunction with Microsoft’s internet explorer or Netscape navigator to access the internet.

2.2.4.5.13. Canes

The cane is intended solely as signal to others that the user is visually disabled. The long cane is a lightweight road or tube which is swung in front to the person in an arc of about the width of the body. The length of the canes should be adjusted to suit the
height of the user. The rigidity of the cane is important since it partly determines the amount of information the user can gain about the road surface. Folding canes are very useful since rigid can be nuisance on public transport.

A cane gives no information about obstacles at head height such as overhanging branches, for this a guide dog or electronic device is necessary.

2.2.4.5.14. Electronic mobility devices

Considerable resources have been devoted to developing mobility devices for blind people with no useful vision. These electronic aids utilize ultrasonic, laser or infrared technology. Ultrasonic aids can suffer from problem with detecting smooth surfaces at oblique angles, infrared aids can have problem in detecting clear glass.

Most of these devices are best used in conjunction with a long cane or guide dog. Training in the uses of these electronic devices is almost essential to obtain optimum performance.

According to Sharada Prasanna Rout article[21], the persons with visual impairments continue to struggle to gain education in contemporary areas relevant to the market place and their disability. Technological progress has much to contribute to this state of affairs, with highly inaccessible computerization of many
online educational courses. Educational institutions have been slow to ensure accessibility of learning materials and environments for these people. Studies show that assistive technologies significantly help disabled students in general and visually impaired in particular to excel in teaching and learning. These technologies comprise a number of products which include a wide variety of software applications, input devices and hardware which allow visually impaired students to perform difficult tasks independently. But ultimately, the educational institutions (colleges or universities) must provide facilities to all students based on the individual needs in support of their willingness to learn. Inadequate teacher training, lack of awareness, infrastructural deficiency and high cost are some of the major problems in the use of technology. But with willingness, appropriate effort and positive outlook these shortcomings can be overcome. All teachers need training for using assistive technologies and special products effectively to address the needs of the students with various disabilities including visually impaired. Thus, it is important to become familiar with the issues surrounding the use of technologies for all individuals who are involved in policy decisions, teacher training and in the funding of educational technologies. By working together, parents, teachers, administrators and students with disabilities and their non-disabled friends can help to create technology friendly environments in which all students have opportunities to learn.
2.2.4.6. Assistive technology for Speech & Hearing Impairment

There are other areas of handicap to which may include speech and hearing impairment. To help them certain assistive technology can be helpful.

Before discussing usefulness of assistive technology, it is necessary to clarify the meaning of assistive technology.

The terms assistive device or assistive technology can refer to “any device that helps a person with hearing loss or a voice, speech, or language disorder to communicate”. The terms often refer to devices that help a person to hear and understand what is being said more clearly or to express thoughts more easily. With the development of digital and wireless technologies, more and more devices are becoming available to help people with hearing, voice, speech, and language disorders communicate more meaningfully and participate more fully in their daily lives.

Health professionals use a variety of names to describe assistive devices:

Assistive listening devices (ALDs) help amplify the sounds you want to hear, especially where there is a lot of background noise. ALDs can be used with a hearing aid or cochlear implant to help a wearer hear certain sounds better.
Augmentative and Alternative Communication (AAC) devices help people with communication disorders to express themselves. These devices can range from a simple picture board to a computer program that synthesizes speech from text.

Alerting devices connect to a doorbell, telephone, or alarm that emits a loud sound or blinking light to let someone with hearing loss know that an event is taking place.

Several types of ALDs are available to improve sound transmission for people with hearing loss. Some are designed for large facilities such as classrooms, theaters, places of worship, and airports. Other types are intended for personal use in small settings and for one-on-one conversations. All can be used with or without hearing aids or a cochlear implant. ALD systems for large facilities include hearing loop systems, frequency-modulated (FM) systems, and infrared systems.

Hearing loop (or induction loop) systems use electromagnetic energy to transmit sound. A hearing loop system involves four parts: a sound source, such as a public address system, microphone, or home TV or telephone, an amplifier, a thin loop of wire that encircles a room or branches out beneath carpeting and a receiver worn in the ears or as a headset

Amplified sound travels through the loop and creates an electromagnetic field that is picked up directly by a hearing loop
receiver or a telecoil, a miniature wireless receiver that is built into many hearing aids and cochlear implants. To pick up the signal, a listener must be wearing the receiver and be within or near the loop. Because the sound is picked up directly by the receiver, the sound is much clearer, without as much of the competing background noise associated with many listening environments. Some loop systems are portable, making it possible for people with hearing loss to improve their listening environments, as needed, as they proceed with their daily activities. A hearing loop can be connected to a public address system, a television, or any other audio source. For those who don’t have hearing aids with embedded tele-coils, portable loop receivers are also available.

FM systems use radio signals to transmit amplified sounds. They are often used in classrooms, where the instructor wears a small microphone connected to a transmitter and the student wears the receiver, which is tuned to a specific frequency, or channel. People who have a telecoil inside their hearing aid or cochlear implant may also wear a wire around the neck (called a neckloop) or behind their aid or implant (called a silhouette inductor) to convert the signal into magnetic signals that can be picked up directly by the telecoil. FM systems can transmit signals up to 300 feet and are able to be used in many public places. However, because radio signals are able to penetrate walls, listeners in one room may need to listen to a different channel than those in another room to avoid receiving mixed signals. Personal FM
systems operate in the same way as larger scale systems and can be used to help people with hearing loss to follow one-on-one conversations.

Infrared systems use infrared light to transmit sound. A transmitter converts sound into a light signal and beams it to a receiver that is worn by a listener. The receiver decodes the infrared signal back to sound. As with FM systems, people whose hearing aids or cochlear implants have a telecoil may also wear a neckloop or silhouette inductor to convert the infrared signal into a magnetic signal, which can be picked up through their telecoil. Unlike induction loop or FM systems, the infrared signal cannot pass through walls, making it particularly useful in courtrooms, where confidential information is often discussed, and in buildings where competing signals can be a problem, such as classrooms or movie theaters. However, infrared systems cannot be used in environments with too many competing light sources, such as outdoors or in strongly lit rooms.

Personal amplifiers are useful in places in which the above systems are unavailable or when watching TV, being outdoors, or traveling in a car. About the size of a cell phone, these devices increase sound levels and reduce background noise for a listener. Some have directional microphones that can be angled toward a speaker or other source of sound. As with other ALDs, the amplified sound can be picked up by a receiver that the listener is wearing, either as a headset or as ear-buds.
Augmentative and Alternative Communication devices (AAC): The simplest AAC device is a picture board or touch screen that uses pictures or symbols of typical items and activities that make up a person’s daily life. For example, a person might touch the image of a glass to ask for a drink. Many picture boards can be customized and expanded based on a person’s age, education, occupation, and interests.

Keyboards touch screens, and sometimes a person’s limited speech may be used to communicate desired words. Some devices employ a text display. The display panel typically faces outward so that two persons can exchange information while facing each other. Spelling and word prediction software can make it faster and easier to enter information.

Speech-generating devices go one step further by translating words or pictures into speech. Some models allow users to choose from several different voices, such as male or female, child or adult, and even some regional accents. Some devices employ a vocabulary of prerecorded words while others have an unlimited vocabulary, synthesizing speech as words are typed in. Software programs that convert personal computers into speaking devices are also available.

Augmentative and alternative communication devices are available for communicating by telephone:
For many years, people with hearing loss have used text telephone or telecommunications devices, called TTY or TDD machines, to communicate by phone. This same technology also benefits people with speech difficulties. A TTY machine consists of a typewriter keyboard that displays typed conversations onto a readout panel or printed on paper. Callers will type messages to each other over the system through the relay service, a communication assistant serves as a bridge between two callers, reading typed messages allow to the person with hearing impairment while transcription is displayed text for the person with hearing loss.

With today’s new electronic communication devices, however, TTY machines have almost become a thing of the past. People can place phone calls through the telecommunications relay service using almost any device with a keypad, including a laptop, personal digital assistant, and cell phone. Text messaging has also become a popular method of communication, skipping the relay service altogether.

Another system uses voice recognition software and an extensive library of video clips depicting American Sign Language to translate a signer’s words into text or computer-generated speech in real time. It is also able to translate spoken words back into sign language or text.
Finally, for people with mild to moderate hearing loss, captioned telephones allow you to carry on a spoken conversation, while providing a transcript of the other person’s words on a readout panel or computer screen as back-up.

Alerting or alarm devices use sound, light, vibrations, or a combination of these techniques to let someone know when a particular event is occurring. Clocks and wake-up alarm systems allow a person to choose to wake up to flashing lights, horns, or a gentle shaking.

Visual alert signalers monitor a variety of household devices and other sounds, such as doorbells and telephones. When the phone rings, the visual alert signaler will be activated and will vibrate or flash a light to let people know. In addition, remote receivers placed around the house can alert a person from any room.

According to P Shubha Rajam and Dr. G. Balakrishnann [38], The Sign Language is a method of communication for deaf – dumb people. The proposed method, a set of 32 signs, each representing the binary ‘UP’ & ‘DOWN’ positions of the five fingers is defined. The images are of the palm side of right hand and are loaded at runtime i.e. dynamic loading. The method has been developed with respect to single user both in training and testing phase. The static images have been pre-processed using feature point extraction method and are trained with 10 numbers of images for each sign. The images are converted into text by identifying the
finger tip position of static images using image processing techniques. The proposed method is able to identify the images of the signer which are captured dynamically during testing phase.

2.2.4.7. Assistive technology for Mental Retardation

Now, let us discuss to how assistive technology can be useful to mentally retarded and cognitive/language impairments.

Assistive technology is the term used to describe devices used by children and adults with mental retardation and other disabilities to compensate for functional limitations and to enhance and increase learning, independence, mobility, communication, environmental control and choice. It also refers to direct services that assist individuals in selecting, acquiring or using such devices.

As per the Persons with Disabilities (PWD) Act, 1995, mental retardation means a condition of arrested or incomplete development of mind of a person which is specially characterized by sub normality of intelligence. This condition may occur in the form of borderline mental retardation, mild mental retardation, moderate mental retardation, severe mental retardation and profound mental retardation. The assistive devices for the persons with mental retardation include worksheets, workbooks, picture boards, charts, pencil grip to aid in writing skills, educational toys and games, blocks, models of common objects, letters, numerals etc. and need based special devices for performing Activities of
Daily Living (ADLs) and educational materials. The assistive device may also be any item advised by the Rehabilitation Professional or treating physician.

The following devices may help them to live at home more safely: Memory aids including jumbo analog wall clocks with daily calendar, talking clocks/wrist watches, voice-activated phone dialers, automated pill dispensers with message machine and timer, and a Find-It beeping device to keep track of small items such as car keys and glasses.

Symbols or warning signs on doors, cabinets and dangerous appliances can help a person with dementia maneuver more safely around the house.

If he/she forgets where he or she is, the following can be quite helpful:

Mobility monitors and tracking systems come in a variety of designs, though all usually require that a person wear a small ankle or wrist transmitter. The transmitter triggers an alert on system or a receiver which you can monitor when person passes beyond a set range or exits activated doorways.

In the article of Zh. Yankova, A. Yaniana article[43], Assistive technology has an important role to play in ensuring that inclusive learning is available to all students. In theoretical and applied
aspect, the priority defined is as development and approbation of methodology for evaluation of the individual needs of children and students with mental retardation from the assistive devices and technologies in their education, qualification of teachers and teams for complex pedagogical evaluation of the contemporary assistive devices and technologies for children and students with mental retardation.

According to Dr. Yaspal Sing and Dr. Anju Agraval’s study [27], the group taught with the help of computer games produced significantly greater remediation of mathematics skills as compared to the group taught through conventional method of teaching.

2.2.4.8. Assistive technology for locomotor Impairments

Among physically handicapped, there are some people with problem of physical or locomotor impairments.

It is necessary to discuss how assistive technology can be helpful to this type of disabilities.

Assistive devices help people with disabilities do what nondisabled persons can do. They can help people with physical disabilities overcome limitations. However, assistive devices are not always available. According to WHO, in some countries only 5 to 15% of physically disabled people can afford assistive devices.
2.2.4.8.1 Wheelchairs and Walking Aids

Wheelchairs help people who cannot stand or control movement of their lower body move around. There are many different types of wheelchairs. Some wheelchairs are manual which means that a person pushes it to move. Others are electric so it can be operated by an electric motor. There are also special wheelchairs that allow people to do specific activities such as sports. For people who have some ability to stand and walk, there are different types of walkers that help persons with physical disabilities keep balance. A Special type of scooter and other moving devices are also available for moving and performing other relevant activities.

2.2.4.8.2. Prosthetic Devices

Prosthetic device replace a missing body parts. So the people who are born with missing limbs or had limbs amputated can replace them with a mechanical one. Today's prosthetic devices look almost like real limbs and can be designed for many purposes. Prosthetic devices are custom made for each individual and they need to be replaced when a person grows or gets heavier.

2.2.4.8.3. Computer Devices

The computers help people with physical disabilities to communicate. Some of them use Alternative Communication System and enter symbols or codes in the computer. Sometimes
they use head pointing devices because the rest of their body cannot be used in communication. In the future computers may make our world more equal because physically challenged people can communicate, work from home, take classes online or even shop and order online.

On the bases of this long and detailed discussion, we can note down most important two points:

1. There are many assistive technology and devices which are quite helpful to the handicapped.
2. This discussion indicates that there are very few studies on modern technology helpful to the various group having physical or mental disabilities.

Looking to this reality prevailing in this field of research, present research study is focused on usefulness of modern technology for better education and effective but speedy rehabilitation of all types of physically and mentally challenged people. Thus we can link up this research study with earlier studies.

Further, we firmly believe that such research project is most needed. For more detail, see last chapter of this report where we have discussed need and necessity of such research studies.
2.2.5. Research methods and technique used for data collection

While preparing research design for this research the most important decision was about tools and techniques used for collecting the data for this study.

For details, refer chapter-3 of this report which is devoted to methodology used in this study for collecting data.

2.2.6. Analysis of data

Here we wish to draw attention to the fact that entire chapter-4 is devoted to analysis of data collected for this research study.

2.2.7. Interpretation of data

Expert research methodologist including Jahoda and others[11] insist that research student must interpret the data for reaching to the conclusion of the research study.

In the last chapter, we interpret the data collected for this study and arrived at some conclusions which throw lights on how modern technology can be helpful for better education and effective rehabilitation of disabled persons.

2.3. Summing up Note

In this chapter, we made an attempt to design research study where we took seven vital decisions which are most essential for success of this research study.
In this chapter we have undertaken bibliography studies related to this research study and then we tried to link up this study with earlier study.

With this remarks we wish to give a full stop to this chapter which focused on research design a blue print for this research study.