B. Ed. Spl. Ed. (M. R. / H. I. / V. I)-
ODL Programme

AREA - C

C - 15 (H.I.) : TECHNOLOGY AND DISABILITY (H.I.)

A COLLABORATIVE PROGRAMME OF
NETAJI SUBHAS OPEN UNIVERSITY
AND
REHABILITATION COUNCIL OF INDIA

AREA - C
DISABILITY SPECIALIZATION
COURSE CODE - C-15 (H.I.)
TECHNOLOGY AND DISABILITY (H.I.)

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The Self Instructional Material (SIM) is prepared keeping conformity with the B.Ed.Spl. Edn.(MR/HI/VI) Programme as prepared and circulated by the Rehabilitation Council of India, New Delhi and adopted by NSOU on and from the 2015-2017 academic session.

Mohan Kumar Chattopadhyay
Registrar

Netaji Subhas Open University

From the Vice-Chancellor's Desk

Dear Students, from this Academic Session (2015-17) the Curriculum and Course Structure of B. Ed.- Special Education have been thoroughly revised as per the stipulations which featured in the Memorandum of Understanding (MoU) between the Rehabilitation Council of India (RCI) and the National Council for Teacher Education (NCTE). The newly designed course structure and syllabus is comprehensive and futuristic has, therefore, been contextualized and adopted by NSOU from the present academic session, following the directives of the aforesaid national statutory authorities.

Consequent upon the introduction of new syllabus the revision of Self Instructional Material (SIM) becomes imperative. The new syllabus was circulated by RCI for introduction in the month of June, 2015 while the new session begins in the month of July. So the difficulties of preparing the SIMs within such a short time can easily be understood. However, the School of Education of NSOU took up the challenge and put the best minds together in preparing SIM without compromising the standard and quality of such an academic package. It required many rigorous steps before printing and circulation of the entire academic package to our dear learners. Every intervening step was meticulously and methodically followed for ensuring quality in such a time bound manner.

The SIMs are prepared by eminent subject experts and edited by the senior members of the faculty specializing in the discipline concerned. Printing of the SIMs has been done with utmost care and attention. Students are the primary beneficiaries of these materials so developed. Therefore, you must go through the contents seriously and take your queries, if any, to the Counselors during Personal Contact Programs (PCPs) for clarifications. In comparison to F2F mode, the onus is on the learners in the ODL mode. So please change your mind accordingly and shrug off your old mindset of teacher dependence and spoon feeding habits immediately.

I would further urge you to go for other Open Educational Resources (OERs) - available on websites, for better understanding and gaining comprehensive mastery over the subject. From this year NSOU is also providing ICT enabled support services to the students enrolled under this University. So, in addition to the printed SIMs, the e-contents are also provided to the students to facilitate the usage and ensure more flexibility at the user end. The other ICT based support systems will be there for the benefit of the learners.

So please make the most of it and do your best in the examinations. However, any suggestion or constructive criticism regarding the SIMs and its improvement is welcome. 1 must acknowledge the contribution of all the content writers, editors and background minds at the SoE, NSOU for their respective efforts, expertise and hard work in producing the SIMs within a very short time.

Professor (Dr.) Subha Sankar Sarkar
Vice-Chancellor, NSOU

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AREA - C

C-15 (H.I) : TECHNOLOGY AND DISABILITY

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C - 15 (H. I.) ❐ TECHNOLOGY AND DISABILITY

Unit 1 □ Listening Devices and Classroom Acoustics

Structure :

1.1 Introduction

Hearing impairment has a large impact on overall development and well being of the individual. Most importantly it impairs communication and makes the individual socially isolated. It is mandatory to reduce hearing problems in order to improve communication in individuals with hearing loss. Listening devices are instruments which provide the desired amplification for these individuals. The use of appropriate amplification device improves quality of life as the communication skills, academic performance, social life and mental well being of the hearing impaired individuals are positively enhanced. They become better integrated to the normal hearing world.

1.2 Objective

After completion of this unit, the student will be able to :

1. In this unit we will learn about various Listening Devices, their functioning, and utility.
2. In this unit we will learn about basic components and functioning of hearing aid, different types of hearing aid and different technologies used in hearing aid.
3. In this unit we will learn about the various outcome measures used in hearing impaired individuals
4. In this unit we will learn about various classroom amplification devices available. Individual and group systems will be discussed.
5. In this unit we will learn about the various implantable devices, their components, functioning and importance.
6. In this unit we will learn about recent updates in ADIP scheme (2014) and how it is important for hearing impaired individuals.
7. In this unit we will learn about care and maintenance of individual hearing aids, group hearing aids and cochlear implants.

1.3 Listening Devices:

What are Listening Devices?

Listening devices are used for hearing impaired individuals to compensate for their hearing loss. These devices aim at making all sounds available in the environment as well as speech of others, audible and clear for hearing impaired individuals. These

devices are available in a variety of types depending on style, size, capacity (power) and technology. There are many makes/brands available commercially which vary in price range again depending on the above mentioned types.

In some situations amplification device (such as hearing aids, Cochlear implants etc) is not sufficient alone. In such cases these devices are paired with Assistive Listening Devices. Assistive Listening Devices (ALD) can be worn separately or paired with the amplification device. e.g FM system, Loop induction system etc

Another very important classification is based on the place of stimulation done by the respective devices. The device can deliver amplified sounds directly to the external ear, or directly to the hearing nerve, or directly to the mastoid bone (bone behind external ear).

Listening devices again can be broadly classified as

1) Hearing Aids
2) Cochlear Implants
3) Middle Ear Implants
4) Bone Anchored Hearing Aids
5) Auditory Brainstem Implants.

1.3.1 Types

INDIVIDUAL VS GROUP LISTENING DEVICE

INDIVIDUAL LISTENING DEVICE - This type is useful for one individual at a time. It is called personalized device. The speech and other sounds are picked up by the device and delivered to the individual wearing it. The amplification device (hearing aid or cochlear implant) has a microphone on its surface to pick up sounds/speech, which is amplified inside the device and then delivered directly to the individual's hearing system. The individual can carry it with him/her. It is totally wearable and portable. Assistive listening device also can be individual in nature e.g FM system which can be paired with individual hearing aid.

GROUP LISTENING DEVICE - As the name suggests this system aims to help a group of hearing impaired individuals at the same time with a common device. This arrangement is usually used in a special classroom. The teacher has a microphone which picks up the teacher's voice, which is then amplified and sent to headphones/

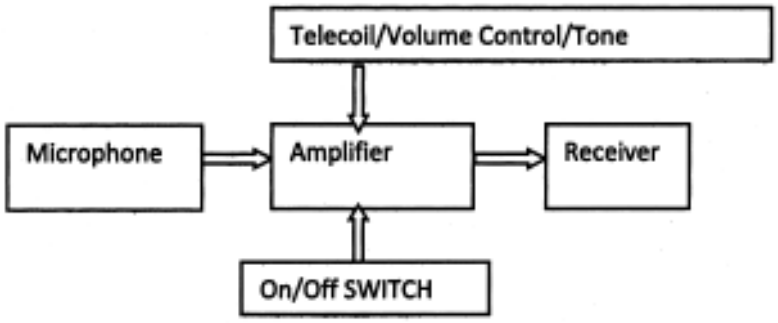
receivers worn by multiple students. So the teacher's voice is heard clearly by a group of students.

Assistive Listening Devices such as loop induction system can also be installed in large areas like classrooms where a loop is installed across the room. The sounds picked up by the microphone are transformed and run through the loop. The telecoil of the hearing aids worn by individuals picks up the signal and it is heard by the individual.

1.3.2 Functioning of Hearing Aids

Before understanding the basic working of a hearing aid, it is essential to know the parts of a hearing aid. The basic parts are as follows:

1) Microphone
2) Amplifier
3) Receiver
4) Telecoil
5) Volume Control
6) Tone Control
7) On/Off switch



Block Diagram of a Hearing Aid

The microphone picks up sounds around it and sends to the amplifier, where the sounds are amplified and filtered in many ways and then finally sent to the receiver which is worn by the hearing impaired individual in his external ear. The hearing aid is powered by a battery. The electronic components consist of transducers, capacitors, resistors, transistors, printed circuit boards are used. An electromagnetic coil system is used to make the telecoil, which helps to hear telephone conversation, speech in induction loop systems etc.

1.3.3 Classification of Hearing Aids

1.3.3.1 Based on Style

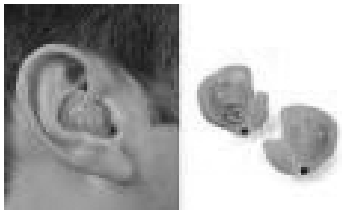
The earliest of amplification system were very basic, non electronic models like ear horns, trumpets etc. Research and development led to the first electric hearing aids which gradually improvised in style and size in order to satisfy the technological advancements as well as cosmetic preference of users. Hearing impaired individuals mostly wanted hidden hearing aids so the miniaturization of size was gradually developed in hearing aid industry.

1) **Body level hearing aids** - As the name suggests the hearing aid is worn on the body of the hearing impaired person(e.g. in the pocket/blouse). The body of the hearing aid has a cord which connects to a receiver, which looks like a button and worn in the ear of the hearing impaired person.

2) **Behind the ear type** - These hearing aids are wearable over the pinna or behind the external ear. The basic parts inside the hearing aid are similar to body level hearing aid only miniaturized in size and advanced technology. The whole hearing aid fits behind the ear, the receiver is also housed in the hearing aid case. The amplified sound reaches the ear via a ear mould or ear tip.

3) **In the ear hearing aids** - These hearing aids are wearable inside the ear, the body of the hearing aid sits in the ear canal with its external part/faceplate sits

at the start point of ear canal i.e. concha. As these hearing aids are smaller than the previous two styles, the internal parts are yet more miniaturized and placed closer to each other in the hearing aid case. As a result these hearing aids come with a lower output or capacity as compared with the previous two styles.



4) **Completely in the canal hearing aid** - This type is even smaller than the previous type and sits deeper inside the ear canal. It's almost invisible from outside. As it is even smaller, it has the lowest output/capacity among all styles. This type is customized and made according to the shape and size of the ear to be fitted.

5) **Receiver in the canal**- It looks similar to a miniaturized behind the ear hearing aid. The receiver of the hearing aid sits in the ear canal in a separate case/tip and connected via a slim tube with the rest of the hearing aid. The capacity of the receiver can be changed depending on the hearing loss of the person.

6) **Bone Conduction Hearing aid** - In some hearing impaired persons conventional hearing aids cannot be fitted. The reason can be malformation of external ear, absence of external ear or a actively discharging ear (presence of pus discharge most of the time due to some active infection in the ear). In these cases a body

type hearing aid/behind the ear hearing aid is fitted with a bone conduction receiver, which resembles the one used for bone conduction testing. The bone conduction receiver is placed on the mastoid bone behind the external ear. The amplified sound is transformed into vibrational energy and then delivered to the mastoid bone.

1.3.3.2 Classification Based on Technology

In earlier days the basic technology used in a hearing aid was quiet simple. All the signal/sound picked up by the microphone of the hearing aid was amplified by a common factor without any other alteration. The final sound delivered was just an amplified version of the input sound. However due to limitations of the components inside the hearing aid, the sound was degraded and distorted in most of the cases as it reached the user's ears. The problem increased when the loudness of the outside sound increased or when the signal was a speech in presence of a background noise. But with the advent of technology the hearing aid industry witnessed a lot of progress within a short span of time. As computer technology advanced, processing speed increased, it was possible to incorporate many features in the hearing aid with less power consumption. Also circuit size could be reduced dramatically.

The technology followed the development path:

Analog- Analog programmable- digital- digitally programmable

ANALOG HEARING AID

These hearing aids continuously make the incoming signal louder. The circuits treat all incoming signal similarly. As the incoming signal becomes louder the analog hearing aid makes it even louder. Some sort of limiting circuits are implemented in the analog circuit, where in the amplifier stops after the incoming signal crosses a particular level of loudness. It is used in Body type, Behind the ear and even In the ear hearing aids. This technology seems to be helpful for severe to profound losses as compared to

lower degrees. Moreover this technology works best for quiet environment. In noisy situations, speech is not clear, as speech and noise are amplified in a similar fashion. This technology will also be helpful for flat hearing losses as compared to sloping hearing losses. Usually the hearing aids using this technology come with simple controls. Other than volume control, there are certain trimmer control options (H N L). Wherein depending upon the slope of hearing loss, low/high frequencies can be emphasized. For flat hearing loss, N (normal) position is the best. Moreover the maximum power output (MPO) can also be adjusted wherein the overall output from the hearing aid can be reduced/increased according to patient's need. This technology comes with fixed gain and maximum output with minimum adjustments possible.

ANALOG PROGRAMMABLE

With the development in computer technology, hearing aids could be designed with a memory. The hearing aids could be programmed in different ways and the two or three programs could be stored and retrieved from memory. The programs can be two different settings in the same hearing aid. e.g one program for indoors and one for outdoors.

DIGITAL HEARING AIDS

Even more advancements in computer technology led to the advent of digital signal processors. Digital Signal Processors were used in hearing aids. This enabled the hearing aids to convert the input signal/incoming signal, picked by the microphone into digital signals (binary digits). This resulted in faster and much better processing i.e, the output was much better in quality and a better representation of the input signal (original sound). Many studies have shown that in the same group of persons with hearing loss, performance was much better with digital hearing aids than analog hearing aids. Special mention is the performance in challenging situations like in presence of background noise, performance with digital hearing aids is way ahead of analog hearing aids.

With the digital hearing aids, the amount of amplification depended on the level of input signal. So for a soft sound, more amplification was given whereas for a loud sound very little or no amplification was given.

DIGITALLY PROGRAMMABLE HEARING AIDS

This Variety of digital hearing aids could be computer programmed. The hearing aid has multiple memories, in which different programs can be stored. The user can change the programs according to specific needs, either with a tiny switch on the hearing aid or with remote control. These hearing aids can be programmed with the help of certain software, which are unique to various manufacturing houses. The hearing aid is connected to the computer via a programming interface. Special adaptors and cables are used for this purpose. Recently the whole arrangement could be made wireless, reducing the need of cables.

These hearing aids come in a variety of capacities, with minimum features to ample features including noise reduction strategy, feedback cancellation, and special treatment to sudden, loud sounds, enhancement of soft sounds, special treatment to speech sounds etc. The price range differs depending on capacity.

This type of hearing aids is contemporary, with most of the hearing impaired population fitted with this type. These are also available and approved by Govt.of India, under the ADIP scheme.

1.3.4 Outcome Measures

The performance with hearing aids needs to be evaluated irrespective of style and technology. The post fitting evaluation is done to understand how much actual benefit the user is receiving with the newly fitted aids. From infants to elder hearing impaired individuals, this assessment is mandatory. The fitting process completes after getting the results with hearing aid.

Certain outcome measures are employed to assess the benefit from hearing aids. These can be questionnaires, aided speech perception tests, aided audiogram, aided behavioral assessment. another handy and quick assesment tool is Ling sounds in Ling's 6 sound test.

1) **Ling six sound test-** Ling (1976, 1989) proposed this test where six speech sounds are used to assess the child's hearing with hearing aids. This is a simple tool and can be used by audiologist, speech-language pathologist, teacher and parents. It quickly gives us an idea about the child's hearing on a day to day basis. Infact after listening check, it must be a regular practice to use Ling six sound test in classroom, therapy and at home.

All the types of auditory response i.e awareness, identification and discrimination can be tested using these sounds.

These speech sounds /a/,/i/,/u/,/m/,/sh/ ,/s/broadly represent the speech spectrum

from 250-8000 Hz. This range is the same range tested by conventional audiometry. Initially the child can be demonstrated the desired response and this test can be administered. The baseline performance may be recorded and further results should be compared to it, any deterioration of response should be a matter of concern. The output of the hearing aid as well the child's hearing should be checked. It is desirable that the child hears all the sounds, but in some cases even in aided condition, certain sounds may not be heard at all, e.g /s/ .

2) **Aided audiogram -** The free field audiometry procedure is carried out in aided condition and the response is plotted on an audiogram. The test should be carried out with 250 Hz to 4KHz. Testing of 8KHz is not important as most hearing aids do not provide amplification in that range. In very young children and infant aided behavioral response may be noted as they cannot be conditioned. The aided performance can then be compared to unaided response to see the amount of benefit. Moreover the aided assessment should be carried out at a regular interval and compared with the baseline measure. Any discrepancy should indicate problem with hearing aid or hearing.

3) **Speech perception Tests** - Many tests use speech material like nonsense syllables, words, sentences to assess the aided performance. The test is again carried out in a free field condition and the speech can be presented live through the audiometer, which the individual can hear via loudspeakers kept at a distance, in aided condition. The speech is presented at around 40 dBHL. Recorded material can also be used. For young children with limited vocabulary, picture identification tests can be used.

4) **Questionnaires** - Various standardized questionnaires are used to get information about the benefit of the hearing aid. These questions are constructed for assessing the improvement in auditory/listening skills, communication skills, social life and quality of life. For very young children parental interviews are conducted to get information.

1.4 Earmoulds

Earmoulds are acoustic modifiers, being an integral part of the hearing aid (though not an actual part).Following are the characteristics of earmould :

1. These are custom made, i.e made according to shape and size of the user's ear. There is a hole made/canal through the ear mould body, which carries the amplified sound and delivers in the ear canal, Correct fitting of earmould ensures no leakage of sound and hence no feedback.

2. These are used with body type hearing aids, behind the ear hearing aids, the in the ear and completely in the canal hearing aids are housed in shells which are also customized.
3. It also acts as an anchor to hold the hearing aid in place and prevents falling of hearing aid.
4. Earmoulds come in different shape and texture (Hard or soft). The shape and texture of the ear mould is selected based on the type, degree and slope of hearing loss. To a certain extent age of the user and preference is also a deciding factor.
5. In a body type hearing aid the earmould is attached to the receiver. The button type receiver snuggly fits into the earmould. The other end of the ear mould sits in the ear canal and delivers sound. The sounds through earmoulds are much better than a uncustomized rubber tip. The sound is more complete, free from distortions and there is no annoying feedback.This type is called a full concha ear mould.

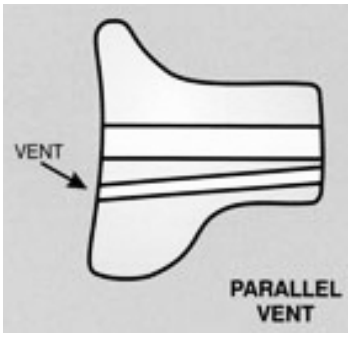
6. In a Behind the ear hearing aid the earmould comes fitted with a tube that is attached to the ear hook of the hearing aid.

7. Hard vs Soft earmould- The decision is mostly made by an audiologist,but it is also important to consider user's preference. Usually the sound passes well through a hard ear mould as the mould material does not sinks under pressure of the moving ear canal. But in some cases,users prefer a soft ear mould for comfort. In case of

very high powered hearing aids soft earmoulds are recommended,as they fit more snuggly with the ear canal reducing chances of feedback compared to heard ear moulds.Whereas in cases where hearing loss is moderate or mild,heard ear mould is always recommended.In case of very young children and elderly,whose ear canals are easily collapsable,hard ear moulds are recommended. Hard earmoulds are easier to insert and take out.

8. Venting- In some earmoulds an additional,bore/hole is created through the mould body,which is called a vent. This is done for users with better hearing in the low frequencies (upto 500 Hz), as the vent allows these sounds to pass naturally through it. This arrangement is done to reduce echo effect i.e patient hears his/her voice more naturally and feels comfortable. Moreover it is also done in users who feel fullness in ear with the hearing aid. There is no sensation of fullness in th ears and the sound clarity is also better However,in cases where the high frequencies have more severe losses,venting is not recommended. As it results in feedback problems.Moreover a vent helps in aeration of the earcanal. This is very helpful for users with a tendency to develop middle ear infections,ear dicarge etc.

The sound bore of the vent can be varied in position,and size to alter the acoustic properties of the amplified sound.e.g parallel vent helps to reduce the low frequency gain without affecting the high frequencies.



1.4.1 Types of Ear Moulds

1. **FULL CONCHA/Shell type** -As the name suggests,this type covers the whole of concha and provides a better acoustic seal. This type is recommended for young children and people with more severe hearing losses.

2. **HALF CONCHA/Half Shell Type-** The top portion of the full concha ear mould is removed for ease of wearing. Elderly people have dexetry issues,they find full concha earmoulds difficult to handle.

3. **SKELETON TYPE-** A big gap is created in the full concha style for a comfortable, lighter fitting.This type can be used for people needing full concha earmoulds but feel fullness and discomfort with a proper full concha type.So a gap is created in the concha part to ease out the fullness.

4. **TIP TYPE-** This type is recommended for milder hearing loss. The ear mould only sits in the ear canal part, leaving the concha free. This style is not recommended

for people with straighter ear canals and children(children have straighter ear canals compared to adults).As a straight ear canal will allow the earmould to fall out easily. Also not recommended for shorter ear canals.

1.4.2 Care and Maintenance of Earmoulds

As the ear moulds are in direct contact with the ear canal, they are exposed to ear wax, sweat and some discharge (if present). So they need regular cleaning. If not cleaned regularly, the sound tube will get easily blocked with ear wax etc, and the user will not be able to hear clearly. The tubing of the ear mould hardens after an interval of time, so needs to be changed regularly. Following care and maintenance regime can be helpful:

1. After each use, the earmoulds need to be wiped with a clean cloth and kept.
2. The earmould should be washed in water with mild cleanser. The receiver should be carefully removed before putting under water.
3. If wax/any other material gets stuck in the sound pipe, it can be cleaned by using a floss.(Usually audiologist assistance may be needed)
4. Hard moulds are breakable when dropped hardly or crushed under pressure. So care must be taken not to drop it.
5. The tubing bent must be changed regularly. If it gets hardened it may come out of the earmould. It can be reaffixed at an ear mould lab.
6. Soft moulds are tearable, so caution must be taken while inserting and taking out the ear mould. The soft material also hardens after a certain period if time indicating the need a new ear mould.

7. In case of young children, the ear canal shape and size changes with age. So they will need new earmoulds at a regular interval atleast till the age of 18 years.

1.5 Classroom Amplification Devices

In classrooms, where the area is large, the hearing impaired individual may face difficulties to hear speech of teacher and peers due to distance and effect of other factors such as noise and reverberation. In such situations hearing aids alone may not be useful; some additional assistive devices may be helpful. These devices can be useful for one individual at a time or can be used in a group of individuals.

1.5.1 Individual Devices

Speech Trainer

This device comes with a microphone for the speaker, the amplifier and headphones to be worn by the hearing impaired individual. The use of speech trainers have reduced in recent times, though many old schools still use these systems. The speech trainer comes with certain controls, where the output of the signal can be altered. The headset also comes equipped with a microphone, so that the user can hear own voice. This is also used during speech therapy sessions. Usually it is worn separately without the hearing aids.

Advantages

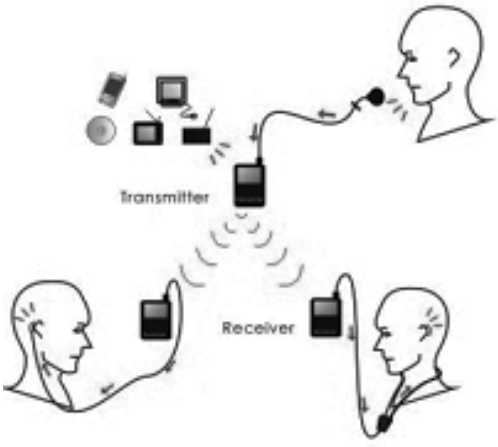
1. The teacher'/trainer's speech reaches the individual's ear easily and is less affected by the noise and reverberation in the room. As the signal is going mostly in the ear canal, hearing becomes much easier.
2. Usually these trainers come with high output capacity, so can be used for severe to profound hearing losses.

Limitations

1. Since it's a wired system, the mobility of the student and teacher is affected.
2. Cannot be used in groups.
3. Useful only for one to one teaching.

Personal neck loop system- The speech of teacher is picked up by a microphone worn by the teacher and sent to a loop worn by the student whose hearing aid is at telecoil position. The signal in the loop is picked up by the hearing aid and amplified.

FM System- These based on FM technology. These are typically used in schools. The teacher wears a microphone that is either clipped on to their collar or as a headset. This is connected to a transmitter, which sends out FM signals to the receiver unit worn by the student. It can also be carried around in the pocket everywhere. It helps reduce the background noise and improves speech clarity even at a distance. It can be used by a hearing impaired student in a normal classroom. It can be used as a individual or group device.



1.5.2 Group Classroom Amplification Devices

1. **Hardwire system -** These systems are permanently installed in a classroom. One unit with the microphone is connected to a number of headphones. The teacher's speech can be heard by a group of students at the same time. There are also separate microphones installed on student's desk, so that even their speech is audible to each other.

Induction loop system: One of the oldest and cheaper forms of assistive listening technology still popular in educational set ups. This system consists of microphone, amplifier, a loop of wire and receiver. The teacher's speech is picked up by a microphone and transmitted through a loop of wire. This wire generates magnetic field. This energy is picked by the individual hearing aid's telecoil. The received signal is then amplified by the amplifier of the hearing aid and converted into sound signal.

Advantages:

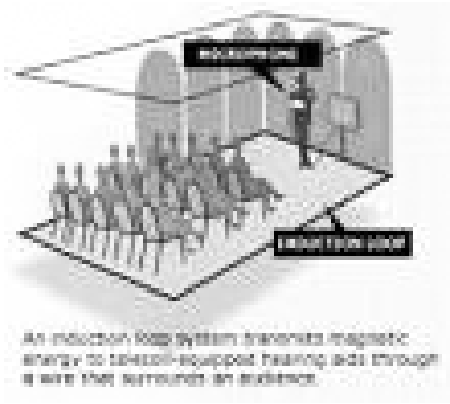
- This system can be installed in a large area, e.g.classrooms.
- It can be used by an individual, with an induction loop worn around the neck by an individual listener.
- Teacher's speech is clearly audible even at a distance
- Use of induction loop improves signal to noise ratio.
- The child can move freely within the loop area
- The system is used with the child's own hearing aids, so the electro- acoustic characteristics selected for a particular child are maintained in the signal received in the input that the child receives.
- The hearing aid can be kept on the MT setting, whereby the child can receive the teacher's voice through the telecoil and the other students' voice through the

microphone. This promotes interaction between the students.

- Low cost and maintenance.

Disadvantages:

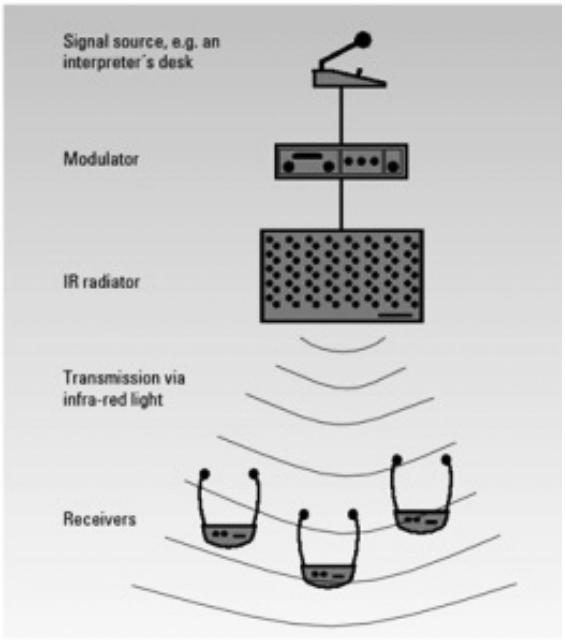
- Spill over: If there is more than one room looped in the same area, magnetic field generated in one room could be picked up by a tele-coil in an adjacent room.
- Fluorescent lights, transformers, electric power wires in the area may cause interference in the induction system, may sound like a hum in the output.



FM System -

This system consists of 2 parts - a transmitter unit and a receiver unit. The transmitter unit is made up of a microphone and a transmitter. The microphone converts the sound signal to electric signals. The transmitter then transmits sound via Frequency Modulated (FM) radio waves to the receiver unit. The receiver unit converts the FM radio waves into audio signal. The receiver unit is worn by the students with hearing impairment.

Infrared technology: Infrared systems pick-up the speaker's voice through a microphone, which converts sound signals into electrical energy. These signals are then sent to a receiver using invisible light rays. The signal is then changed into sound energy. Infrared is most useful for settings like auditoriums, television, audio-visual classes for children.



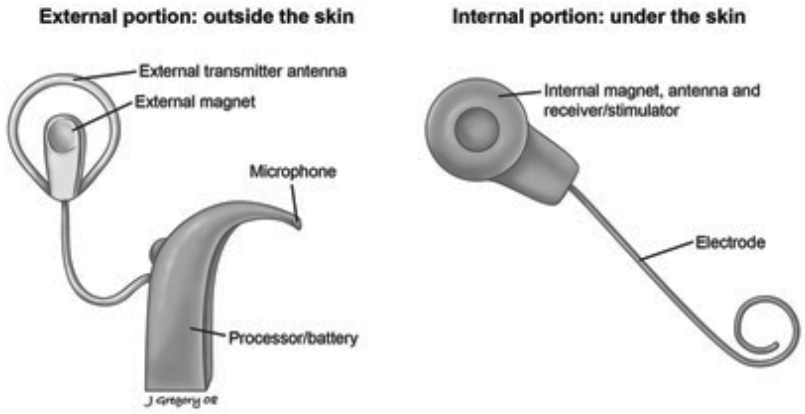
1.6 Cochlear Implants

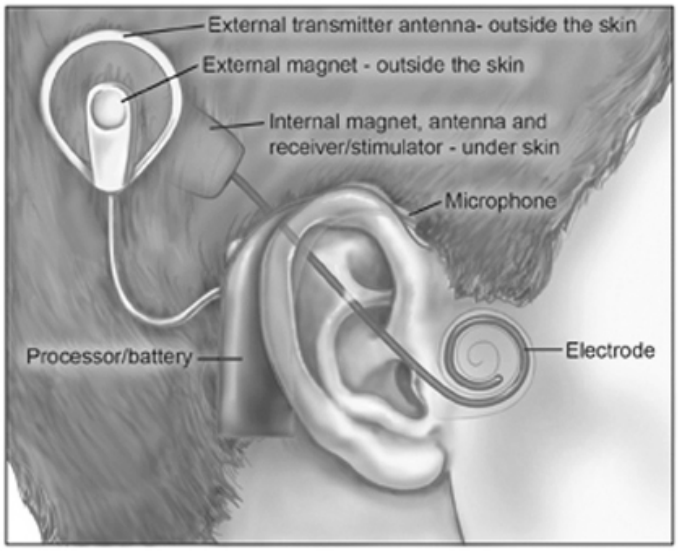
These are amplification devices which are surgically placed inside the inner most part of the ear, i.e.cochlea. the input signal is converted into electrical signal, which stimulates the auditory nerve or the VIIITH nerve.

CANDIDACY

1. Hearing impaired individuals with severe to profound hearing loss.
2. Individuals who do not benefit from hearing aids or get limited benefits.
3. Individuals whose aided performance on speech perception tests is less than 50%.
4. No benefit from hearing aid, 3months post fitting with hearing aids.
5. No other psychological deficits
6. No problems/disorders in higher processing centres.
7. Intact auditory nerve

COMPONENTS AND FUNCTIONING





There are two major parts, external and internal. The external part is worn either on the body or ear of the individual. It mainly comprises of the speech processesor. The internal part is surgically placed inside the ear/head. The components are as follows

External components

1. Microphone `- Housed inside the prossessor,it picks up surrounding sounds including speech signal.

2. Speech processor- Can be a body type or Behind the ear type. It modifies the signal and converts into digital signal and sends the digital signal to a transmitting coil via a cable.
3. Transmitting Coil - This part has a magnet in the middle of a disc, this enables this part to adhere to a internal component placed under the skin which also has a magnet. The transmitting coil transmits the entire signal to the internal component via skin in the form of radio waves.

Internal Components

1. Receiver-Stimulator unit- This part receives signal from the external transmitting coil. The part is surgically placed under the skin, behind the ear, on the mastoid bone.
2. The receiver - stimulator unit sends the final signal to selected electrodes (programmed), which are placed inside the cochlea.

The fitting of cochlear implants is a long process and needs intensive speech and language therapy, auditory training and proper educational placement post fitting.

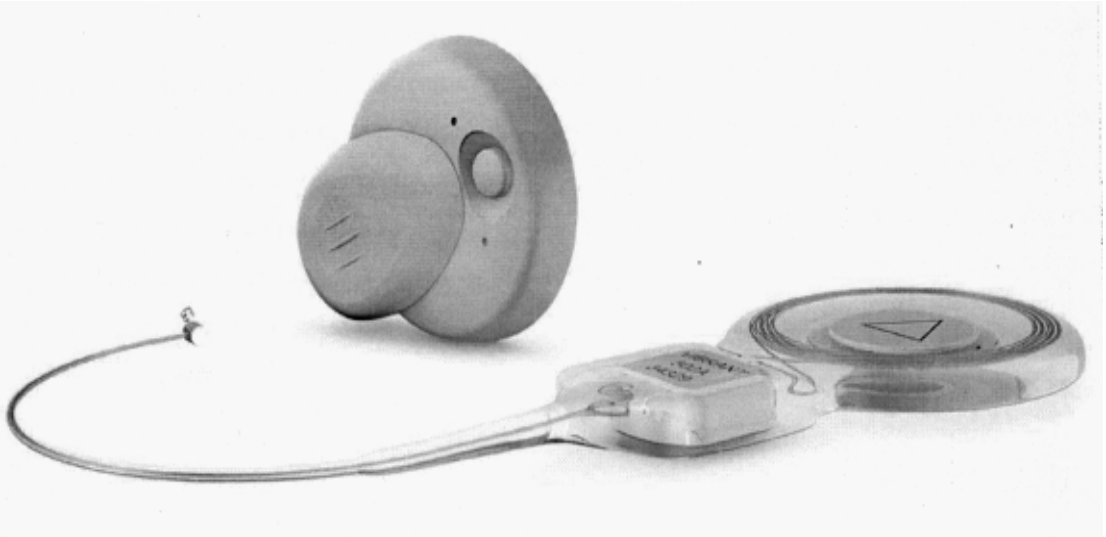
The first part of the fitting procedure is about deciding on candidacy. Once decided, the individual has to undergo certain audiological, radiological, & speech-language evaluations. A thorough medical checkup is done to check suitability for surgery. After the surgery takes place, the cochlear implant is switched on and programmed (mapping). Many follow up visits at regular intervals are required to settle the appropriate map/ program. The child is under intense speech - language therapy, AVT, and educational placement.

Importance of Cochlear Implant

This extraordinary technology has given the gift of hearing to many individuals who received limited or no benefits from hearing aids. Once they have better hearing, their social, speech- language, academic and overall development with gets enhanced. Children who are implanted at a very young age (within 3 years) can be easily mainstreamed into normal educational systems.

MIDDLE EAR IMPLANTS

This type of implant is surgically placed in the middle ear of hearing impaired individual. It also has two parts, external and surgically placed internal part. The internal part directly stimulates the inner ear, bypassing the external and is placed in the middle ear. Although intactness of certain middle ear structures is mandatory in one category of middle ear implants. It provides excellent sound quality.



CANDIDACY

- Individuals with mild to severe sensorineural hearing loss (the internal part will be different than in case of conductive or mixed hearing loss)
- Individuals with conductive and mixed hearing losses.
- Individuals who cannot tolerate foreign bodies in the ear canal for medical reasons, e.g., chronic ear canal inflammations or ear canal eczemas.
- Individuals who require a free ear canal for personal or professional reasons, e.g., musicians, singers or physicians.

COMPONENTS AND FUNCTIONING

External Part

1. Audio processor, which is worn on the head of the recipient, with a microphone to pick up external sounds. This part has a disc magnet which attaches to the magnet on the internal receiver part above intact skin.

Internal part

1. Internal prosthesis, consisting receiver unit and a transducer unit. After the receiver unit receives the signal from external audio processor, it sends it to the transducer which delivers vibration/mechanical signal to the middle ear bones.

   The implant directly vibrates the small bones in the middle ear. The internal part of the device mechanically vibrates the bones in the middle ear .The tiny transducer, attached to the incus bone in the middle ear, is approximately the size of a grain of rice. It is 100 percent digital and is programmed by an audiologist . The internal prosthesis converts sound into mechanical energy which is directly transmitted to the auditory ossicles. The external audio processor picks up the sound from the environment and transmits it across the skin to the receiver of the prosthesis. The signal is then transmitted to the transducer causing it to vibrate. The transducer mechanically stimulates the ossicles, like the natural process of hearing. The internal part is surgically implanted under the skin behind the ear. The transducer is attached to the long process of the "incus" bone during the surgical process. The ossicular motion creates a movement in the cochlea, stimulating the hair cells. The hair cells provide stimuli to the auditory nerve, which is interpreted as sound by the brain.

Bone Anchored Hearing Aid (BAHA)

This type of device is also implantable. BAHA stimulates the cochlea by transmitting the sound waves through the bones in our skull, or bone conduction, thereby bypassing the outer and middle ear. Once the cochlea receives the sound signals, the information is converted in to neural signals and transferred to the brain.

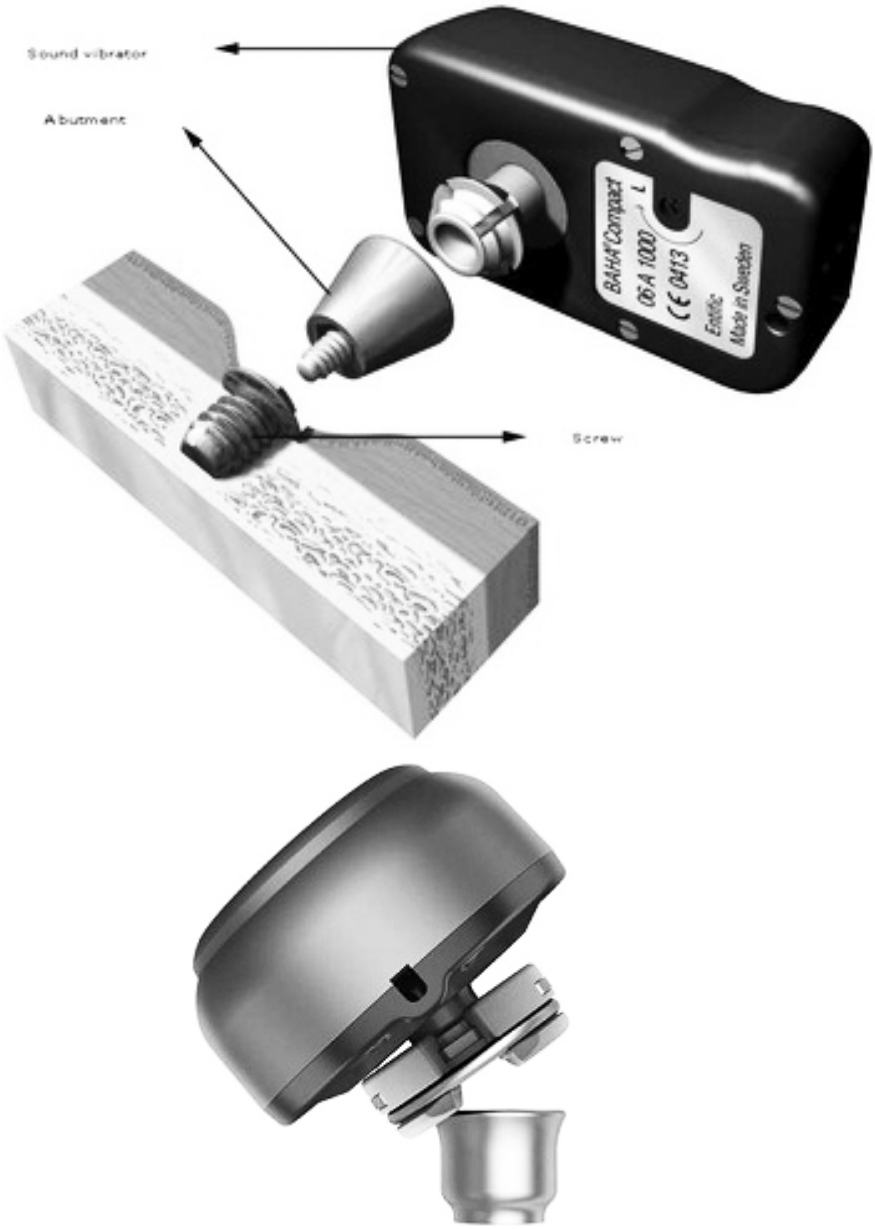
CANDIDACY

1. Individuals with bilateral canal atresia is an indication for the use of BAHA. This is because canal atresia prevents insertion of an air conduction aid.
2. Individuals with chronic ear infections when insertion of ear moulds is a problem.
3. Individuals with unilateral hearing loss who cannot benefit from use of regular hearing aids. (sensory neural, but good bone conduction hearing)

COMPONENTS & FUNCTIONING OF BAHA:

BAHA has 3 components. They are :

1. Titanium screw that becomes integrated with the skull bone behind the ear.
2. Titanium abutment is fitted to the titanium screw which is already integrated to the skull bone.
3. Ear level sound vibrator.



Sound processor coupling to abutment

BAHA implantation is a surgical procedure..The titanium screw is inserted during surgery. Titanium screw integrates with bone in such a fashion that it never comes out easily. Three months post surgery the abutment and sound vibrator/processor are attached.

There is a small opening in the skin, which gives anchor for the abutment. The sound vibrator attaches to the abutment. The sound is picked up by the microphone, converted into vibrations, which is transmitted to cochlea through the internal part of BAHA and through bone.

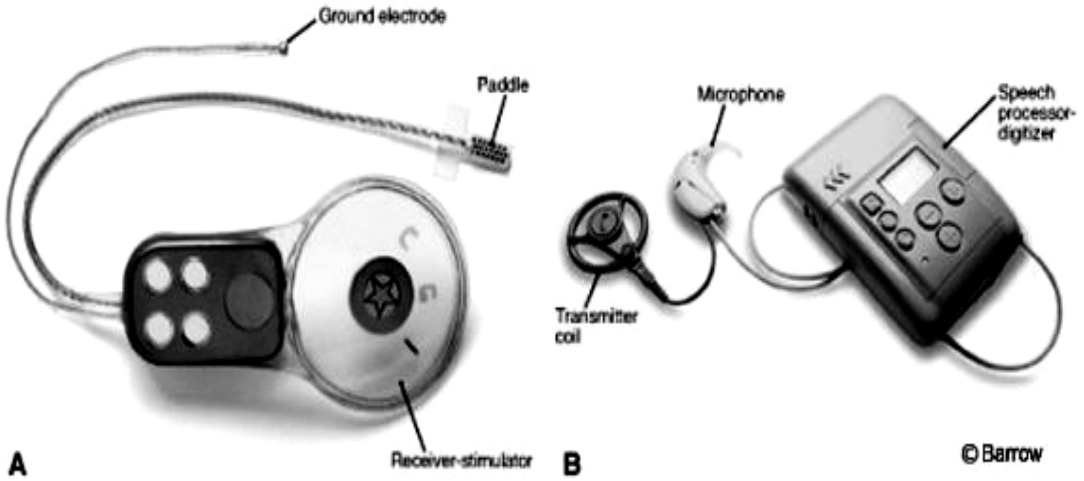
Importance of BAHA

1. It is a device of choice for individuals who cannot be fitted with conventional hearing aids. This can be due to a variety of factors, such absence of external ear, middle ear infections with active ear discharge.
2. It is also useful for individuals with unilateral sensorineural hearing loss(bc upto 55dBHL)s

AUDITORY BRAINSTEM IMPLANT(ABI)

As the name suggests this device is fitted in the brainstem, beyond the cochlear or inner ear. The first point or relay station after cochlea is the cochlear nucleus where the ABI is implanted. The decision of ABI implantation is taken in individuals who do not benefit from cochlear implants.

ABIs provide limited benefit for speech understanding. The hearing for environmental sounds and certain speech input is improved. But for better understanding of speech the patient has to use speech reading.



CANDIDACY

1. Individuals of atleast 15 years of age.
2. Individuals with damaged auditory nerve due to conditions like tumour of auditory nerve (NF2), where the auditory nerve(s) are irreversibly damaged.

COMPONENTS AND FUNCTIONING

External Components

Audio processor

Internal Component

The implant consists of an electronics housing and an implantable soft silicone matrix with an electrode array. An additional reference electrode is used for advanced telemetry measurements.

The soft silicone matrix with a 12 contact electrode array is surgically inserted directly onto the brainstem.

The sounds picked up by the microphone in the audio processor are transmitted to the internal part, where the electrode array sends electrical stimulation to the brainstem.

ADIP SCHEME 2014

Scheme of Assistance to Disabled Persons for Purchase/Fitting of Aids/Appliances (ADIP Scheme) by Govt. of India.

The original ADIP scheme came into focus after the implementation of PWD Act 1995,1996. The Scheme was revised w.e.f. 1st April, 2014.It stated:

"Provision for cochlear implant for 500 children per year with Hearing disability under the scheme, with a ceiling of Rs. 6.00 lakh per unit."

There is a provision of online form fill up and submission, for applying for cochlear implant. AYJNIHD(D), Mumbai has the authority to approve the list of benifieries. The surgery will be carried out in one of the empanelled hospitals under the scheme. Post implant rehabilitation,speech-language therapy for 10 weeks with 3hours per week is allotted. Additional sessions can be provided with special permission from competent authority. Post implant the child will be monitored at 3,6,9 and 12 months.

Candidacy

Individuals are eligible to claim cochlear implant under ADIP in the following cases:

1. Child will get only unilateral cochlear implant
2. He/She should have Indian citizenship
3. Age of the child

- Child with congenital deafness (since birth) upto 5 years as on 31st December in the current year

OR

- Upto 12 years for child with post lingual deafness i.e. after development of speech & language

4. Degree of hearing loss - Severe to Profound sensorineural hearing loss in both ears
5. Child should not have any associated developmental delay or Mental Retardation or cognitive deficit etc.
6. Child should have Hearing Disability certificate
7. Child should have used suitable hearing aid for atleast 3 months with no significant improvement in speech and language development
8. Family Income

- 100% subsidy for income less than 15,000/- per month

OR

- 50% subsidy for income Rs.15,000 to Rs.20,000 per month
- Income Certificate of family is mandatory

9. Have reports of hearing evaluation, speech-language evaluation, psychological evaluation and required medical evaluations.
10. Agreeing to the criteria/condition that Pre implant candidacy evaluation such as Audiological , Radiological (CT Scan/MRI) and vaccination charges are to be borne by the family as not covered under the scheme

11. Agreeing to the criteria that - Caste certificate has to be submitted if SC/ST or will be considered under General quota

1.7 Comparison between Individual Hearing Aids, Group Hearing Aids and Cochlear Implants

Individual hearing aids are fitted to individuals with hearing loss (anywhere between mild to severe). There a variety of options possible in individual hearing aids. Individual hearing aid's performance depends on the technology used. Digitally programmable ones are highly recommended for their better performance. In this category also there are plenty of options available commercially. The advantages of individual hearing aid is it can be used by the individual according to own requirements. The mobility is not restricted. The user can upgrade his/her hearing aid as and when required.

There are certain limitations, the cost of a new hearing aid has to be totally born by the individual totally (socially backwards can apply under ADIP scheme). These hearing aids undergo regular wear and tear, so they need to be changed at every 5 years (appx).Hearing aids are electronic devices, may need servicing and repair. The cost of service and repair again has to be born by the individual.

Care and Maintenance

1. It should be kept clean and free from moisture. - after every use, should be cleaned with a dry cloth and kept back.
2. The battery should be removed, when not in use. Batteries to be changed regularly.
3. Hearing aid should be removed during bath.
4. It should be sent for regular servicing.
5. It should not be dropped from a height.
6. It should not be exposed to excessive heat and strong electric/magnetic field.
7. Hearing should be checked at a regular interval, hearing aid or settings should be changed in case of change in hearing thresholds.
8. The overall life of a hearing aid is about 5-8 years. It should be changed at that interval.
9. In case of any problem it should be taken to audiologist.

10. In classrooms, teachers can keep a regular check on the functioning of hearing aids worn by the students. The switches, battery, and overall condition of the hearing aid to be checked regularly. Even the sound quality to be checked regularly.

Group Hearing aids-

The onus of care and maintenance of the group hearing aids is usually on the institutional set up, where it is used. The hearing aids are set at a same level, so individual requirements are difficult to address. One to one communication training/teaching is difficult. Mobility of the students get restricted. It is less often used.

However the overall cost of the system and maintenance cost is more economical.

Cochlear Implants

1. This is recommended for individuals who do not benefit from conventional hearing aids.
2. It involves a surgical procedure. The instrument has an implantable part and an external part. As surgery is involved, a lot of detailed evaluations including a thorough medical evaluation is mandatory.
3. The overall cost of fitting and post fitting rehabilitation is higher than individual or group hearing aids, by a huge amount.
4. The maintenance and repair requirements are quiet less, but repair cost is also higher compared to individual hearing aids.
5. Individuals fitted at the right time, followed by vigorous rehabilitation work-up, perform way ahead than hearing aids. The speech clarity, suprasegmentals are much natural.
6. However due to inherent cost and need for surgery, it is highly recommended for individuals who are performing poorly with hearing aids.
7. There are certain risks involved, with surgery though very limited.

CARE AND MAINTENANCE

1. CI should be kept away from dirt and moisture.
2. Regular charging of batteries is required.
3. Daily use of dehumidifying kits is mandatory.

4. The individual should not pass high thorough magnetic fields with the external component on.
5. The external component should not be dropped.
6. The transmitting cable should be handled with care.

1.8 Let Us Sum Up

1. Listening devices are given to individuals with difficulty in hearing, to improve their overall quality of life.
2. There are a large variety of these devices available commercially.
3. A basic hearing aid can have different styles and technology in them.
4. The styles are names Body type, Behind the ear, In the ear, Completely in the canal and receiver in the canal hearing aids. Each one has their own advantage and limitations.
5. The technology in the hearing aids can be a basic analog processing or a more sophisticated digital signal processing. Owing to better technology, the performance of digital hearing aids are way ahead than analog hearing aids. Although some individuals prefer analog hearing aids.
6. The benefits of fitting hearing aids can be measured in users, by various outcome measures such as Ling six sound test, speech recognition measures, aided audiograms,quetionaire etc.
7. Hearing aids are not sufficient in all hearing impaired individuals and also in all listening situations.
8. In difficult listening situations, assistive listening devices are very helpful. These can be used alone or attaché to the hearing aid.
9. Many of the assistive listening devices are used in classrooms for hearing impaired children. Commonly used are FM systems, Loop induction systems.
10. In individuals where conventional hearing aids have poor performance, the next level in intervention are with implantable devices

1.9 Check Your Progress

1. What are the basic components of a hearing aid?
2. What are ling sounds? What is their use?
3. What are digitally programmable hearing aids?
4. List various classroom amplification systems available?
5. What is the difference between full concha and tip size ear mould.
6. List the various implantable devices with highlighting one advantage of each device.
7. Write about care and maintenance of behind the ear hearing aid.

1.10 References

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Unit 2 ❐ Technology for Management for Speech

Structure :

2.1 Introduction

Computer-based speech training has capabilities of offering the children immediate and meaningful visual feedback and might make it easier for the teacher to instruct and explain what is wrong and what is correct and through motivational and frequent training establish an intelligible production. In most schools for deaf children in Sweden, computer-based visual speech training has become a standard and valuable complement to the regular speech-training activities.

Hard of hearing have vocal organs which are normal and hence can produce speech. This is especially so if they have some language ability. That is, if a child has acquired deafness after having exposed to hearing the language. Hence the dictum **"deaf need not be dumb"**. The reason that they may not be able to produce speech is because of the lack of auditory feedback, i.e., inability to hear what they have spoken and hence unable to correct what is spoken if it is incorrect.

- **Picture-Word-Ariculation test** may be used for an evaluation of the pronunciation errors. Exercises may be given to **correct the pronunciation errors**.
- Their dependency on **lip reading** sometimes leads to mis-pronunciation of speech sounds. For example, 'p', 'b' and 'm'. **Nasal indicator** may be used to make them aware of the production of nasals.
- Also, the hard of hearing often lack **'breath support'**. That is they are unable to speak for a long duration in a single breath and they have to take breaths often. Their breath support has to be improved.
- Further, a hard of hearing child tries to speak at a **very loud voice or shrill** voice since for the child itself they sound normal. In course of time this leads to **voice abuse** and possible damage of the vocal folds (the voice box). This can be prevented by a proper voice control.
- Some hard of hearing children speak with a **mono-tone pitch or dull voice**. They lack proper intonation and their voice will not be lively.

2.2 Objectives

After Completion of this unit, the learners will be able to

1. gain an understanding of computer based learning aids/ equipment for management of speech.
2. use computer based speech equipment for children with H.I.
3. know and apply computer based speech equipment for management of supra-segmental in children with H.I.
4. detail out the basic infrastructure for the use of computer based speech hearing aids/ equipments.
5. understand and manage tele speech therapy/ technique.

Training schedules:

The length of the session ranges from twenty minutes to one hour, and the child must leave the ordinary school schedule, or come to the therapist after school has ended for the day. The therapist and child usually meet once a week, but depending on the child and its problems, they can meet from three times a week to once a month. When speech training begins, the therapist assesses the deviations that the child has and based on this plans the training. There is no typical training session since it is adapted to the child and the uniqueness of his/her speech. However, one of the features that the sessions have in common is that they are always playful and full of variation. The therapist does not only spend time training the phonetic difficulties that the child has, but also uses the material at hand to help the child with its language development, which is often weakened. The therapist tries to relate to the child's daily life and reality in all the training exercises, and to further develop the language that the child already possesses. If possible, the child is trained in discriminating speech sounds and to listen to its own utterances. Many of the respondents talked about awareness, to enhance the awareness of the world of sounds, awareness of breathing, awareness of the language etc. The therapist often begins with the speech sounds that the child already masters and from these makes the child aware of the deviant speech sounds. The techniques that the therapist uses are multimodal; enhancing the learning process with the help of vision, touch and hearing if possible. When the child becomes more mature, the therapist and child together analyze in a more theoretical way what happens with the articulators during speech production.

2.3 Computer based training aids/equipment for management of speech (Dr. Speech, Vaghmi, and Speech Viewer)

Computer-aided speech training presents visual feedback of distinctive contrasts that are not visible via speech reading and consequently difficult to produce correctly. There is a wide consensus that computer-based speech training (CBST) systems are useful tools in speech training. However, they are not suitable for all the needed exercises and a major drawback is that they usually require help from educated personnel. CBST systems are today widely used in speech training for children with a hearing or speech impairment. Examples of such commercially available systems are Dr Speech, Speech viewer, Vaghmi, etc.

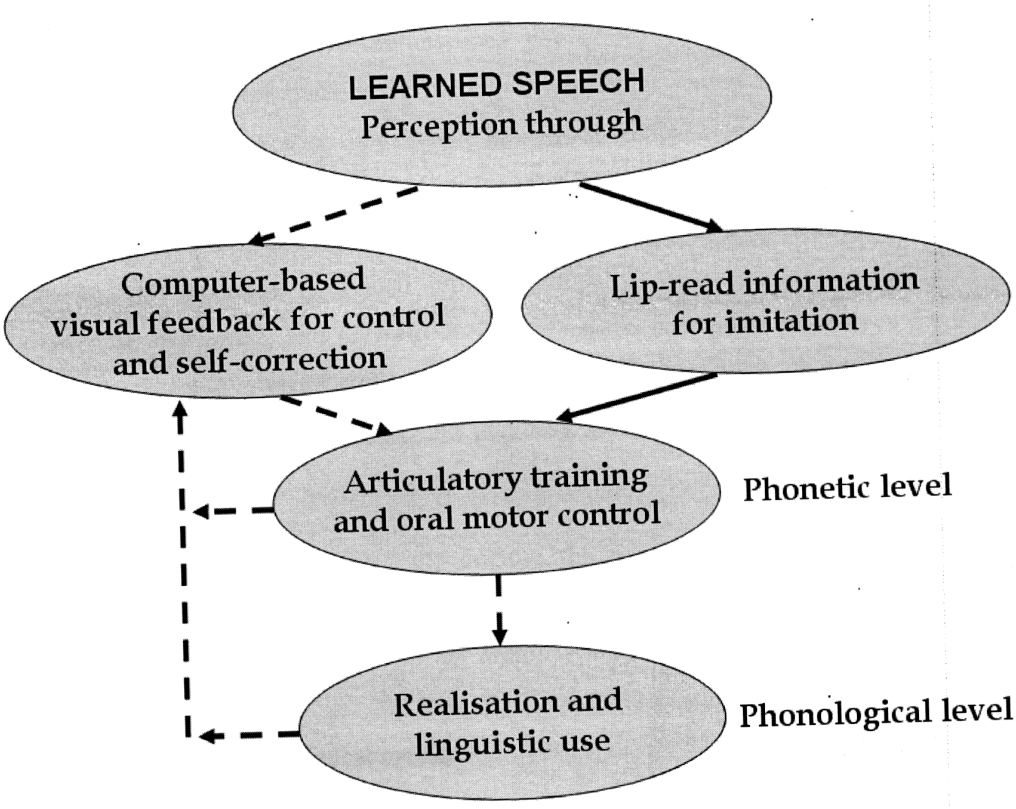


Figure :Assistance of computer-based visual feedback in profoundly hearing-impaired children's speech development.

Some of the computer assisted softwares are as follows:

Dr Speech: is clinical software which provides valuable assistance during assessment and treatment of voice and speech disorders in children with hearing impairment. Demographic information, such as names, address, number of visits, types of disorders, progress reports, insurance claim, etc. is easy to display. When such clinical software is installed in a laptop computer, it provides clinicians with a "portable clinical voice laboratory" equipped with powerful clinical tools that easily can be carried from one treatment location to another. Today's practitioners can benefit from the use of clinical software that has been adapted to the needs of clinicians.

It uses voice-activated game-like tool to provide real-time reinforcement of a client's attempts to produce changes in pitch, loudness, voiced/unvoiced phonation, voicing onset, maximum phonation time, sound and vowel tracking. Children, in particular, enjoy therapy with this colorful, interactive, video game because they receive immediate feedback on their performance. Clinicians will enjoy the versatility and unique features of this technique. For example, while a child is playing a game, you can quickly review the graphical display or statistical data of the child's performance. This technique is divided into two groups: 1) ***Awareness*** teaches children about the attributes of their voice, and (2) ***Skill Builder*** gives the user goals to achieve for a given range and time. The examples of comprehensive user logs and tracking client's progress are provided. Best of all, real-time recording and playback gives you the tools you need to maximum your client's therapy.

Innovative computer technologies are not only helping the needs of persons with speech disorders, but also serving the laryngologists and speech pathologists to perform a more accurate and professional service.. With *a PC desktop or laptop computer, a 16-bit sound card, a microphone and speakers*, the clinician has met the simple requirements for starting and operating a speech laboratory in the clinical practice.

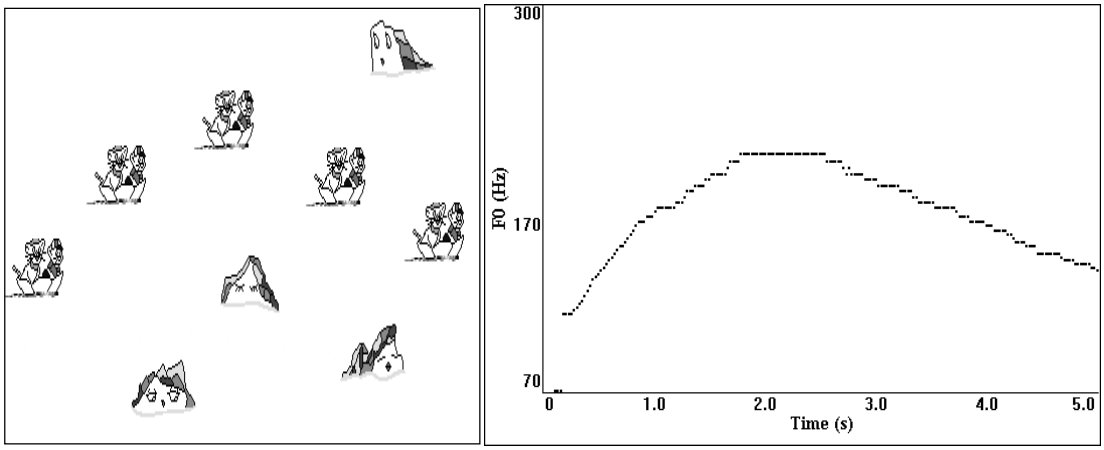
Speech is a product of the interaction of respiratory, laryngeal and vocal tract structures. The larynx functions as a valve that connects the respiratory system to the airway passages of the throat, mouth and nose. The vocal tract system consists of the various passages from the glottis to the lips. It involves the pharynx, oral and nasal cavities, including the tongue, teeth, velum, and lips. The production of speech sounds through these organs is known as articulation.

For speech skill builder, it is necessary for us to focus on the acoustical and physiological phenomena in both laryngeal and vocal tract systems. The parameters,

such as, pitch, loudness, voicing, voicing onset, phonation time and formants, are closely related to these two systems. This paper employs Speech Therapy program, a clinical software from Tiger DRS. This software provides real-time cartoon displays of continuously varying pitch, loudness, voicing, voicing onset and phonation time displays so the children can receive immediate feedback on his/her performance with fun. In other words, the acoustical and physiological phenomena from the children can be evaluated from this technique. Clinical application of this technique will be described in the following experiments for details.

Experiment 1: Pitch Skill Builder

Using pitch module, clinicians could help the children refine pitch control and develop smooth modulation of pitch contour. Certain patients are unconsciously or consciously making an effort to higher or lower their pitch. The clinician should teach patient to target optimum pitch by the control of vocal fold vibration. For example, one of the best way to refine pitch control is to use rise-fall pitch technique. In the Figure 1 (a), by extending /a/ in front of microphone, the boat moves around the rocks based on a rise-fall pitch pattern. With this game, the children receive immediate feedback on their pitch performance. After the game, the clinicians can look at objective information of the pitch control, as shown in the Figure 1 (b). In clinical practice, the clinician may select different pitch patterns for different needs of the patients.



(a) Real-time cartoon display (b) Objective information of pitch curve

Fig. 1. Pitch controls how the boat moves around the rocks (target: rise-fall pitch pattern)

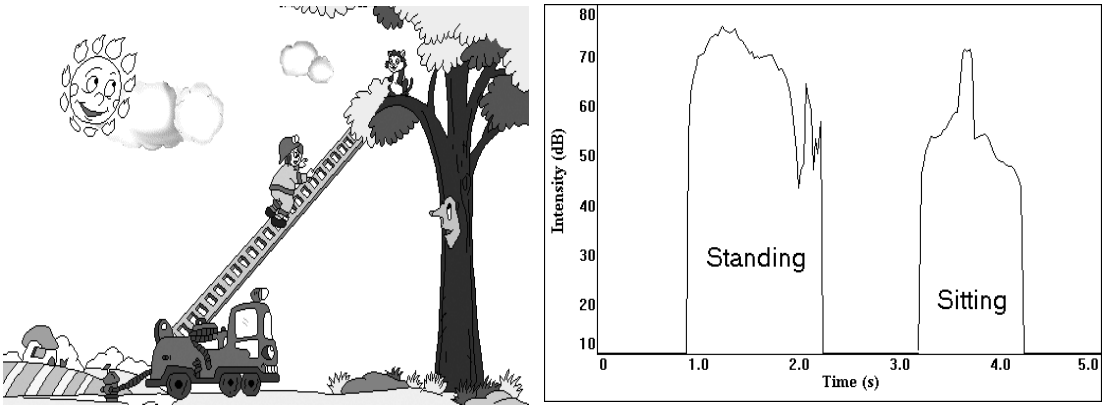
Pitch measure provides information about intonation. The pitch is mainly decided by the rate of vocal fold vibration. In the Pitch Skill Builder, the clinicians should help the patients to find the optimum pitch and pitch range and how to maintain this optimum situation. In clinical practice, a complete statistical report before or after therapy is important. The Table 1 lists the pitch changes during three-week therapy by pitch skill builder technique for the male patients with female voices. The result of speech therapy is obviously.

Table 1: Pitch changes during three-week therapy

	Patient 1 (male, 12 y)	Patient 2 (male 15 y)	Patient 3 (male, 17 y)	Therapy Technique
Ave. Pitch 1 (week)	282 Hz	325 Hz	208 Hz	
Ave. Pitch (week 2)	253 Hz	287 Hz	181 Hz	Warm-up "rise-fall pitch" skill builder
Ave. Pitch (week 4)	232 Hz	262 Hz	157 Hz	Warm-up "flat-pitch" skill builder

Experiment 2: Loudness Skill Builder

Using loudness module, clinicians could help the children lower the loudness level of speech when the usual level is higher, and higher the loudness level when the usual level is lower. The clinician should teach the patient to control his/her loudness change by the correct control of breathing. For example, one way to control loudness is to use correct control of breathing and body position. In the Figure 2 (a), by increasing the loudness through a good body position, the fireman climbs higher toward the top target. With this game, the children receive immediate feedback of loudness changes with their different body position (standing vs. sitting). After that game, the clinician can look at the different loudness data (standing vs. sitting), as shown in the Figure 2 (b). The top target corresponds to a certain loudness level that can be modified by the clinicians.



(a) Real-time cartoon display (b) Objective information of loudness curve

Fig. 2. Loudness controls how higher the fireman climbs (target: top).

Loudness measure provides information about syllable stress. The intensity of vocal fold vibration is decided mainly by the loudness. In the Loudness Skill Builder, the clinicians should find the best way for the patients to make a target. The Table 2 lists the loudness changes during seven-week therapy by loudness skill builder technique for the patients with right RLN paralysis. The result of speech therapy is obviously.

Table 2: Loudness changes during seven-week therapy

	Patient 1 (male, 11 y)	Patient 2 (male 13 y)	Patient 3 (male 14 y)	Therapy Technique
Ave. Loudness (week 1)	61.1 dB	66.5 dB	68.2 dB	
Ave. Loudness (week 3)	63.4 dB	67.1 dB	69.1 dB	Warm-up. Standing phonation by turn-head left. Loudness skill builder with correct control breathing.
Ave. Loudness (week 8)	66.2 dB	67.8 dB	71.3 dB	Warm-up. Sitting phonation by turn-head left. Loudness skill builder with correct control breathing.

Experiment 3: Voicing Skill Building

Using voicing module could help the children assess their voiced and unvoiced phonation from the computer screen. Voicing refers to the vocal behavior by which the conversion of continuous airflow into a series of glottal pulses is regulated. Voiced phonation, such as /z/, is regulated by the vocal fold vibration, while voiceless phonation such as /s/, is not regulated by the vocal fold vibration. For example, one way to feel voicing is to produce a pair of phoneme /s, z/, /f, v/ etc. In the Figure 3, when you phonate a voiced sound, a mouse (red) will come from left side; when you have a voiceless sound, a mouse (green) will appear from right side.

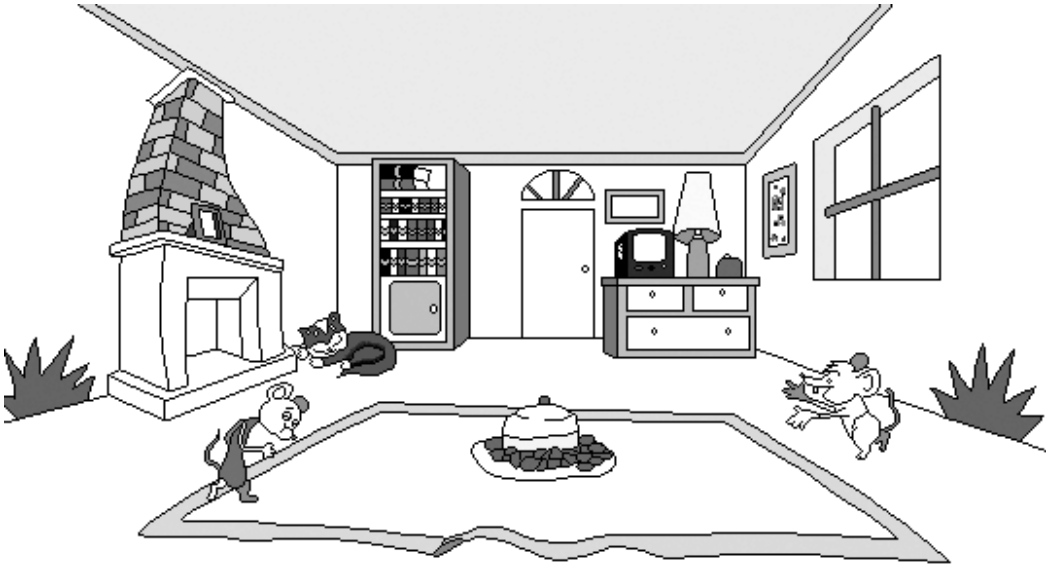


Fig. 3. Voicing mode determines which of the mice will run.

Voicing measure provides information about phonatory pattern. Using voicing onset module, clinicians could assist the children with modification of glottal attacks before the appearance of supraglottal articulatory event.

Experiment 4: Voicing Onset Skill Building

Using voicing onset module, the clinician can help the children to control the vocal fold attacks correctly. In the Figure 4, when you initiate a voiced phonation, a flower will open. If you saw /ba/, /po/, the first flower will open at the beginning of /b/, and the second flower will open at the beginning of /o/ because /p/ is a voiceless phoneme.

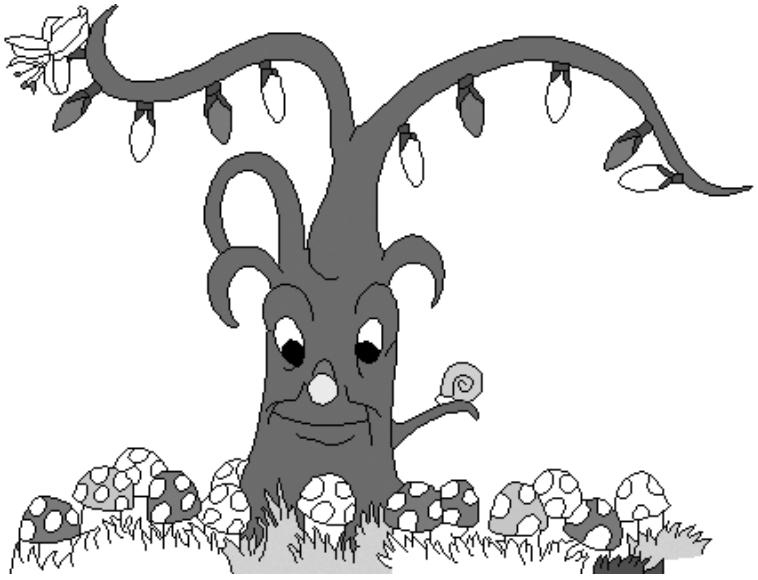


Fig. 4. Voicing onset mode controls how the flower opens around the tree.

Voicing onset provides information about glottal attacks. How fast can you make the ten flower open ? What happens if you extend a vowel, but have voice breaks ? All these cases depend on the voicing onset.

Experiment 5: Phonation Time Skill Building

The term, Maximum Phonation Time (MPT), implies such abilities in voice production as how long one can sustain phonation. The patients are instructed to sustain vowel /a/ or other vowel as long as possible following deep inspiration. MPT is decreased in many pathological states of the larynx, especially in cases with incompetent glottal closure. MPT values smaller than 10 seconds should be considered to be abnormal. For example, the clinicians should provide the patients the best way to make the respiration and phonation correctly. In the Figure 5, the strawberry moves from left to right when you keep phonation after deep inspiration. The target for you to reach is at right side. The target setting can be changed for the needs of patients.

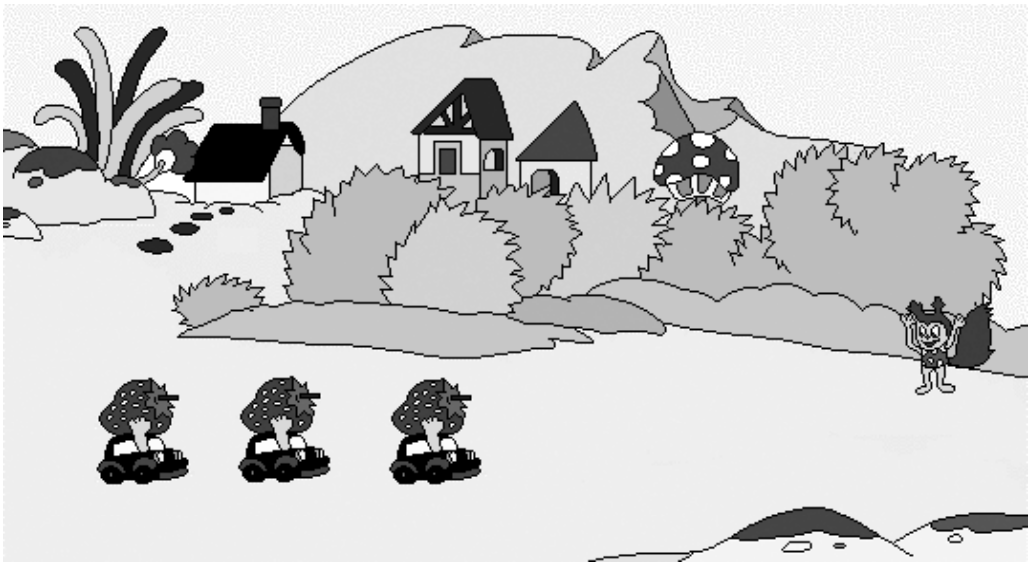


Fig. 5. Keeping phonation moves the strawberry from left to right.

Experiment 6: Speech Articulation

Speech articulation within vocal tract is determined by three major factors: the place of major constriction, the degree of constriction at that point and the lip constriction, as in Figure 6 and Figure 7. The vocal tract shape and lip movement will be provided for each vowel and consonant. In clinical practice, a brief education about speech articulation (tongue and lip movement) should be provided before therapy.

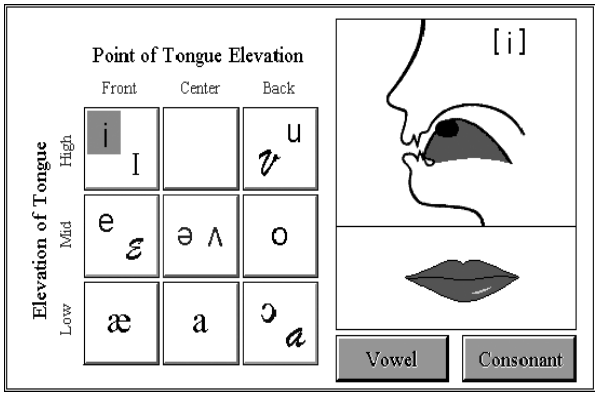


Fig. 6 Vowel production (vowel /i/)

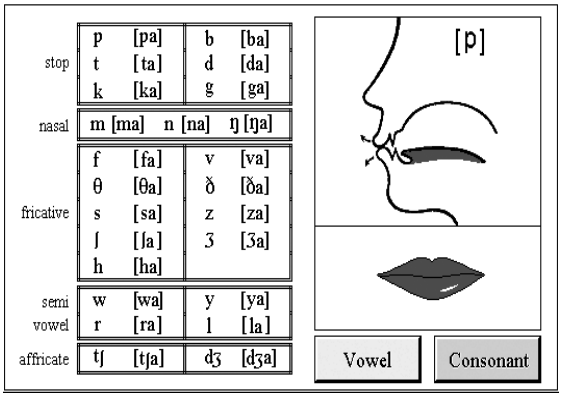


Fig. 7 Consonant production (vowel /p/)

Real-time vowel space training reveals first and second formants for speech inputs. With this tool, clinician can show patient about the effect of major constriction place in vocal tract from computer screen. The tongue tip movement mainly determines the second formant changes. For example, when the children produce a series of vowel /I-e-æ-a -u/, the vowel tracking will appear as in the Figure 8. By the graphic display, the clinician can judge the tongue tip position and phonetic accuracy quickly.

Experiment 6: Speech Articulation

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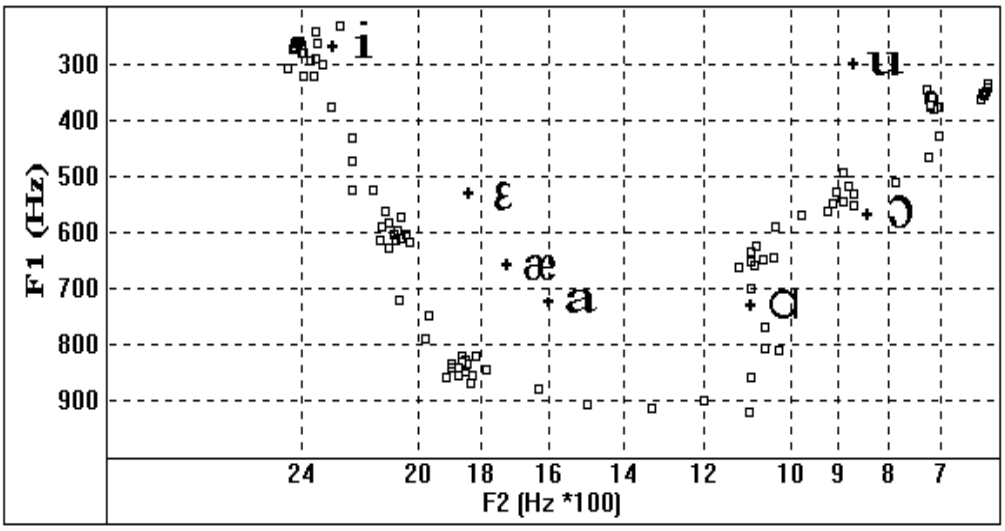

Fig. 8 Dynamic vowel tracking

Experiment 7: Sound Awareness

In Sound Awareness module, the children should understand normal speech level. Another important thing is to have children to understand difference among non-speech, speech, whistle and hiss. In the Figure 9, the clinicians can help patients to understand how much loudness or effect is necessary to move the graphic. The sound can be set to indicate a normal, conversational speech level. If you set it too high, you might not get the object to move at all.

Fig. 9. A seesaw moves when there is a sound over silence setting.

Vagmi :

Therapy modules are easy to use software tools that effortlessly convert P.C. into therapy equipment. No programming skills are required to use these modules and even your child can be his or her own therapist. These modules are visually appealing with exciting graphics and re enforcement messages. Using Vagmi therapy modules, clinical reports to great scientific accuracy can also be generated. The following are the therapy modules:

1. Vagmi Picture-Word-Articulation (PWA) Module can be used

(a) As a Phonic drill to (test) evaluate the pronunciation of speech sounds for the hard of hearing as well as children with normal hearing and identify the sounds whose pronunciation have to be corrected

(b) For stroke patients in helping memory recall

(c) To learn a secondary language at word level

This module is currently available in **English, Kannada, Telugu, Hindi, Oriya, Arabic, and is easily programmable by an experienced user to any desired language.** Also,

the existing test can be modified by adding various different pictures and sound clues. **A parent supervisor or a therapist** or a special teacher accompanying the client grades the pronunciation as 'poor', 'just ok', 'fair'; 'average', 'good', etc. A corresponding reinforcement is given. The score achieved is saved. Pictures and words for all the speech sounds of a language may be tested in the picture-word-articulation test. Based on the overall performance, the next step to be followed can be decided. For example, after the test, if it is observed that the client is unable to pronounce the 's' sound properly, then the test can focus only on the 's' sounds.

2. Vagmi Therapy Pronunciation Module

There are two broad categories in this module:

- **Discrimination tests for fricatives (s, sh, z), stops (p-b, t-d, k-g), laterals (l, r) and nasals (m, n)**

'If one cannot discriminate the sounds, one cannot produce the sounds'. Here, the client should be able to distinguish if the consonant in a pair of words is the same or different. After testing his/her ability to discriminate, the pronunciation may be corrected.

- **Production therapy**

When a client is identified with an inability to produce a particular speech sound correctly, such incorrect pronunciation of vowels or consonants can be corrected with the help of appropriate graphs, games, challenges and tasks incorporated in this therapy module.

A unique feature developed out of scientific research and effort by Dr. TVA is the display of tongue and lip shapes for vowel pronunciation and the subtle distinction between s and sh. These are in a very effective way incorporated and displayed in our pronunciation therapy module aiding the child or the client in getting the pronunciation right within very few attempts.

SpeechViewer III is a sophisticated clinical tool that takes advantage of the computer's multimedia capabilities. It has a menu bar for quick and elegant access to speech exercises, point and click capability and enhanced phoneme model creation. There is a full range of speech exercises, from creating awareness of speech elements to building skill in those elements. Vibrant color animations and visual feedback of speech attributes includes pitch, loudness, voicing, timing, spectra, phoneme pronunciation and co-articulation. The auditory feedback synchronizes with the color graphic display of speech

patterns (e.g. a teddy bear moving, a balloon expanding, a bouncing ball etc.). Audio can be replayed at normal or slower speeds. The exercises have been designed as 'games' and this format will appeal to clients. The graphics are clearly drawn and are age appropriate with a choice of 4 exercises for most of the elements. Each exercise has a variety of graphic designs to keep therapy sessions interesting and therefore engage and involve the client in the activity.

The Exercises Menu

Each exercise is very clearly listed and described in the User Guide and in the Online Help system. The Purpose, Starting and use of the Settings sections are easy to understand and follow, even for a lay person! The 34-page tutorial is a comprehensive guide to using SPV3 more effectively and provides excellent background information as to its usefulness and application.

When you choose a client ID, or click on Start, you are presented with a menu with 13 items. These include:

Sound Presence	enhances awareness of sound (four delightful games)
Loudness Range	enhances awareness of the loudness of sound (e.g. a meter, a balloon expanding)
Voice Presence	develops an awareness of voicing (a clown changes colour, a man's lips move)
Voice Onset	increases the awareness of voicing onset and control over voicing
Voice Timing	improves coordination of respiration and voicing
Pitch Range	increases awareness of vocal pitch and quantifies pitch range
Pitch Control	builds skill in voluntary fine control of pitch
Phoneme Accuracy	improves the accuracy of phoneme production (using a fun game format)
Multi-phoneme Chains	develops skills in pronouncing a sequence of different phonemes
Two-Phoneme Contrast	improves accuracy in contrasting phonemes
Four-Phoneme Contrast	improves accuracy in contrasting phonemes

Pitch and Loudness Patterning increases skill in producing acceptable speech patterns

Spectra Patterning Uses spectral analysis to improve accuracy of phoneme production.

On the Menu Bar you see four groups. These each suggest exercises that you might consider for each speech parameter. The groups are Pitch, Prosody, Voicing and Phonology. Each of the exercises has a sub menu (e.g. Sound Presence has Alien, Dog, Flamingo and Kaleidoscope). Some will suit younger clients, whilst others will appeal to older users. At the base of the screen appears a Status Bar. It indicates such things as the conditions that have been set, who is speaking (the clinician or the client), the integrity and status of the statistics, whether the threshold is too loud and shows the microphone status (on or off).

2.4 Use of Computer Based Speech Equipment for Management of Voice in Children with Hearing Impairment

Profoundly hearing-impaired children often suffer from disorders of physiological control like deviant respiratory patterns as well as breathiness, voice breaks, unstable pitch, nasality and vocal fry. This is due to a restricted use of the vocal apparatus and the fact that they have to learn oral language by a laborious visual imitation of speaking (Grewel, 1963). Non-visible speech elements like for instance, nasality, voicing, and fundamental frequency can be related to typical deviations in the speech of profoundly hearing-impaired children (Martony, 1971; Monsen, 1976; Öster 1992b).

2.4.1 Nasalance Module

In this module, the speech output from the lips (oral level) as well as the nostrils (nasal level) is broadly separated and their respective levels are measured. Thus one can become aware of the level of the speech output coming from the nostrils and lips separately. For example, when a word like 'appa' if said properly, has no nasalance. On the other hand, when a word like 'amma' is said properly, there will be a presence of a nasal sound in the word. The colourful display of the levels in this module helps even a hard of hearing client to become aware of the production of nasal sounds.

Nasalence Measurement

When Nasalence is measured quantitatively, for an ideal voice, for steady vowels, the nasalence must be 0%; In case of 'hyper-nasality', if the problem is due to lack of awareness, rather than an organic disorder, therapy is your solution.

Ideally, when pronouncing 'm' or 'n', nasalence must be as high as possible (>80%). If not, the case is called 'hypo-nasality' and can be corrected using therapy if the problem is due to lack of awareness, rather than any organic disorder.

The unique feature of the various modules developed by Voice and Speech Systems is that it not only provides therapy for various and numerous dimensions of voice and speech problems but it also gives you an option to measure your deviation from the normal. Using Vagmi Therapy Nasalence Module one can not only **correct hyper or hypo nasality** by means of **interesting games** but also first **measure** the degree of deviation from the normal voice quality and the **severity of nasalence** in one's voice.

There is an organ called **'velum'** near the root of the tongue. Sometimes this is referred to as 'little tongue'. This acts as a valve. Lifting this valve leads to the blockage of sounds via the nostrils producing a nasal voice. On the other hand, this valve or the velum has to be lowered to produce sounds such as 'm', 'n'. When a person is unable to control the movement of velum and if it is always in a lowered position then his/her speech sounds highly nasal. This is called 'nasal voice'.

The inability to move the velum may be because of **lack of awareness or bad practice**. In such a case therapy programs help one become aware of the action of velum and there by learn to regulate it. On the other hand, if the nerve connecting to the muscles of the velum is unable to activate it, it is a permanent damage, may be since birth - a **congenital defect**. In such a case therapy will not help.

2.4.2 Therapy for Breath Support Module

The duration for which a client is able to say a **steady vowel with a single breath** is referred to as the maximum phonation duration (MPD) or maximum phonation time (MPT). Poor MPD may arise either because of **poor respiratory support** or **inefficient use of the available air in the lungs**.

Vagmi Therapy Breath Support Module gives you Measurement or Assessment as well as Therapy menu options to help increase breath support such that the client is able to talk with strength in their voice and for longer duration without getting tired.

- **Voice Initiation and Sustenance -** This is a measurement program to verify if the client's voice has sufficient respiratory support.

- **MPD Measurement -** This is to measure the MPD as well as to check the steadiness in the client's voice.
- **MPD Therapy -** This has a number of games like Pacman, puzzles and many challenges to help the client increase their breath support to be able to talk for a long duration comfortably.

2.4.3 Therapy for Voice Control Module

If voice is of breathy quality, a qualified speech language pathologist or ENT specialist can ascertain this using the menu options **'Acoustic Glottogram'** for measurement and **'Glottal Leakage for therapy**.

Acoustic Glottogram

The phonation signal of a steady 'aa' or 'A' is recorded and the air flow through the glottis is deduced. The 'pattern' or the 'shape' of the **air flow** through the glottis depends on the manner of **vibration of the vocal folds**. Thus an experienced professional can interpret the voice quality as breathy or modal or pressed or falsetto by looking at this pattern. Also, the opening, closing and closed durations relative to pitch period can be deduced. Using the pattern displayed as a feedback, the client may try to improve the voice quality.

Glottal Leakage

The duration for which a client can say a steady vowel with a single breath is referred to as the maximum phonation duration (MPD). Although the respiratory support of the client is good, the **air stored in the lungs may be depleted very fast** due to the client's **breathy voice**.

This module provides a graphic display corresponding to the voice quality of the client. One has to achieve as large a phonation duration as possible while maintaining a good voice quality.

Voice Focus

The pronunciation of sounds must be clearly enunciated. If the movement of the **articulators**- tongue, jaw and lips is highly **restricted** then the voice quality is poor. Examples of poor voice quality are 'clenched teeth', 'palatalized' etc.

The client is asked to say steady vowels or vowels in a context. Then, the module measures and gives a graphic display of the spread in **'vowel space'**. When the vowel space of the client is compared with the vowel space of a normal reference, it gives an idea about how clustered or blurred one's voice is for correction.

2.5 Use of Computer Based Speech Equipment for Management of Suprasegmentals in Children with Hearing Impairment

Children with hearing impairment have been found to have a monotonous rhythm due to incorrect pausing between syllables. Sometimes their fundamental frequency is extremely high with a lowering at the end of every vowel. The children also had extended segment duration. Children with a normal speaking rate however may not have fluent speech fluent, due to the fact that they breathe after every second word. They may emphasize the beginning and the end of every sentence. The most interesting deviation is vowel-dependent fundamental frequency variation because of an excessive articulatory tension. Some children might have a normal fundamental frequency but a remarkably slow tempo. Furthermore, they might as well extend the occlusion phase in the production of the plosives /p, t, k/. The prosodic deviations of each child forms the basis for the rules used to generate the prosody of the simulated speech. The following module is usually incorporated for management of suprasegmentals:

2.5.1 Intonation and Accent Module

Intonation

The **variation in pitch over the length of an utterance** is measured while a client speaks and it is determined if the client's voice has some intonation or is dull, flat or monotone.

By testing the steadiness in voice, this module also helps as a **preliminary screening tool of a voice disorder**. This feature can also be used for **practicing to sing a musical note** at a particular appropriate pitch. Also, the same program may be used to measure the range of pitch- lowest to highest. By displaying the volume instead of the pitch, rhythmic patterns of short and long vowels in syllables also may be displayed.

Accent

This feature is **language independent**. A model utterance of **any language** can be recorded and saved. This model intonation pattern to be achieved can be displayed in the upper window. The intonation of the client's production is shown in the lower window for comparison to achieve the desired intonation of the chosen language. The client can also listen to the model utterance and compare it with his/her own production thus getting close and achieving the desired intonation pattern.

2.6 Basic infrastructure required for using computer based speech training aids/equipment

2.6.1 Room and equipment:

For an effective computer based speech training it is pertinent to have a few stringent criterions. According to Rehabilitation council of India guidelines an institute with speech science lab should ideally be a quiet room. The average size of the room should be (6×6) sq. ft.. With computer PC- AT with VGA color monitor. Hi- fi ampli deck with speakers and good microphone, software for diagnostic/therapeutic use, audio cassettes for training. Other important factors to be considered are a well lit room with good aeration. Comfortable seating arrangement and a less reverberant room is desirable. The cleanliness of the room and equipment is essential. Power cables should be nicely secured. A power back up with voltage stabilizer is also required for unobstructed training program.

2.6.2 Speech training system:

What distinguishes a good computer-based speech training system? Throughout the literature many design considerations are mentioned, but few are collected into a theoretical framework against which different systems can be compared or analyzed.

Watson and Kewley-Port (1989) argues that a good system should possess the same properties as a speech therapist and defines this with the following characteristics;

- being able to assess the speech of a child and distinguish problem areas, being able to make a treatment plan
- Give cues in form of produced speech; give feedback based on the child's production and keep records of how the child performs.
- physical source of feedback, from which modality is the information of the speech production obtained, standards of evaluation, what kind of model should be used to compare the speech production with and level and type of detail on which feedback is based, that is how much processing should be done before the result is displayed and in which form it should be displayed.

Mahshie (1995) also carries out a discussion on good computer-based aids and does this from three main pedagogical factors. The *task and target skills the child needs to learn, the cues given to the child and the feedback* on how good the production was. Interesting here is perhaps the task and target skill that is not mentioned by Watson and Kewley-Port. Other important considerations mentioned in the literature are those

concerned with most computer-based systems. The system must be easy to use, clear instructions are needed and, the system must be acceptable for both therapists and children (Oster 1996).

- Clear instructions and pedagogical manuals must be created and made available for use with different groups of children.
- The visual feedback of the child's voice and articulation should be shown immediately and without delay.
- The aid must be acceptable to the therapist as well as to the child, which means that the aid must be attractive, interesting, easily comprehensible, easy to handle, and motivating.
- The visual pattern must be natural, logical and easily understandable. This means that training parameters as, e.g., pitch could be shown vertically as pitch variations occur; intensity through the size of an object that becomes larger as a sound becomes louder and smaller as a sound becomes softer; intonation and stress through a continuous red curve; duration could be shown horizontally and voicing through a relationship between voicing and the change of a color.
- The aid should provide a contrastive training, that is, the correct model of the therapist and the deviant production of the child are shown simultaneously and compared with each other.
- The aid should provide a flexible, individual, and structural speech and voice training and give an objective evaluation of the child's training results.

2.7 Tele Speech Therapy/Telepractice

2.7.1 Tele Speech Therapy

Telepractice is the application of telecommunications technology to the delivery of speech language pathology and audiology professional services at a distance by linking clinician to client/patient or clinician to clinician for assessment, intervention, and/or consultation. Supervision, mentoring, and pre-service and continuing education are other activities that may be conducted through the use of technology.

The term **telepractice** is rather frequently used terms **telemedicine** or **telehealth** to avoid the misperception that these services are used only in health care settings. Other terms such as **teleaudiology telespeech**, and **speech teletherapy** may be used in addition

to **telepractice**. Services delivered by audiologists and speech-language pathologists are also included in the broader generic term **telerehabilitation** (American Telemedicine Association, 2010). **Telepractice is an appropriate model of service delivery for audiologists and speech-language pathologists**.

Telepractice venues include schools, medical centers, rehabilitation hospitals, community health centers, outpatient clinics, universities, clients'/patients' homes, residential health care facilities, childcare centers, and corporate settings. There are no inherent limits to where telepractice can be implemented, as long as the services comply with national, state, institutional, and professional regulations and policies.

2.7.2- Types of Tele speech therapy-

The two most common terms describing types of telepractice are **synchronous** (client/patient interactive) and **asynchronous** (store and forward).

a) Synchronous services are conducted with interactive audio and video connection in real time to create an in-person experience similar to that achieved in a traditional encounter. Synchronous services may connect a client/patient or group of clients/patients with a clinician, or they may include consultation between a clinician and a specialist (Department of Health and Human Services, 2012).

b) In asynchronous services, images or data are captured and transmitted (i.e., stored and forwarded) for viewing or interpretation by a professional. Examples include transmission of voice clips, audiologic testing results, or outcomes of independent client/patient practice.

c) Hybrid applications of telepractice include combinations of synchronous, asynchronous, and/or inperson services.

2.7.3- Rules and Regulations of Telepractice:

- Individuals who hold the degree in Speech language Pathology and audiology should be trained in telepractising can only perform this service.
- Professionals shall evaluate the effectiveness of services provided, technology employed, and products dispensed, and they shall provide services or dispense products only when benefit can reasonably be expected.
- Individuals shall make use of technology and instrumentation consistent with accepted professional guidelines in their areas of practice. When such technology is not available, an appropriate referral may be made.

- Individuals shall ensure that all technology and instrumentation used to provide services or to conduct research and scholarly activities are in proper working order and are properly calibrated.

2.7.4-Roles and responsibilities for audiologists and SLPs in the provision of services via telepractice include

- understanding and applying appropriate models of technology used to deliver services;
- understanding the appropriate specifications and operations of technology used in delivery of services;
- calibrating and maintaining clinical instruments and telehealth equipment;
- selecting clients who are appropriate for assessment and intervention services via telepractice;
- selecting and using assessments and interventions that are appropriate to the technology being used and that take into consideration client/patient and disorder variables;
- being sensitive to cultural and linguistic variables that affect the identification, assessment, treatment and management of communication disorders/differences in individuals receiving services via telepractice;
- training and using support personnel appropriately when delivering services;
- being familiar with the available tools and methods and applying them to evaluate the effectiveness of services provided and to measure outcomes;
- maintaining appropriate documentation, including informed consent for use of telepractice and documentation of the telepractice encounter;
- being knowledgeable and compliant with existing rules and regulations regarding telepractice including security and privacy protections, reimbursement for services, and licensure, liability and malpractice concerns;
- collaborating with physicians for timely referral and follow-up services (Hofstetter, Kokesh, Ferguson, & Hood, 2010);
- using web-based technology to engage clients through virtual environments and other personally salient activities (Towey, 2012).

Telepractice is constantly evolving. Ongoing education and training is required to maintain expertise and familiarity with changes in technology and potential clinical applications.

2.8 Let us sum up

The speech therapist along with educator is irreplaceable and must be present in all stages of speech teaching. The speech therapist is necessary not only to evaluate the deviations of the child's speech and to make a plan of suitable exercises, but also to judge the mood of the child and depending on it make the speech training session as motivating as possible.

An efficient CBST system must allow the speech therapists to easily adapt and refine the exercises depending on the development and motivation of the child during the supervised sessions. In a human-led session, the therapist makes quick changes between exercises and aids in order to make the session as fulfilling and stimulating as possible. This variation and knowledge are extremely difficult to mimic automatically with a computer-based system, but given the functionality a therapist would make the right choices.

A computer-based speech training aid would be of most help if it supports repeated practice without the help of a speech therapist. Automation of the speech, that is to practice a speech sound until it can be produced automatically without being aware of how it is done exactly, requires much practice. Usually there is not enough time to accomplish this during speech sessions. If there were systems available that could give corrections without assistance from a therapist, the repeated practice to automate the speech sounds could be done by the child on her/his own.

A speech training aid should be easy to adapt to the child and his/her problems. Every child with a speech deficit is unique and has unique difficulties. Another reason for adaptability is the motivational factor. Depending of the mood of the child, the system must be adaptable in order for the therapist to find an exercise that motivates the child enough to practice more. A CBST system should support language learning. Speech training is much more than just practicing on producing speech sounds. Children with speech deficits often have a second impairment in the form of a language deficit, and the therapist helps the child to further develop the language that the child already has conquered. The material used in a computer-based system should relate to the daily life of the children using the system. The therapist tries to connect the exercises with the daily life of the child in order to support and develop the child's own language. It is natural that a CBST ideally should do the same. User Profiles There should be a possibility to store the sounds being trained. This feature is important as a way to

record the development of the child, but also to strengthen the connection between training and the child's own life. A CBST should provide the possibility to store pictures and text together with the speech sounds. A reoccurring tool in speech training is a physical notebook, in which pictures and text used in the training are collected. This tool should be adapted to the CBST situation. Using an electronic note-book such as Digital Portfolio [13] the therapist can enhance the connection between the training and the child's experience by adding items that are relevant to the child. As an example, the exercises could be illustrated with digital images of the child's own life. The interactive electronic note-book would hence make the system more adaptable and make it easier to vary the exercises in order to avoid that the training becomes boring. Due to the variability of the deviations that the children have, the system should ideally have the same variability.

Rewards: Rewards should be distributed according to the effort made by the child, and not only the result of the child's attempts. When talking about rewards during one of the interviews, the problem of how to distribute the reward came up. The therapists agreed that the notion of rewards is good, but that current CBST systems often distribute the rewards based only on the result. An example of this is a game where the child steers a car with its voice and is supposed to avoid colliding with obstacles. The reward, a cheering sound, is only given if no collisions occurred, which seems hard on a child who has been trying hard and collided only once during the game. Another example is implementations where the child gets to play a game as a reward after producing a specified amount of good pronunciations. Since the children are at different levels and some children have enormous difficulties that might not ever be overcome, some children may never get to play a rewarding game or only play for a short time, if rewards are distributed according to results. The teacher should be able to vary the amount of reward in a computer-based aid. This feature is needed not only because the children are different from each other, but also due to the fact that the child develops and acquires new skills.

Parental Involvement If the system or parts of the system should be used outside the school, or without the presence of a therapist, the exercises must be different than those used by the therapist. Many parents would like to be more involved in the speech training.

2.9 Check your progress

- Discuss some of the computer based speech training programmes
- Discuss the management of voice of children with hearing impairment

- Discuss the management of suprasegmentals in children with hearing impairment
- What are the basic infrastructure requirement for using computer based speech training aids/equipment
- Discuss about tele speech therapy

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Unit 3 □ Technology Facilitating Language and Communication

Structure :

3.1 Introduction

Technology helps us in learning.It also helps us in improving our knowledge and skill development. Thereby facilitating language and communication skills.There are various types of low cost technology which enable not only the disabled population but also normal students.Visual aids like classroom objects,writing boards,old news papers help a child to learn. Various printed materials like pictures, magazines, photographs,

calendars and postcards can be used.Audiovisual materials like cassette, tape-recorder,cable television,slides and transparencies are also helpful in facilitating learning.Electronic and web based technology like television,digital recorders,downloaded AV films also facilitates language and communication.Language and communication can be achieved through use of search engines,online learning materials and language apps.

Web based technology has been used for using and training of Indian sign language. The ISL Pronto live chat support software is now integrated with **Lionbridge GeoFluent** to help businesses assist international customers more effectively. Whilst ISL Pronto enables website customer service with real-timeinteractions between online visitors and help desk operators translations into and between 30+ languages are initiated on-demand by customers or operators within the existing ISL Pronto chat application. A new software application being developed by scientists in Aberdeen is the first of its kind in the world which can be used on portable devices and allows users to customise sign language to their own specific needs.The technology has the potential to transform how sign language users communicate, whether they are profoundly deaf or have lost hearing in later life.Computing scientists at *Technabling*, a spin-out company of the University of Aberdeen, are behind the technology which aims to bridge the gap between sign language and more standard forms of communication.This technology has the ability to convert sign to text and text to sign.AAC(Alternative Augmentative Communication) also facilitates language and communication. Advances in computer technology have led to the creation of specialized devices-called augmentative and alternative communication (AAC) devices-that help make it possible for individuals with no speech, or individuals with poor speech, to overcome their communication problems.Augmentative devices are designed to support or enhance the speaking capability of a person. Alternative devices, on the other hand, replace speech as a means of communication.There are a variety of electronic AAC devices on the market, ranging from very low tech to very high tech, and ranging in price.

3.2 Objectives

After completion of this unit, the student will be able to :

1. To have knowledge about various Low Cost Technology and its application in development of teaching learning materials.

2. To develop an overview of various Electronics and web based technology applications:T.V,digital recorders,downloaded AV films,search engines,online learning materials, language apps
3. To develop knowledge of various web based technology for using and training of ISL.
4. To know about the concept of sign to text and text to sign.
5. To know about AAC for children with Hearing Impairment.

3.3 Low Cost Technology and its application in development of teaching learning materials

Visual aids are very important and effective in the process of meaningful teaching and learning. If we use audio-visual aids considering the needs of the students as well as the lesson, impact of lesson, teaching and classroom environment is long lasting.

Visual aids capture the attention of students and they start participating and taking interest in the lesson.Students not only clarify their concept but also associate their abstract concepts with the visual aids and they get better understanding of the concepts.

Visual examples from surroundings of the daily life work as great motivation for the students. Paul Stephens (1994) said that for the effective teaching it is necessary for the teachers to make subject exciting and like that whenever possible the students can relate to their real world.Teachers should take great interest in selection of creative teaching techniques and must incorporate low cost AV aids in their lesson plan.Maximize student participation to lessen teacher's work load. Head teacher may act as a resource person.School canteen can be a good source to collect resource materials. Every year assign a project to senior classes that become a permanent part of the school such as wall clock making and hang it in the classroom or one point camera making and take a group photo of that year students with their respective teacher and principal and display it in the entrance or any important place.Honor the class by placing their names on their projects.

Students individually and in groups under the supervision of subject teacher may be assigned the preparation of teaching aids which may help out to meet the expenditure.Hold student's competitions individual and in groups for model preparation. Such a brain storming initiative will motivate them to come out with hundreds of new ideas ensuring learning.

Display student's projects in the form of exhibition to inspire others to participate in such competitions.Appreciate innovative ideas that are not copied from anywhere.

3.3.1 Types of Low Cost Material Used for Teaching

Teaching aids based from surrounding:

a) Yourself

b) Children

c) Classroom Objects

d) Writing Board

e) Library old newspapers

f) School dustbins

The teachers themselves: The teacher can use gesture, facial expression and actions to show the meaning of words and to explain situations wear makeup, colors and clothes that have some symbolic meaning to the lesson.

Children: Children, illustrate the situation according to the instructions given by the teacher.

Classroom Objects: Such as table, chairs, window, fans etc. can be used as AV aids to give some specific concepts e. g. talking about materials, preposition (asking position of different objects) shape, colors etc.

Writing Board: the teacher or students can use it to draw pictures, diagrams, maps etc.

3.3.2 Three types of Low cost Material can be used for successful teaching/learning as per requirement.

Printed Materials	**Audio-Visual Material**	**Display Material**
Textbook & Reference	*Radio*	*Pictures*
News Paper	*Cassette & Tape Recorder*	*Flash Cards*
Magazines		
Photographs	*Cable Television*	*Charts*
Calendars/ Postcards	*Satellite Television*	*Graphs*
		Maps
	Slides	*Diagrams*
	Transparency	*Posters & Bulletin Board*
	Computers/CD's	*Peg Board*
	Film Strips	*Flannel Board Small*
	Mobile Videos and Sounds	

3.3.3 Making and Using Low Cost Teaching Aids

Making teaching aids is an emotionally intellectually aesthetically and professionally

rewarding experience. It is an act of creation. It is an affirmation that I as a teacher care about the pupils and believe that, with the help of these learning aids, they can learn. It is an act of love.Teaching aids provide a stimulus for exploration end thinking. With the added input of verbal, personal communication with an adult, interaction and discussion arise...and these are crucial to reel, activity-based learning.

Adults (and older children) help younger ones to interpret sensory and language experiences, to clarify them and relate them to their previous understandings. Children then learn by blending language with experiences. They learn to think. For maximum mental growth and personality development, a child's life needs to be filled with stimulating, encouraging experiences. Appropriate low cost learning materials (teaching aids) help children to develop their innate abilities

Who can make these low cost teaching aids?

Teachers, anganwadi / balwadi workers.

Teacher trainees and workshop/refresher course participants.

Older school students...to fulfil the community service requirements of their syllabus. Interested parents and other community volunteers.Residents of old-age homes, jail inmates, and others.

3.4 Electronics and web based technology applications : T.V, digital recorders, downloaded AV films, search engines, online learning materials, language apps

Children learn best by observing and copying the behaviors of adults. It is therefore evident that learning is more effective when sensory experiences are stimulated. These include pictures, slides, radios, videos and other audiovisual tools including TV,Digital Recorders,downloaded AV films . According to the Webster dictionary, audio-visual aids is defined as 'training or educational materials directed at both the senses of hearing and the sense of sight, films, recordings, photographs, etc. used in classroom instructions, library collections or the likes". There are various types of audiovisual materials ranging from filmstrips, microforms, slides, projected opaque materials, tape recording and flashcards. In the current digital world, audiovisual aids have grown exponentially with several multimedia such as educational DVDs, PowerPoint, television educational series, youtube, and other online materials. The goal of audio-visual aids is to enhance teacher's ability to present the lesson in simple, effective and easy to understand for the students. Audiovisual material make learning more permanent since students use more than one senses. The outcome is to promote the audiovisual material in secondary schools because they lack the resource to produce them. The visual instruction makes abstract ideas more concrete to the learners. This is to provide a basis for schools to understand the

important roles in encouraging and supporting the use of audiovisual resource. In addition, studies have shown that there is significant difference between the use and non-use of audiovisual material in teaching and learning.

The web is a fast growing Technology.The number of sites doubles every six months.Web is too vast to browse by merely following the links.A number of websites consist of searchable indexes to information on the web.Infosys and yahoo are topic oriented indexes.Altavista is a search engine with availability of full text indexes.Askjeeves is a natural language search site.Search engines keep track of information available on the internet.They have programs to follow everylink in a given page and make an entry into huge database,which is often indexed.There is another type of search engine known as meta search engine that gives information to other search engines.There are various online learning materials which help in facilitating language and communication that can be accessed in the internet.Apart from that we have various language apps available and downloaded in ipads and mobiles which facilitate communication.Some of them are discussed below.

3.4.1 Language Apps for children

App Name	Focus	Age Group	Description	Purchase/Download Info
Peek-a-Boo Barn Lite	• Spatial concepts (in, on, under, next to) • Animal sounds • Vocabulary (animals names, open/shut, barn) • Turn-taking • WH questions (what, where)	0-3	Listen to animal noises, then push barn doors to reveal the farm animal inside. Available in 10 languages.	Free on iTunes for iPhone/iPad and Android
Toca Boca Kitchen Monsters	• Verbs • Labeling (foods) • Language expansion (practice 2+ word phrases) • WH questions • Following directions • Environmental sounds	2-6	Choose and prepare various foods before feeding them to a Toca monster.	Free on iTunes for iPhone/iPad

App Name	Focus	Age Group	Description	Purchase/Download Info
Tally Tots	• Verbs • Two-word combinations • Counting • Concepts (i.e. matching, size (big/little, on/off) • Following directions	2-6	Involves counting 1-20. Each number coordinates with an activity that illustrates language concepts	iTunes for iPhone/iPad and KindleFire/Android
Speech Tutor	• Articulation • Visual cues (what mouth, lips, tongue, etc. are doing) for production • Tips for producing the sound • Other information about a selected sound	All Ages	Watch a virtual mouth as it produces selected sounds. This application also provides tips for producing the sound and age for when we expect mastery of each sound.	Free on iTunes for iPhone/iPad
My Play Home Lite	• Vocabulary (around the house) • Actions • Pronouns • Following directions	2-6	Manipulate people and things inside an interactive home (i.e. make Mom drink water, put Dad behind the couch, make the boy jump on a chair).	Free on iTunes for iPad and Android
Articulation Station	• Articulation • Matching • Labeling	All ages	Speech sounds in words, sentences and stories in all positions of words (i.e. initial, medial and final). Choose from flashcards or matching games. Easy to keep track of accuracy and progress	Free to download on iTunes for iPhone/iPad
iSequence	• Sequencing • Expressive language (grammar, syntax) • Vocabulary	5-7	Put 3-4 picture sequences in the correct order. Includes 100 sequences.	On iTunes for iPhone/iPad

App Name	Focus	Age Group	Description	Purchase/Download Info
Blue Whale-NACD	● Apraxia and articulation (CVC productions only)	1+	Imitate consonant-vowel-consonant ("CVC") productions. 8 levels of complexity included.	On iTunes for iPad. Also available for for Kindle, Android tablets and Nook.
Describe It to Me	● Word-finding ● Categories ● Salient features ● Object function ● Parts ● Location	5+	Complements EET program (Expanding Expression Tool). App can be used both expressively (e.g. to generate ideas), or receptively (e.g. correctly select or point to various objects' categories, function, parts). Customize vocabulary given child's needs, as well as skills targeted (categories, parts, etc).	On iTunes for iPad (free sample on iTunes).
Full Social Skills Builder	● Understanding emotions ● Perspective taking ● Identifying appropriate responses (making comments, asking for information)	5-12	Videos are organized according to age group (school age, adolescent). Watch videos in different environments (school, community). Child answers 3-5 multiple choice questions following video.	On iTunes for iPhone/iPad.

Here are seven other assistive communication apps for the iPad that you may find useful:

Proloquo2Go

Company: AssistiveWare

Proloque2Go is the most well known of all the assistive communications apps on the iPad. It is also one of the priciest. Proloque2Go is a full-featured augmentative and alternative communication solution for autistic children who have difficulty speaking. Easy to set up and use it provides natural sounding text-to-speech voices, high resolution up-to-date symbols, powerful automatic conjugations, a default vocabulary of over 7,000 items and is fully expandable. The app is very easy for individuals with special needs to navigate through the menus. It has a beautiful graphic display and great voice quality.

iCommunicate for iPad

iCommunicate for iPad allows you to create pictures, flashcards, storyboards, routines, visual schedules and record custom audio in any language. Aside from beeing an AAC device iCommunicate also includes task completion and audio visual prompting. iCommunicate comes preloaded with 10,000 symblstix pictures. You also have the ability to insert Google images and the story boards are printable. One negative is that this app is for the iPad only. The feature set is definitley not as robust as Proloque2Go, but you get what you pay for.

Looking to get your feet wet with an AAC app without forking over big bucks? iComm may be for you. iComm lets you load picture and audio and record your own voices. Ideal for children with autism, cerebral palsy, apraxia and down syndrome. A heads up, although this app is free a lot of the features available. Another downer is that iComm only works with the iPad and iPhone and not the iPod Touch.

My Talk Tools Mobile

My Talk Tools Mobile for the iPhone, iPod touch and iPad enables people with communication difficulties to express their needs and desires to those around them. My Talk Mobile represents a major breakthrough in augmentative, alternative communications (AAC) by making it easy to customize how you communicate through a variety of images, pictures, symbols and audio files including human voice. In 5 minutes, you can create your very own content and communicate in a way that YOU choose. My Talk offers a robust feature set for the price. The app can also be shown on an external display making it great for school.

Look2Learn - AAC

Look2Learn (L2L), a revolutionary AAC software application for the iPod Touch, iPhone, and iPad allows individuals to work at their communicative level using photographs to express wants and needs. The easy to use system integrates preloaded vocal output so that individuals can use their "voice". In addition, users are able to record their own personalized audio and pair it with photos! This is a good app for beginners not willing to shell out more money. One thing to concerned about is that the app can only hold 140 pictures.

Voice4u, is a revolutionary AAC (augmentative and alternative communication) application that helps individuals to express their feeling, thought, actions and things they need. It is a perfect solution for learning and communication for autistic individuals and people around them. With it, you will never have to guess at an individuals' wants

and needs and will break down the barriers of communication for individuals with special needs. Two complaints about Voice4U are that the illustrations are not the best and that you are limited to 9 categories.

iConverse

XcellentCreations

iConverse is an educational tool designed for young children, autistic individuals, and individuals with other communicative disabilities, and also toddler-aged children who have yet to master language. iConverse is an Augmentative Alternative Communication (AAC) application for the iPhone and iPod Touch that replaces bulky and expensive communication devices used in the past. iConverse comes with only 6 preloaded image buttons so you will need to do some button making work before you can use it. It also does not come with a scheduler to help with transitions.

Use of computers for communication and networking activities via the Internet can expand the learning environment beyond the walls of the classroom and allow students with disabilities, just like other students, to access and send information literally around the world. Yet improved access and delivery systems do not necessarily bring improved instruction. To the contrary, improved learning is dependent upon the quality of instruction and not on the medium through which it is delivered.Communication technologies become a powerful tool for learning only if they offer students opportunities to gather a wide variety of resources and information and then to exchange their thoughts and ideas with others in collaborative learning environments, networked through the Internet. Use of web based technology can enhance a student's acquisition of skills and content knowledge when the computer is used to deliver well-designed and well-managed instruction.A teacher's ultimate goal is to help students develop skills and knowledge that can be used in real-world settings.Many computer-based applications--such as the Internet, communication technologies,CD-ROM reference materials, and multimedia presentation tools can provide students with opportunities to use their skills to engage in projects.

3.5 Web based technology for using and training of ISL

Cloud-based remote desktop, live chat and web conferencing solutions, had announced a partnership with Lionbridge Technologies, Inc. (NASDAQ: LIOX), a leading provider of translation solutions, to deliver customer support software with automated multi-language chat translations. The ISL Pronto live chat support software is now integrated with Lionbridge GeoFluent to help businesses assist international customers more effectively. Whilst ISL Pronto enables website customer service with real-time interactions between online visitors and help desk operators, the integrated GeoFluent service delivers instant, quality translations of their text chats. Translations into and between 30+ languages are initiated on-demand by customers or operators within the existing ISL Pronto chat application. ISL Pronto is live chat support software for websites that lets you respond directly to your online visitors and offer immediate technical assistance. Apart from basic text chatting, rich functionality such as customer identification, CRM integration, quality desktop sharing and a video conference, improves consumer satisfaction and increases conversions. Unlike other live chat solutions, ISL Pronto is available in 32 languages, including most of the European languages, as well as Arabic, Japanese and Chinese.

Although international companies find the service appealing, the main problem with real time support remains in language related issues. "Since the language barrier exists in a surprisingly high percentage of chats," explained Jure Pompe, CEO and co-founder of ISL Online, "we wanted to improve ISL Pronto with an automated on-demand translation service to help assist international customers better, faster and without the extra language-specific operators. Lionbridge's GeoFluent was the logical addition to our chatting facilities."

GeoFluent is a customized automated translation solution for customer support applications such as online chat and community applications. Unlike other automated translation solutions, GeoFluent's patent-pending technology delivers an actionable and understandable real-time translation where other automated approaches fail, and where traditional translation approaches are not practical. With GeoFluent, support organisations can expand their international operations more easily while reducing their costs. In India Indian Institute of Technology Guwahati is undergoing a research project.Development of Text to Speech System in Assamese and Manipuri Languages Sponsoring Agency: DIT, Govt. of India. Principal Investigator: Prof. S. R. M. Prasanna Co-investigator: Dr. R. Singh (CSE Dept.)

Another research project is been carried out in IIT,Guwahati on Development of

an Indian Sign Language Recognition System for Hearing Impaired Students of India.

Sponsoring Agency: National Mission on Education through ICT, MHRD, Government of India.

Sponsoring Agency: National Mission on Education through ICT, MHRD, Government of India.

Principal Investigator: Dr. M. K. Bhuyan

Co-investigator: Prof. P.K. Bora

Ramakrishna Mission Vivekananda University , was established with Faculty of Disability Management and Special Education (FDMSE) as one of its faculties in Ramakrishna Mission Vidyalaya, Perianaickenpalayam, Coimbatore.They have created a visual dictionary of Indian Sign Language containing huge number of signs and they are improving it everyday. They are also planning to introduce flash cards, quizzes, puzzles etc to make learning Sign Language easy and fun.

3.6 Sign to text and text to sign technology

The software application being developed by scientists in Aberdeen is the first of its kind in the world which can be used on portable devices and allows users to customise sign language to their own specific needs.The technology has the potential to transform how sign language users communicate, whether they are profoundly deaf or have lost hearing in later life.Computing scientists at *Technabling*, a spin-out company of the University of Aberdeen, are behind the technology which aims to bridge the gap between sign language and more standard forms of communication.One of its main focuses is to help young deaf people gain employment opportunities.Dr Ernesto Compatangelo, a lecturer in Computing Science at the University of Aberdeen, and founder and Director of *Technabling* said: "The aim of the technology - known as the *Portable Sign language Translator (PSLT)* - is to empower sign language users by enabling them to overcome the communication challenges they can experience, through portable technology."The user signs into a standard camera integrated into a laptop, notebook, Smartphone or other portable device such as a tablet."Their signs are immediately translated into text which can be read by the person they are conversing with."The intent is to develop an application - an "app" in Smartphone terms - that is easily accessible and could be used on different devices including Smartphones, laptops and PCs. "The *PSLT* has the potential to be used with a range of sign languages including British Sign Language (BSL) and

Makaton.The number of people in the UK whose first or preferred language is BSL is estimated to be between 50,000 (Action on Hearing Loss) and 70,000 (British Deaf Association).BSL is however, a general-purpose language and therefore poses limitations for users, making it impossible for them to easily express certain concepts and terms that are very specific or used only within particular areas of society - for example education and the workplace.To overcome this, *PSLT* enables users to personalise sign language to their own individual needs.In India some IT based companies are trying to develop some web based software and mobile applications to convert the sign to text and text to sign.

3.7 Augmentative and Alternative communication for children with Hearing Impairment and additional /associating concerns.

Advances in computer technology have led to the creation of specialized devices-called augmentative and alternative communication (AAC) devices-that help make it possible for individuals with no speech, or individuals with poor speech, to overcome their communication problems.Augmentative devices are designed to support or enhance the speaking capability of a person. Alternative devices, on the other hand, replace speech as a means of communication.There are a variety of electronic AAC devices on the market, ranging from very low tech to very high tech, and ranging in price. Some devices are "dedicated,"that is, their only purpose is to provide a means of communication. Other devices have been designed to work in conjunction with a computer that plays multiple roles (such as word processing or calculations). In addition, existing computers can now be modified for use as an AAC device through the addition of special communication software and hardware. These modifications are often less expensive and more flexible than many custom-built AAC devices.All AAC systems vary in terms of their portability, complexity, input method, vocabulary representation format, and means of output delivery. Selecting an appropriate system must be tied to the needs and capabilities of the student. For example, students with physical or mental disabilities who cannot use a standard keyboard can use alternative input devices, such as touch-sensitive pads,selection switches, or optical pointing devices. For students who have difficulty with vocabulary, AAC systems have been developed to allow communication through word selection devices or even devices using pictures and

graphics. To assist students with disabilities in delivering a message, various speech and print output devices have been developed. Today, many communication devices have incorporated either synthetic or digital speech output.Synthetic speech is artificially generated by the computer, while digital speech is an actual recording of human speech stored in the memory of the device. Written output can be provided by printers that are built into the communication device or attached externally, but this option is cumbersome because of the large amount of paper required. As a result, some devices use liquid crystal displays (LCDs) to show students' messages--some displaying a single line of text at a time, some displaying multiple lines of text, and some using both the LCD and speech output together.Clearly, AAC systems can be extremely powerful tools for individuals with speech and language disorders. At a banquet for software publishers in 1998, a letter was read from a young man whose computer had been outfitted with a device converting text to speech output. In his letter, he talked about how technology had changed his life:"Until now, I have never had a voice or a way to communicate. Until this year I was in a special education classroom. Now I am in the regular school in eighth grade. My computer has been the best thing that has ever happened to me in my life. Now people do not have to read my words. They can listen like everyone else." While an AAC device can enable some students with severe communication disorders to participate in instructional activities alongside their nondisabled peers, the rate of message transmission is still quite slow compared with normal speech. As computer-based technologies advance and AAC devices become smaller, more flexible, and less expensive, they will likely help even more students with communication disorders in the future.

3.8 Let Us Sum Up

Technology plays a very important role in facilitating language and communication.Both low cost technology as well web based technology helps in development and learning.Low cost aids like printed materials as in books,news papers, magazines, articles, calendars, postcards, flashcards, diagrams, charts, etc facilitates learning. Apart from it Audiovisual aids using electronic technology like television.digital recorders, audiovisual films also helps in learning.Internet has made everything and anything impossible as possible.With one touch and click everything is in our hands.Various search engines,online learning materials and various downloaded language apps can facilitate learning.

Web based technology for using and training in ISL implies to the use of Internet based technology for training in Indian Sign Language.The ISL Pronto is a recent development which is a live chat support software for websites that lets you respond directly to your online visitors and offer immediate technical assistance. IIT Guwahati is undergoing two projects regarding web based technology and its use in ISL.Ramkrishna Mission ,Coimbatore has developed a web based ISL Dictionary.

AAC systems can be extremely powerful tools enabling some students with severe communication disorders to participate in instructional activities alongside their nondisabled peers.

The barriers of inadequate teacher training and high cost are problematic-significantly inhibiting the use of technology in classroom settings. There is no doubt that technology has the potential to act as an equalizer by freeing many students from their disability in a way that allows them to achieve their true potential. More widespread use of technology would meet both the legal requirements and the spirit of the laws calling for students with special needs to be educated in the least restrictive environment. Working together, parents, teachers,administrators, and school board members, as well as both students with disabilities and their nondisabled peers, can help create classroom environments in which all students have opportunities to learn.

3.9 Check your progress

1. What do you mean by low cost technology teaching aids?
2. What are the different types of low cost technology teaching aids?
3. What are the different electronic and web based applications?
4. How can internet be used as a technology facilitating language and communication?
5. What is sign to text and text to sign technology?
6. How can web based technology be used in training of ISL?
7. What is Alternative and Augmentative Communication?
8. What are the different types of AAC'S used for Hearing Impaired population?

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Unit 4 ▫ Technology Facilitating Education

Structure :

4.1 Introduction

Technology is everywhere in education: Public schools in the United States now provide at least one computer for every five students. Learning management systems, student information systems, and other software are also used to distribute assignments, manage schedules and communications, and track student progress. Educational software and applications have grown more "adaptive," relying on technology and algorithms to determine not only what a student knows, but what his or her learning process is, and even his or her emotional state. For all the technological progress, though, implementation remains a major challenge. Schools and educators across the country continue to wrestle with the changing role of teachers, how to balance flexibles and "personalized" models

with the state and federal accountability requirements they still must meet, and the deeper cultural challenge of changing educators' long-standing habits and routines. Despite the massive investments that many school systems are making, the evidence that digital personalized learning can improve student outcomes or narrow achievement gaps at scale remains scattered, at best.

4.2 Objectives

After learning this unit the learners will be able to:

- Know about the technological impact on education
- Know about the changing trends in teaching and learning process
- Know about various technology products for educational purposes
- Know about the technology based educational services
- Know about the importance of Information and communication technology and its impact on education of children with hearing impairment
- Know about the future technologies and universal design also

4.3 Technology and its impact on education: changing trends in teaching and learning

The definition begins with the proposition that "educational technology is the study and ethical practice of facilitating learning . . ." indicating that helping people to learn is the primary and essential purpose of educational technology. All of the AECT definitions since 1963 have referred to learning as the end product of educational technology. However, the definitions have differed regarding the strength of the connection between technological interventions and changes in learner capability.

According to Association for Educational Communications and Technology as "the study and ethical practice of facilitating learning and improving performance by creating, using, and managing appropriate technological processes and resources". Educational technology refers to the use of both physical hardware and educational theoretics. It encompasses several domains, including learning theory, computer-based training, online learning, and, where mobile technologies are used, m-learning. Accordingly, there are several discrete aspects to describing the intellectual and technical development of educational technology:

- Educational technology as the theory and practice of educational approaches to learning
- Educational technology as technological tools and media that assist in the communication of knowledge, and its development and exchange
- Educational technology for learning management systems (LMS), such as tools for student and curriculum management, and education management information systems (EMIS)
- Educational technology itself as an educational subject; such courses may be called "Computer Studies".

When children with disabil ities are given opportunities to flourish as any other children, they have the potential to lead fulfilling lives and to contribute to the social, cultural and economic vitality of their communities. Yet surviving and thriving can be especially difficult for children with disabilities. All too often they are isolated and excluded, cut off from health, education and social services, and with limited opportunities to participate in family and community life. This frequently impacts on their future employment opportunities and participation in civic life. Assistive technology includes products and related services that improve the functioning of children with disabilities. It can be instrumental for children's development and health, as well as for participation in various facets of life. These include communication, mobility, self-care, household tasks, family relationships, education, and engagement in play and recreation. Assistive technology can enhance the quality of life of both children and their families.

Assistive technology is one of the key elements to advancing inclusion of children with disabilities together with additional supports such as personal assistance, sign language interpreters and removal of barriers. Access to assistive technology for children with disabilities is critical for many to access and benefit from education. Access to assistive technology is a precondition for achieving equal opportunities, enjoying human rights and living in dignity. Girls and boys with disabilities are entitled to available and affordable assistive technology.

The global need for assistive technology for children has not yet been adequately quantified. Estimates indicate that about 0.5% of a population need prosthetic or orthotic

devices, about 1% need a wheelchair, and about 3% need a hearing aid. These needs vary between countries as well as between regions within a country due to factors such as variations in age distribution and prevalence of various impairments. In developing countries, up to 0.6% of children have hearing impairments within the neonatal period. However, hearing aids are not always an appropriate solution. In Chile and China, about 7-9% of school aged children would benefit from using properly prescribed eyeglasses. In Sweden, about 0.2% of all children aged 0-17 years use wheelchairs. In some African countries, the largest discrepancy between self-reported needs for and received rehabilitation services was found to be in the area of assistive technology. WHO estimates that only 5-15% of assistive technology needs are met in many developing countries. Studies in Malawi and Namibia indicate that more than 80% of those who need assistive technology do not have it.

When appropriate to the user and the user's environment, assistive technology is a powerful tool to increase independence and improve participation. It helps individual children become mobile, communicate more effectively, see and hear better, and participate more fully in learning activities. Moreover, assistive technology supports children to access and enjoy their rights; do things they value; and bridges disparities between children with and without disabilities. It provides the means of access to and participation in educational, social and recreational opportunities; empowers greater physical and mental function and improved self-esteem; and reduces costs for educational services and individual supports. Benefits in areas such as health, mobility and education have been linked to the use of assistive technology. By improving access to education and increasing achievement in school, assistive technology can have a positive socioeconomic effect on the lives of children with disabilities.

By facilitating the participation and inclusion of children with disabilities in all aspects of life, assistive technology can impact on self-image, self esteem and sense of self-worth. In a study in Bangladesh, the use of assistive technology was associated with better attitudes from community members. "Given opportunities to flourish as others might, children with disabilities have the potential to lead fulfilling lives and to contribute to the social, cultural and economic vitality of their communities". Assistive technology reduces costs when it supports early childhood development and educational achievement, and avoids repetition of learning missed due to educational barriers. It reduces costs by supporting independent functioning and access to healthcare in lieu of personal support services, and independent community living in lieu of

institutionalization. Assistive technology may "reduce the need for formal support services, reduce the time and physical burden for caregivers, [and prevent] falls, injuries, further impairments and premature death". The link between school dropout and unemployment is clear, and frequently leads to high costs for society. An educated child with a disability supported by assistive technology will have better opportunities for employment. This results in less dependence on welfare and social security measures, greater contribution to the country's economy and gross domestic product (GDP), and a return on investment that goes beyond an individual family to the larger nation. For example, in Sweden, the cost for assistive technology for a student is recovered if he or she is able to enter the labour market just one month earlier due to this technology. Thus, assistive technology is an important part of any development strategy.

Providing assistive technology to children as early as possible will facilitate their development and prevent secondary conditions such as deformities. For example, correction of a clubfoot by the means of a simple foot orthosis at an early age may reduce the need for costly surgery at an older age. Some children with severe disabilities that are unable to attend school can access education from home and communicate with others with the help of assistive technologies, accessible information and communication technologies (ICTs) or cloud-based services. ICTs offer new ways to break down accessibility barriers and provide children with disabilities the opportunities to exchange knowledge and information, and to communicate in ways they otherwise have not been able to do. ICT tools and applications are paving the way for children with disabilities to access educational materials and resources in different formats and to engage in the same academic activities as their peers without disabilities.

There are over 11 million people with a limiting long-term illness, impairment or disability in the UK. Many of them are using educational resources and completing university courses. Universities have a responsibility to provide these students, and all students, with the necessary learning materials regardless of their accessibility needs. It is here, in the place where educational resources and students with disabilities intersect, that technology has a vital role to play. Technology could operate as the great equalizer. It could and indeed, it should help move all students towards a level playing field. This is particularly true in when it comes to learning resources, and specifically textbooks.

Textbooks are core to the university learning experience, yet for students with disabilities, particularly those with visual impairments, they can be a challenge. Static print sizes, outdated tools to translate print to speech, and complicated page layout and

design can make it harder for those with a disability. This in turn impacts on the quality of their educational experience. A study conducted by the Higher Education Academy among students in the UK indicated that resources are a common issue affecting the happiness of disabled students.

Consider another statistic: according to the Office for Disability Issues, disabled people are around three times less likely to hold any qualifications than non-disabled people, and around half as likely to hold a degree-level qualification. A total of 19.2% of working-age disabled people do not hold any formal qualification. Technology can change things. One area in which this is true is e-textbooks, the digital representation of a print text. In the shift from print textbooks to e-textbooks, accessibility can be moved to another level. Suddenly text isn't an unchangeable object; it can be scaled up or down depending on the student's needs. Images can be read aloud through tagging tools. Access to print-fidelity page images means students can follow along in lectures page by page. Simultaneously, access to text representation (suited to screen readers and text-to-speech software) means students can adjust their e-textbook according to their needs.

Through technology, learning is becoming increasingly flexible. It can move outside the lecture hall, on to podcasts, and across devices, becoming available anywhere and at any time. The Higher Education Academy noted that students with disabilities have a need for flexibility. Technology can help provide this. Students no longer have to carry around heavy textbooks. Nor do they have to go physically to the library or bookshop to access learning materials.

Resources such as e-textbooks have taken off in the past few years. In the US, the Student E-rent Pilot Project (STEPP) programme offers e-textbooks specifically modified for accessibility, in support of the Americans with Disabilities Act and the Rehabilitation Act of 1973, Section 504. A survey of 1,185 students found that 77% reported having saved money by renting their textbooks, and 80% who needed an accessible textbook were satisfied with the quality of accessibility.

It's only a matter of time before similar technological developments happen in the UK. Over the past few years, concerns about the student experience for individuals with disabilities have grown. Today's students are paying more than ever for a university education. Higher tuition fees and a growing awareness of disabilities will drive developments in technological resources. Yet there's another dimension to consider: in an era of increased fees, affordable educational resources are key. All students are

concerned to find savings. Students with print-related disabilities should be able to enjoy the cost-saving benefits made possible by online learning materials. They also should be able to access the countless digital efficiencies of these resources, the types that their peers have enjoyed for years.

While technological advances have been happening, there is still more to be done. Universities, companies, and e-textbook providers need to emphasise low-barrier, commercial alternatives for all higher education accessibility needs. They need to aim to provide industry-leading access to all subject areas, including Stem subjects.

Providers need to go beyond content access and come up with more universal design study tools that assist all students. Technology has helped increase accessibility in universities, but there is still a way to go.

Technology can be the great equalizer in a classroom with diverse learners. Whereas teachers can find it difficult to differentiate instruction for 30+ students in one class, all with different needs and abilities, "assistive technology" (devices and software to assist students with disabilities) can often help teachers personalize lessons and skills enhancement to each child. Children with learning disabilities often have better technology skills than their teachers and are drawn to computers and other gadgets, so using them in the classroom makes perfect sense. For children with physical disabilities, technology can give access to learning opportunities previously closed to them. E-readers help students turn book pages without applying dexterity, and voice adaptive software can help students answer questions without needing to write. Computers are engaging and more advanced than the typical modified lesson allows. The widely-used teacher education textbook Educating Exceptional Children has a special section in each chapter focused on assistive technology explaining how it is used with exceptionalities ranging from giftedness to autism. Assistive technology is not always just for students with disabilities; it can be used to help any student with motivation, academic skills, and social development.

UNC's Center for Literacy and Disability Studies uses technology in their mission to promote literacy and communication for individuals of all ages with disabilities. The Center has developed a three-part video on reading assessment and assistive technology that explains evidence-based practices of improving literacy through technology. Additionally, the Center has developed "alternative pencils" for students with disabilities who cannot hold a traditional pencil or see a page, including children with deaf-blindness.

These technologies include alphabet eye gaze frames allowing children to "point" to letters with their eyes, onscreen keyboards that are controlled by switches, and electronic flipcharts.

LEARN NC (Learn NC was a program of the University of North Carolina at Chapel Hill School of Education from 1997 - 2013. It provided lesson plans, professional development, and innovative web resources to support teachers, build community and provide K - 12 education in North Carolina. Learn NC is no longer supported by the School of Education - this is a historical archive of their website) offers an extensive set of resources to help teachers meet the needs of all learners, including "Reaching Every Learner: Differentiating Instruction in Theory and Practice," a series of articles and web conferences about differentiation. In addition, LEARN NC's technology integration page provides links to web resources, lesson plans, articles, and online courses designed to help educators incorporate technology into their teaching

Voice thread is a free software program that captures student voices and photos in order to collaborate on a topic. It is a technological substitute for written papers and allows students freedom to narrate their own projects.

Sounding Board is an ipad/ipod Touch app that lets a student turn their device into a story board communicator. Students with writing disabilities and communication disorders can use the symbols to create their own messages in the same way that traditional symbol boards work, but easily and with a limitless supply of symbols.

Tech matrix offers consumer guides and links to software and assistive technology devices for students with disabilities. The site is sponsored by the National Center for Technology Innovation and the Center for Implementing Technology in Education. Tech matrix gives information and links to resources for teaching science, math, reading, and writing using technology with special education students.

4.4 Technology products for educational purposes: listening (induction loop/FM/IR), visual (speech to text/ text to speech) audio visual (computer based learning & self learning packages, multimedia)

Technology plays an important role in providing a delivery mechanism to reach the next generation of explorers to inspire, inform, and involve them in NASA research

activities and encourage them to pursue science, technology, engineering and mathematics fields. NASA is committed to distributing educational information through instructional and outreach products. In the future, powerful technologies will enable new learning environments to be developed that use simulations, visualizations, immersive environments, game playing and learner networking. These tools will create rich and compelling learning opportunities, thereby meeting the needs of learners while empowering educators and other adults to unlock the potential of a student's mind. Learning will be on demand, meaning that students, educators, and the general public will have access to exactly what they need when they need it. NASA is moving toward this education future by developing new methods for making its exciting discoveries and valuable resources available to students, educators and the public.

Flash notes allow students to upload their lecture notes and sell them to other students who need more help or resources. The rating system allows the best note takers to get more business and the general pool of knowledge expands as students continue to share their work with one another.

Study Blue's main attraction is that it is mobile. Whether standing in line for coffee, riding the train, or waiting at the dentist, a student can easily access their class work and prepare for an exam. The social aspect also helps students find other people studying similar subjects, capitalizing on a different set of notes and study guides.

Imagine the ability to sign your name on a digital document using only your finger and the air. That is technology behind LEAP Motion, a company intent on giving people a more natural way to interact with the computer. LEAP has developed a piece of hardware that allows anyone to write, draw, zoom, play, and interact with their computer screen using a finger, fingers, or entire hand. By moving your hand over the device, the mouse follows your movements.

Celly is a text-messaging network that allows anyone to create a network anywhere-at a rally, event, in the classroom, or on a field trip using smart phones. Teachers that have used this in their classrooms have noted that those who normally never speak up…do. It forces students to write their thoughts clearly and concisely. Rather than fighting the tide against texting, instructors are using it for academic purposes. Lesson Cast allows teachers to submit a 2-minute lesson plan strategy, idea, or resource using video, documents, Power point, etc. and share it with other instructors.

Kid Blog provides a safe opportunity for children to start up their own blog connected to the classroom. Teachers can help students design a blog around a science project, a history lesson, or an entire year's worth of school progress. The students get the benefit of other students and parents commenting on their work- a great motivation for hesitant writers. Kid Blog makes it easy to keep the child and content secure from the dangers of the Internet.

This new technology (Knewton) company aims at personalizing content for optimal learning. The platform monitors the student's activity and uses the information to give the student the best personalized resources based on their level of performance. The technology also boasts integration among different disciplines creating a more comprehensive set of resources that interact with one another. Knewton grows more intuitive the more the student uses the software. It can follow a student through their entire education career.

Induction loop systems help people who are deaf or hard of hearing pick up sounds more clearly, by reducing background noise. They work in a particular area when a person's hearing aid is switched to the 'T' setting (or loop programme). This allows them to focus on sounds - such as a person speaking - from the loop system microphone, rather than the internal hearing aid microphone, which will normally amplify all noises in the area. The system helps hearing aid users to communicate efficiently and confidentially, even in noisy environments where deaf and hard of hearing people often struggle.

A room loop is used where people are gathered in an audience, such as lecture or conference halls, theatres, meeting rooms, places of worship, residential homes, community centres or court buildings. It helps overcome factors such as poor acoustics, background noise or distance from the speaker. Room loops comprise of a microphone, an amplifier and a length of cable that is "looped" around the room, often hidden away in the ceiling, under the carpet or around the skirting board. Hearing aid users simply switch to the 'T' setting to amplify speech directed into the microphone.

An infrared system has a similar function to a room loop but uses different technology. Sound, such as somebody's voice, feeds into a microphone and is processed in a pre-amplifier or mixer before being passed to an infrared radiator. This transmits the signal as invisible infrared light to a receiver borrowed from the venue and worn by

the listener. Hearing aid users use a neck loop with the receiver to transfer the signal into their hearing aids, but those without hearing aids can plug a set of headphone into the receiver and benefit from the amplified sound as well.

A counter loop is used in areas of initial customer contact, such as customer service desks, ticket offices, till areas, bank counters, hotel receptions etc. A permanently installed system is best for busy counters where there is a regular need for hearing support. Counter loops are mains-powered and discreetly installed out of view, with only the microphone visible. The system enables easy voice communication through such barriers as security screens, other conversations, or background noise.

A portable loop, such as the Loop Hear, has a microphone, amplifier, loop cable and rechargeable battery all built into a single unit. This can be carried from place to place as needed. This flexibility makes portable loops ideal for meetings across a desk, in interview rooms or at counters. Because they require no installation, they are also good value for money. However, they have a more limited range than an installed loop and take up more space.

Loop systems, however, have seven distinct advantages over these other hearing assistive systems. Here are some of the advantages that make loop systems so valuable, not only to hard-of-hearing people, but also to the owners of looped venues.

- Since audio-frequency loop systems make use of the principles of magnetic induction, hard-of-hearing people wearing hearing aids that have telecoils do not need any other equipment in order to clearly hear the sound source. They can freely move around or sit anywhere within the area covered by the hearing loop.
- Hard-of-hearing people can use their own telecoil-equipped hearing aids which are correctly matched to their specific hearing losses. They do not have to take their hearing aids off in order to use the facility's assistive device.
- Telecoils do not use any additional power so they do not drain a hearing aid's battery faster than normal.
- Hard-of-hearing people with telecoils in their hearing aids do not require special receivers that they otherwise would have to pick up before, and return after, each meeting. Nor do they have to worry about the batteries going dead and search out a staff person who can replace the batteries.
- Facility operators do not have to supply the receivers, make them available for

pickup and ensure their return. This saves them manpower and money. Thus, loop systems are a win-win situation for both hard-of-hearing people and the facility operators of looped facilities.

- Loop systems give accessibility access. Did you know that there are 12 to 15 times as many hard-of-hearing people as there are people in wheel chairs. Wheelchair ramps abound. Why not loop systems too? That is why hearing accessibility is so important.
- Loop systems are universal. There is nothing proprietary about them. This means they will work with any hearing aids that have telecoils. Furthermore, they can work anywhere in the world since they are not dependent on proprietary technology nor on a specific frequency band.

Disadvantages:

- Perimeter loops (single wire around the room) cannot be used at the same time in adjacent rooms due to the spillover effect. However, phased array technology (a "mat" or "grid" of multiple wires) provides significantly less spillover, thus allowing loops to be installed and used simultaneously in adjacent rooms
- Loops might be difficult or impractical to install at some facilities
- No privacy as signal is universal and not encrypted.
- While it's possible that fewer receivers will be needed, some patrons might not use hearing aids but still experience difficulty hearing in large venues. Hence, facility owners will still be required to maintain, clean, dispense and collect receivers and keep receiver batteries charged
- T-Coil receivers (inside hearing aids/cochlear implants or used with earphones) are susceptible to electromagnetic interference from electrical equipment. Therefore, care needs to be taken to reduce/eliminate this interference before installing the loop system
- Cannot support hearing assistance and audio description for the blind and cannot support multiple languages

The personal FM system consists of a transmitter microphone used by the speaker (such as the teacher in the classroom, or the speaker at a lecture) and a receiver used by the listener. The receiver transmits the sound to the listener ears or, if you wear a hearing

aid, directly to the hearing aid. Personal FM systems are useful in a variety of situations, such as in a classroom lecture, in a restaurant, in a sales meeting, or in a nursing home or senior center. FM systems are also used in theaters, places of worship, museums, public meeting places, corporate conference rooms, convention centers, and other large areas for gathering. In these situations, the microphone/transmitter is built into the overall sound system. User are provided with an FM receiver that can connect their hearing aid or cochlear implant. The receiver can also connect to a headset if user don't wear a hearing aid.

There are many advantages to the use of frequency modulation. These have meant that it has been widely used for many years, and will remain in use for many years.

- Resilient to noise: One of the main advantages of frequency modulation that has been utilised by the broadcasting industry is the reduction in noise. As most noise is amplitude based, this can be removed by running the signal through a limiter so that only frequency variations appear. This is provided that the signal level is sufficiently high to allow the signal to be limited.
- Resilient to signal strength variations: In the same way that amplitude noise can be removed, so too can any signal variations. This means that one of the advantages of frequency modulation is that it does not suffer audio amplitude variations as the signal level varies, and it makes FM ideal for use in mobile applications where signal levels constantly vary. This is provided that the signal level is sufficiently high to allow the signal to be limited.
- Does not require linear amplifiers in the transmitter: As only frequency changes are required to be carried, any amplifiers in the transmitter do not need to be linear.
- Enables greater efficiency than many other modes: The use of non-linear amplifiers, e.g. class C, etc means that transmitter efficiency levels will be higher - linear amplifiers are inherently inefficient.

There are a number of dis-advantages to the use of frequency modulation. Some are can be overcome quite easily, but others may mean that another modulation format is more suitable.

- Requires more complicated demodulator: One of the minor dis-advantages of frequency modulation is that the demodulator is a little more complicated, and

hence slightly more expensive than the very simple diode detectors used for AM. Also requiring a tuned circuit adds cost. However this is only an issue for the very low cost broadcast receiver market.

- Some other modes have higher data spectral efficiency: Some phase modulation and quadrature amplitude modulation formats have a higher spectral efficiency for data transmission that frequency shift keying, a form of frequency modulation. As a result, most data transmission system use PSK and QAM.
- Sidebands extend to infinity either side: The sidebands for an FM transmission theoretically extend out to infinity. To limit the bandwidth of the transmission, filters are used, and these introduce some distortion of the signal

Infrared systems are often used in the home with TV sets, but, like FM systems, they can also be used in large settings like theaters. With an infrared system, sound from the TV is transmitted using infrared light waves. This sound is transmitted to the listener receiver, which they can adjust their desired volume. The TV can be set to a volume comfortable for any other viewers with normal hearing. Thus, TV watching as a family becomes pleasurable for all

Advantages:

- Listener/user will not hear unwanted radio signals with an infrared system like listener/user might with an FM system
- Listener/user can wear the receiver in many different ways. For example: If Listener/user wants to listen through hearing aids, they can wear a body receiver or a neck loop
- If Listener/users do not want to listen through hearing aids, they can wear an under-the-chin receiver with headphones
- Listener/users have more privacy with an infrared system. No one can hear what they are listening to from outside the room because infrared signals cannot travel through walls
- Some conference rooms and movie theaters have infrared receivers that they loan out for personal use

Disadvantages:

- Listener/user cannot use an infrared system outdoors during the daytime. Too much light can affect the infrared light waves

- If a room has a transmitter, listener/user can sit anywhere in the room but nothing can come between the transmitter and the receiver. Infrared light waves cannot travel through walls, people, or objects
- An infrared system is usually not as portable as an FM system

Speech-to-text software is a type of software that effectively takes audio content and transcribes it into written words in a word processor or other display destination. This type of speech recognition software is extremely valuable to anyone who needs to generate a lot of written content without a lot of manual typing. It is also useful for people with disabilities that make it difficult for them to use a keyboard. Speech-to-text software may also be known as voice recognition software.

Although speech-to-text software is commonly sold as a standalone application, it has also been built into newer operating systems for some devices. Most speech-to-text software programs aimed at assisting with transcription focus on recognizing a wide range of vocabulary from a single user or a limited set of users, rather than recognizing a smaller range of vocabulary from a larger user base.

In terms of technical function, many speech-to-text software programs break spoken-word audio down into short "samples" and associate those samples with simple phonemes or units of pronunciation. Then, complex algorithms sort the results to try to predict the word or phrase that was said. Speech-to-text software has improved quite a bit in accuracy and evolved in general functionality to play a larger role in modern communications over digital platforms.

Voice recognition is an alternative to typing on a keyboard. Put simply, you talk to the computer and your words appear on the screen. The software has been developed to provide a fast method of writing on a computer and can help people with a variety of disabilities. It is useful for people with physical disabilities who often find typing difficult, painful or impossible. Voice-recognition software can also help those with spelling difficulties, including users with dyslexia, because recognised words are almost always correctly spelled.

Voice-recognition software programmes work by analysing sounds and converting them to text. They also use knowledge of how English is usually spoken to decide what the speaker most probably said. Once correctly set up, the systems should recognise around 95% of what is said if you speak clearly. Several programmes are available that

provide voice recognition. These systems have mostly been designed for Windows operating systems, however programmes are also available for Mac OS X. In addition to third-party software, there are also voicerecognition programmes built in to the operating systems of Windows Vista and Windows 7. Most specialist voice applications include the software, a microphone headset, a manual and a quick reference card. You connect the microphone to the computer, either into the soundcard (sockets on the back of a computer) or via a USB or similar connection. Then you can begin talking using the following steps.

Text-to-speech (TTS) is an assistive technology that reads digital text aloud. It's sometimes called "read aloud" technology. With a click of a button or the touch of a finger, TTS can take words on a computer or other digital device and convert them into audio. TTS is very helpful for kids who struggle with reading. But it can also help kids with writing and editing, and even focusing.

TTS works with nearly every personal digital device, including computers, smart phones and tablets. All kinds of text files can be read aloud, including Word and Pages documents. Even online web pages can be read aloud. The voice in TTS is computer-generated, and reading speed can usually be sped up or slowed down. Voice quality varies, but some voices sound human. There are even computer-generated voices that sound like children speaking.

Many TTS tools highlight words as they are read aloud. This allows kids to see text and hear it at the same time. Some TTS tools also have a technology called optical character recognition (OCR). OCR allows TTS tools to read text aloud from images. For example, your child could take a photo of a street sign and have the words on the sign turned into audio.

Print materials in the classroom like books and handouts can create obstacles for kids with reading issues. That's because some kids struggle with decoding and understanding printed words on the page. Using digital text with TTS helps remove these barriers. Since TTS lets kids both see and hear text when reading, it creates a multisensory reading experience.

Depending on the device your child uses, there are many different TTS tools:

- Built-in text-to-speech: Many devices have built-in TTS tools. This includes desktop and laptop computers, smart phones and digital tablets and Chrome. Child

can use this TTS without purchasing special apps or software.

- Web-based tools: Some websites have TTS tools on-site. Also, kids with dyslexia may qualify for a free Book share account with digital books that can be read with TTS. (Book share is a program of Understood founding partner Benetech.) There are also free TTS tools available online.
- Text-to-speech apps: Kids can also download TTS apps on smart phones and digital tablets. These apps often have special features like text highlighting in different colors. Some examples include Voice Dream Reader and Claro Scan Pen.
- Chrome tools: Chrome is a relatively new platform with several TTS tools. These include Read & Write for Google Chrome and Snap & Read Universal. People can use these tools on a Chrome book or any computer with the Chrome browser.
- Text-to-speech software programs: There are also several literacy software programs for desktop and laptop computers. In addition to other reading and writing tools, many of these programs have TTS. Examples include Kurzweil 3000, Claro Read and Read & Write.

Computer-based learning (CBL) is the term used for any kind of learning with the help of computers. Computer-based learning makes use of the interactive elements of the computer applications and software and the ability to present any type of media to the users. Computer-based learning has many benefits, including the advantage of users learning at their own pace and also learning without the need for an instructor to be physically present. Computer-based learning is also known as computer-aided instruction.

The computer-based learning model can be used by a myriad of learning programs across the world. It can also be combined with traditional teaching methods to enhance the overall educational and training experience. As far as organizations are concerned, computer-based learning could help in training employees in a more effective and profound manner. Individual courses can be imparted in a cost-effective manner to learners.

Computer-based learning is mainly used in:

- Knowledge-based training and assessment

- Simulation-based learning and training
- Creative and instructional games
- Problem-solving training

There are many advantages associated with computer-based learning. It provides more learning opportunity for people from disadvantaged environments. People can learn at a pace comfortable for them, unlike in a traditional classroom. Users need to spend only the required time to learn the subject in the case of computer-based learning, and it is also available all the time. Computer-based learning is cost effective in many ways, as it reduces travel time and also the same application can be used to teach new students or users. The learning also offers safety and flexibility as well as helps learners to track their progress. Another big advantage is in the reduction of overall training time.

There are, however, some drawbacks associated with computer-based learning. Students do not have the opportunity for physical interaction with the instructors. Development of computer-based learning can be time consuming. The software or the hardware required for learning can be expensive. Furthermore, not all subjects or fields can be supported or assisted by computer-based learning.

A self-learning package is a document containing all that is necessary for a student to attain one or more educational objectives independently of the teacher. Using these packages, the student can take over a large part of his training, while the teacher remains available when needed.

Multimedia is content that uses a combination of different content forms such as text, audio, images, animations, video and interactive content. Multimedia contrasts with media that use only rudimentary computer displays such as text-only or traditional forms of printed or hand-produced material. Multimedia can be recorded and played, displayed, interacted with or accessed by information content processing devices, such as computerized and electronic devices, but can also be part of a live performance. Multimedia devices are electronic media devices used to store and experience multimedia content.

Multimedia presentations may be viewed by person on stage, projected, transmitted,

or played locally with a media player. A broadcast may be a live or recorded multimedia presentation. Broadcasts and recordings can be either analog or digital electronic media technology. Digital online multimedia may be downloaded or streamed. Streaming multimedia may be live or on-demand. Multimedia games and simulations may be used in a physical environment with special effects, with multiple users in an online network, or locally with an offline computer, game system, or simulator.

The various formats of technological or digital multimedia may be intended to enhance the users' experience, for example to make it easier and faster to convey information Or in entertainment or art, to transcend everyday experience. Enhanced levels of interactivity are made possible by combining multiple forms of media content. Online multimedia is increasingly becoming object-oriented and data-driven, enabling applications with collaborative end-user innovation and personalization on multiple forms of content over time. Examples of these range from multiple forms of content on Web sites like photo galleries with both images (pictures) and title (text) user-updated, to simulations whose co-efficients, events, illustrations, animations or videos are modifiable, allowing the multimedia "experience" to be altered without reprogramming. In addition to seeing and hearing, haptic technology enables virtual objects to be felt. Emerging technology involving illusions of taste and smell may also enhance the multimedia experience.

4.5 Technology Based Education Services: online-learning, Web based learning, Computer assisted Learning, video remote interpreting, C-print technology, open, close and real time captioning.

Technology integration is the use of technology tools in general content areas in education in order to allow students to apply computer and technology skills to learning and problem-solving. Generally speaking, the curriculum drives the use of technology and not vice versa. Technology integration is defined as the use of technology to enhance and support the educational environment. Technology integration in the classroom can also support classroom instruction by creating opportunities for students to complete assignments on the computer rather than the normal pencil and paper. Technology integration in class would help students to explore more.

Integrating technology with standard curriculum can not only give students a sense of power, but also allows for more advanced learning among broad topics. However, these technologies require infrastructure, continual maintenance and repair - one determining element, among many, in how these technologies can be used for curricula purposes and whether or not they will be successful. Examples of the infrastructure required to operate and support technology integration in schools include at the basic level electricity, Internet service providers, routers, modems, and personnel to maintain the network, beyond the initial cost of the hardware and software.

Technology integration alongside standard education curriculum can provide tools for advanced learning among a broad range of topics. Integration of information and communication technology is often closely monitored and evaluated due to the current climate of accountability, outcome based education, and standardization in assessment.

Technology integration can in some instances be problematic. A high ratio of students to technological device has been shown to impede or slow learning and task completion. In some, instances dyadic peer interaction centered on integrated technology has proven to develop a more cooperative sense of social relations. Success or failure of technology integration is largely dependent on factors beyond the technology. The availability of appropriate software for the technology being integrated is also problematic in terms of software accessibility to students and educators. Another issue identified with technology integration is the lack of long-range planning for these tools within the educative districts they are being used.

Technology contributes to global development and diversity in classrooms and helps develop upon the fundamental building blocks needed for students to achieve more complex ideas. In order for technology to make an impact within the educational system, teachers and students must access to technology in a contextual matter that is culturally relevant, responsive and meaningful to their educational practice and that promotes quality teaching and active student learning. Following the moment when educators realize their students are capable, independent technology users who can create inspiring digital masterpieces. In the former mindset of teaching with technology, the teacher was the focal point of the classroom, creating (often time-consuming) interactive and multimedia presentations to add shock and awe to his or her lessons and capture the attention of the 21st century child.

A new mindset of teaching through technology must emerge, which depends on a

vital shift in teacher/student roles. This helps both student and teacher simultaneously. The four Cs are at the heart of the International Society for Technology in Education's National Educational Technology Standards (NETS) for Students, providing a substantial framework for defining the focus of technology objectives for K-12 students. For example, in implementing these standards it have been found that even our youngest 21st century learners are capable of independently creating digital storybooks, artwork, presentations, and movies.

An online learning course is one you take without meeting a teacher in a classroom. You can study at home or at work - wherever you like, whenever you like, within a prescribed time frame. The courses have a set schedule and are delivered over a 14 week period. Most courses do not require that you be online at a certain time of day or night, but that you are active in the course during the schedule. You cannot start courses late nor finish early.

Online learning is away of studying for an internationally recognized qualification without needing to attend classes on campus. It is aimed at those who wish to study for a postgraduate qualification alongside work or other commitments, online programmes are of equal value to on campus programmes in terms of entry criteria and overall workload. The only difference is in the way the course is delivered. To study online programme, students will usually only need a computer with internet access. As an online learning student, students will :

- ❖ Earn an intentionally recognized degree
- ❖ Be able to study anywhere
- ❖ Have the flexibility to study when its most convenient to them
- ❖ Be taught by academics working at the leading edge of their field
- ❖ Become part of a rich and varied online community
- ❖ Have access to university support services

If one prefer to study at his/her own pace in the comfort of his/her home or office, or if one live a distance from campuses, these courses are for them. Although online learning is a convenient way to take courses, it is not necessarily suited to all students. Some students find it difficult to study independently and need the face to face interaction with the instructor and students that is found in a classroom setting. Online learning students must have self-discipline and excellent reading, writing, and analytic skills.

Benefits of online learning:

- Work in the comfort of your own home or office
- Cost Efficient - no need to travel to the college, and no parking or babysitting expenses
- Courses fit into life, family and work schedule
- Avoid late arrivals to class or class distractions
- Enables the opportunity to ask questions spontaneously
- Instructors are accessible and approachable
- Students have access to their course 24/7
- May be less intimidating than in a classroom setting
- Students are able to enhance their technology and Internet skills
- Accommodates different learning styles using a variety of delivery methods

Disadvantages of Online Learning:

- Only in a small group a person can develop properly. At school, students learn how to make friends, be patient, get rid of disappointment, and especially to compete. Competition between colleagues can be very stimulating and students will only benefit from it. Online learning cannot offer human interaction.
- Another disadvantage refers to the fact that online courses cannot cope with thousands of students that try to join discussions. Also, online learning can be difficult, if it is meant for disciplines that involve practice.
- In conclusion, online learning should be seen as a complement and extension of classical forms of learning. Not even the best online course can fully replace the personal contact with a teacher, or the human relationships that develop in a group. So, traditional classes shouldn't be replaced with online learning.

Web-based learning has got much attention as being an incredible opportunity to study nowadays. Despite of its popularity the notion still remains unclear and confusing. First of all it has many names. You have probably heard the following terms: online learning, e-learning, computer-based training, technology-based instruction etc. Generally the meaning and the basic concept of them are the same. Web-based learning is one way to learn, using web-based technologies or tools in a learning process. In

other words, learner uses mainly computers to interact with the teacher, other students and learning material. Web-based learning consists of technology that supports traditional classroom training and online learning environments. "Pure" web-based courses are wholly based on computer and online possibilities. In this case all the communication and learning activities are done online. On the other hand, web-based courses may have some face-to-face sessions besides the distant learning tasks. In this case they are called blended courses as they blend web-based activities with face-to-face activities.

Web-based learning can be also formal or informal. Formal web-based learning is purposed and learning activities are organised by teachers. Informal learning takes place while you are searching material from the Internet. It is self-paced, depending on your goals and ambition to learn.

Generally, web-based learning and traditional learning are similar in terms of desired goals: to acquire new knowledge and skills. In both ways the teacher is mentoring and students are doing various learning activities. Differences between them are seen when we take a closer look at learning activities and tools, teaching approaches, communication issues, etc. The biggest difference between web-based learning and traditional learning is in communication issues. Web-based learning offers many opportunities for interaction with both fellow students and instructors. Communication can take place via various communication tools such as e-mail, telephone, chat etc. In a traditional way of learning communication and interaction take place mostly at the same time and place as face-to-face meetings. You can learn more about communication on the web in the fourth part of this material.

Due to the distance between the teacher and students in a web-based learning new learning and teaching approaches are needed. Web-based learning enables learner-centred approach. Learning is seen as an active construction of meaning. The main idea behind teaching is to guide and facilitate learning. Group work and independent learning are at the same time the key words of web-based learning. In traditional learning teacher-centred approach is more common, teacher giving/providing knowledge and students passively receiving it.

Prerequisite for using new approaches is changes of roles of teachers and students. In web-based learning, the teacher is a motivator who encourages and supports students in independent and group work activities. Teacher should be an organiser who plans learning activities to support students in learning process. In addition, teacher has to be

a mentor who guides and tutors students through learning material and learning tasks. Students are active in their learning process. Students should construct their own knowledge and organise their learning. Furthermore, they should be able to adopt new technology-based learning tools and approaches. As a result from new teaching and learning approaches student assessment in web-based courses is also different. In a classroom setting it is usual to have an oral or written exam after the course. Web-based learning assumes different learning tools compared to classroom learning. Modern technology (computers, CD, audio, video, PDA, mobile) is used to create suitable learning environments, disseminate information and carry out various learning activities.

Web-based learning has both advantages and disadvantages. When comparing them, one can notice that the same factors can be advantages as well as disadvantages depending on the context.

Advantages:

- New learning theories and approaches enable to learn and teach in a more effective way. Students can experience a sense of equality. Course work and challenging assignments are stimulating for knowledge building.
- Students can work at their own pace, when they want. Web-based learning enables to study more deeply areas of interest. It encourages exploring material on your own and enables to skip over materials already mastered. Web-based learning supports personalised learning and is self-directed. It builds self-knowledge and self-confidence and encourages students to take responsibility for their own learning.
- Web-based learning enables to join discussions at any hour and encourages also those who don't like to speak. It facilitates learning through a variety of activities. Learners have access to courses, which enables to reduce travel time and costs.
- Web-based learning provides interaction between students and instructors. Students can share their ideas with other students, which may help to understand the material better.
- Students can study anywhere and anytime if they have an access to computer and Internet. Web-based learning provides continual and also direct access to materials, resources in many different formats and of good quality.

- Working on the web offers an opportunity to communicate with students using e-mail, discussion boards etc. Teachers receive students' work quickly and they provide timely feedback to students' questions.
- When you learn to use one browser and certain software, you will probably be able to use other browsers and software as well. Some of the software and web browsers are free of charge on the internet. Web-based learning develops knowledge of the Internet and computer skills that help learners throughout their lives and careers.

Disadvantages:

- Teachers and learners have to adopt new learning theories and approaches. Role changes of teachers and learners may cause frustration and confusion. Without the common structures of a traditional class, students may feel lost or confused about course activities and deadlines.
- Learners who are not self-motivated, self-directed and independent are not able to plan their own learning and may have problems. Material and assignment instructions might be too complicated to understand independently. Some of the students may lose motivation without certain deadlines. Independent learning requires certain skills: technological, communication skills, self-motivation and effective study habits.
- Learners with low motivation or bad study habits may fall behind. They may have difficulties in organizing their learning.
- Prohibits those who are not active learners in a group. Human contact is missing as interaction is relied on electronic communication.
- Problems with technology might prevent the access: low speed connection, difficulties to download information, problems with communication tools. Some courses and materials might be out of date. There may be lack of quality control.
- Teachers are overloaded with students and their contacts. Students may feel isolated from the instructor and classmates. Instructor may not always be available when students are studying or need help.
- Managing computer files and online learning software can be complex for students with beginner-level computer skills. Poor usability may cause troubles with navigation, computers crash or have viruses, impossible to send mails. Software and access to the Internet and e-mail is not free all the time.

Computer-assisted learning (CAL) any use of computers to aid or support the education or training of people. CAL can test attainment at any point, provide faster or slower routes through the material for people of different aptitudes, and can maintain a progress record for the instructor. Computer-assisted learning is one of several terms used to describe this application of computers. Other terms include computer-aided (or -assisted) instruction, CAI, computer-based learning, CBL, and computer-managed instruction, CMI.

Advantages:

- CAL is individualized, that is each student is free to work at his own place, totally unaffected by the performance of any other students.
- Information is presented in a structured form. It proves useful in the study of a subject where there is hierarchy of facts and rules.
- CAL forces active participation on the part of the student, which contrasts with the more passive role in reading a book or attending a lecture.
- CAL utilizes a reporting system that provides the student with a clear picture of his progress. Thus students can identify the subject areas in which they have improved and in which they need improvement.
- By enabling students to manipulate concepts directly and explore the results of such manipulation, it reduces the time taken to comprehend difficult concepts.
- CAL offers a wide range of experiences that are otherwise not available to the student. It works as multimedia providing audio as well as visual inputs. It enables the student to understand concepts clearly with the use of stimulating techniques such as animation, blinking, graphical displays etc.
- CAL provides a lot of drilling which can prove useful for low aptitude students and through which high-aptitude students can be escaped.
- CAL can enhance reasoning and decision-making abilities.

Disadvantages:

- CAL packages may not fulfill expectations of teachers. Objectives and methods decided by the CAL author and of a teacher may differ.
- Motivating and training teachers to make use of computers in education is a

challenging task. They may have fear of this new device. They may be unwilling to spend extra time for preparation, selection and use of CAL packages. It may also be perceived as a threat to their job.

- There are administrative problems associated with computer installation. The problems particularly related to the physical location of the computer resources, the cost of hardware maintenance and insurance and time-tabling.
- The rapid development of hardware makes it difficult to select a system before it becomes obsolete. If a new system is installed by a maximum number of institutions, they may not get courseware required for the system and courseware developed so far may become useless.

Video remote interpreting (VRI) is a video telecommunication service that uses devices such as web cameras or videophones to provide sign language or spoken language interpreting services. This is done through a remote or offsite interpreter, in order to communicate with persons with whom there is a communication barrier. It is similar to a slightly different technology called video relay service, where the parties are each located in different places. VRI is a type of telecommunications relay service.

Video remote interpreting is a form of sign language interpreting that allows people who are deaf or hard of hearing to communicate with a hearing person at the same site via video conferencing instead of live, on-site interpreting. VRI is especially useful when there is a lack of available qualified interpreters, such as at a rural location and when an interpreter is needed immediately and there is no available interpreter on-site.

VRI works by using video conferencing equipment at both locations. The interpreter, who is typically at a call center, uses a headset to hear what the hearing person says. As the hearing person speaks, the interpreter signs everything said to a web camera. When the person who is deaf replies via their web camera, the interpreter sees and voices the interpretation. The person who is deaf and the person who is hearing can talk back and forth, just as if the interpreter was in the same room.

VRI is provided on a fee-for-service basis by several interpreting agencies; costs may vary based on whether an interpreter is needed immediately or is scheduled ahead of time. More information on VRI can be provided by a local sign language interpreting agency, which can be found by searching for "video remote interpreting" on the web.

VRI should not be confused with Video Relay Service (VRS), where a telephone conversation between two people at different locations is interpreted.

Advantages:

- Accuracy - The visual support associated with Video Remote Interpreting can provide enhanced accuracy for spoken language and American Sign Language (ASL).
- Non-Verbal Communication - Seeing the facial expressions of the interpreter via VRI, and knowing they understood what was said and the ability to confirm the meaning of non-verbal communication can enhance the interpreting experience.
- Immediacy and Connections - Video Remote Interpreting provides fast connect times for situations requiring immediate connections in which visual communication with the interpreter is necessary, or when a more personal connection will help the conversation.

Limitations:

Technology is improving many aspects of our lives and sign language interpreting is no exception. Video Remote Interpreting, or VRI, can be a wonderful and cost-effective way to access interpreting services on-demand. If at any time the deaf consumer determines that VRI does not provide effective communication, the consumer may choose to decline the use of VRI in medical settings. Some medical situations that may not be conducive for VRI are:

- Some mental health settings
- Initial meetings with a specialist
- Highly sensitive communications (e.g., diagnosis of a serious illness)
- Eye exams
- Some occupational and physical therapy sessions
- Patient transport
- Video quality is distorted due to signal interference with other medical equipment or "dead zones" within a facility
- The video interpreter available is not qualified for the scenario in which they are asked to interpret without preparation time or background knowledge of the patient's situation

Additionally, some situations that might typically work well with VRI will not be appropriate due to the nature or condition of the patient. This could include if the patient:

- Is a child
- Has limited cognitive ability
- Is heavily medicated, intoxicated, or in severe pain
- Is highly emotional and/or presents violent tendencies
- Has a secondary disability, such as low vision
- Has an injury or is undergoing a procedure that prohibits the ability to view the interpreter on a monitor

C - Print is a speech-to-text (captioning) technology and service developed at the National Technical Institute for the Deaf, a college of Rochester Institute of Technology. The system successfully is being used to provide communication access to individuals who are deaf or hard of hearing in many programs around the country. In addition to educational environments, C-print also can be used in business and community settings and with individuals with other disabilities, such as those with a visual impairment or a learning disability.

Open captions appear on your television or computer screen during a program to display spoken dialogue as text. Captions are designed to make it easier for viewers who are deaf or hard of hearing to enjoy a television or online streaming video program. Captions are also useful in noisy places or places where multiple televisions are running different shows simultaneously.

Advantages of Open Captions

- One of the drawbacks to using closed captions is that the viewer must activate them himself: A task which may be difficult for some viewers, and which varies from one television or streaming service to the next. Open captions remove this hurdle and provide their captions at all times. This makes open captioning more universal, as separate captioning decoders aren't required.

Disadvantages of Open Captions

- Open captions are encoded directly into the video stream of a video, making it impossible to disable them for viewers who don't want or require them. The quality

of open captions is also directly tied to the quality of the video: If the video is blurry or otherwise low-quality, the captions are also blurry and may be difficult to read.

Closed captions are a text version of the spoken part of a television, movie, or computer presentation. Closed captioning was developed to aid hearing-impaired people, but it's useful for a variety of situations. For example, captions can be read when audio can't be heard, either because of a noisy environment, such as an airport, or because of an environment that must be kept quiet, such as a hospital.

Captions, composed of text, are used by people who are deaf or hard of hearing to access content delivered by spoken words and sounds. Real-time captions, or Computer Assisted Real-time Translation (CART), are created as an event takes place. A captioner (often trained as a court reporter or stenographer) uses a stenotype machine with a phonetic keyboard and special software. A computer translates the phonetic symbols into captions almost instantaneously and displays them on a laptop or on a large display screen. A slight delay may occur because of the captioner's need to hear and enter the words and the computer's processing time. Real-time captioning can be used for programs that do not have written scripts or captions such as: lectures, classes, congressional or council meetings, news programs, and non-broadcast meetings, such as those of professional associations.

Remote real-time captions are produced at a remote location and then transmitted to the site where the program is taking place. For example, in a lecture hall an instructor can talk into a microphone that is connected via telephone lines to a captioner in a different city. From that location, the captioner, using similar equipment as described above, transmits the captioned text via the internet, using special software, to a laptop in the lecture hall- or to a laptop in a student's home, if they are unable to attend the lecture in person.

Although most real-time captioning has been estimated to be well over ninety percent accurate, the audience will see occasional errors. The captioner may misunderstand a word, hear an unfamiliar word, or there may be an error in the software dictionary. Captions can also benefit individuals who understand the written better than the spoken word of the language in which a presentation is delivered as well as people who are viewing the program in a noisy (e.g., airport or sports bar) or noiseless (e.g., a work cubicle) environment. Captions that are not "real-time" include those provided on television programming and those made available on prerecorded video that can be rented or purchased.

4.6 ICT and education of children with hearing impairment: Planning, implementation and evaluation of teaching-learning

Information and Communication Technology (ICT) is an extended term for information technology (IT) which stresses the role of unified communications and the integration of telecommunications (telephone lines and wireless signals), computers as well as necessary enterprise software, middleware, storage, and audio-visual systems, which enable users to access, store, transmit, and manipulate information.

The term ICT is also used to refer to the convergence of audio-visual and telephone networks with computer networks through a single cabling or link system. There are large economic incentives (huge cost savings due to elimination of the telephone network) to merge the telephone network with the computer network system using a single unified system of cabling, signal distribution and management.

However, ICT has no universal definition, as "the concepts, methods and applications involved in ICT are constantly evolving on an almost daily basis." The broadness of ICT covers any product that will store, retrieve, manipulate, transmit or receive information electronically in a digital form, e.g. personal computers, digital television, email, robots. Skills Framework for the Information Age is one of many models for describing and managing competencies for ICT professionals for the 21st century.

ICT, or information and communications technology (or technologies), is the infrastructure and components that enable modern computing. Although there is no single, universal definition of ICT, the term is generally accepted to mean all devices, networking components, applications and systems that combined allow people and organizations to interact in the digital world.

ICT encompasses both the internet-enabled sphere as well as the mobile one powered by wireless networks. It also includes antiquated technologies, such as landline telephones, radio and television broadcast all of which are still widely used today alongside cutting-edge ICT pieces such as artificial intelligence and robotics. ICT is sometimes used synonymously with IT (for information technology); however, ICT is generally used to represent a broader, more comprehensive list of all components related to computer and digital technologies than IT. The list of ICT components is exhaustive, and it continues to grow. Some components, such as computers and telephones, have existed for decades. Others, such as smart phones, digital TVs and robots, are more

recent entries. ICT commonly means more than its list of components, though. It also encompasses the application of all those various components. It's here that the real potential, power and danger of ICT can be found.

The present curricula for ICT in Education aims at realizing the goals of the National Policy of ICT in Schools Education and the National Curriculum Framework. Given the dynamic nature of ICT, the curricula, emphasizing the core educational purposes, is generic in design and focuses on a broad exposure to technologies, together aimed at enhancing creativity and imagination of the learners.

For the teacher, it is an initiation into:

- Learning to make right choices of hardware, software and ICT interactions
- Exploring educational possibilities of technology,
- Growing to become a critical user of ICT

For the student, it is an initiation into:

- Creativity and problem solving
- An introduction to the world of information and technologies
- An opportunity to shape career pursuits

The Information and Communication Technology (ICT) in schools have been subsumed in the Rashtriya Madhyamik Shiksha Abhiyan (RMSA). Now ICT in Schools is a component of the RMSA. The Information and Communication Technology (ICT) in Schools was launched in December, 2004 and revised in 2010 to provide opportunities to secondary stage students to mainly build their capacity on ICT skills and make them learn through computer aided learning process. The Scheme is a major catalyst to bridge the digital divide amongst students of various socio economic and other geographical barriers. The Scheme provides support to States/UTs to establish computer labs on sustainable basis.

The scheme has essentially four components:

- The first one is the partnership with State Government and Union Territories Administrations for providing computer aided education to Secondary and Higher Secondary Government and Government aided schools

- ❖ The second is the establishment of smart schools, which shall be technology demonstrators
- ❖ The third component is teacher related interventions, such as provision for engagement of an exclusive teacher, capacity enhancement of all teachers in ICT and a scheme for national ICT award as a means of motivation
- ❖ Fourth one relates to the development of a e-content, mainly through Central Institute of Education Technologies (CIET), six State Institutes of Education Technologies (SIETs) and 5 Regional Institutes of Education (RIEs), as also through outsourcing

The scheme currently covers both Government and Government aided Secondary and Higher Secondary Schools. Financial assistance is provided for procurement of computers and peripherals, educational software, training of teachers, development of e-contents, Internet connectivity & set up of smart schools. So far, 87033 government and government aided secondary and higher secondary schools have been approved for coverage under ICT in Schools Scheme.

Under the existing Information Communication Technology in School Scheme as against the target of setting up of 150 more such schools, this Ministry has approved for coverage of 63 Smart School so far. The Smart Schools are being established in the Districts by conversion of one of the existing State Government schools to serve as a role model and Technology Demonstrator among the neighbourhood schools. Under the ICT in Schools, to promote computer enabled learning and usage of ICT in teaching in Government and Government aided Secondary and Higher Secondary Schools has provision for instituting the National Award for innovative use of ICT to motivate the Teachers and Teacher Educators for innovative use of ICT in teaching-learning. The National Award for Teachers using ICT for innovation in education for the year 2010, 2011, 2012 and 2013 was given away to the 9 awardees along with the National Teacher Award on Teachers Day.

ICT is of particular value in developing the language experiences of learners with HI. ICT can be a very visual medium, with pictures, signs or texts on screen allowing pupils to extend both their general knowledge and use of language without being dependent on the spoken word. Learners who have a HI often need opportunities to extend their use of descriptive language in order to describe, compare and contrast objects: all skills that underlie effective information handling. Collaborating on an ICT

activity can encourage a group of students to extend their use of language and their understanding of concepts as they plan and carry out their work.

The types of technology which are of most benefit to those with HI include:

- CD-ROM
- Control software
- Data logging
- Logo or turtle graphics
- Multimedia
- White boards

CD-ROM technology can provide hearing-impaired students with access to information in a more immediate and visual form than was previously possible. The opportunity to create multimedia presentations, by combining text, pictures and sound, can enable students to experiment with different methods of combining sound and vision. Where appropriate, the sound output can be linked to the enhanced amplification used by the student. These sounds become more meaningful when heard in conjunction with moving images on screen. ICT can provide a first-hand experience to supplement and extend students' work without the students being dependent on text for structuring their ideas. For example, control software can be used to allow students to create and control a burglar alarm using a control box attached to the computer. Data logging software enables students to monitor the change in temperature of water in a beaker through sensors attached to the computer. Logo or turtle graphics provide a means of directing a floor robot or turtle through a maze by sending a series of instructions from the computer. Because all these are 'visual' as opposed to 'aural' there is less chance of misunderstanding.

It is important for all those working with the student to agree on the rationale for using an ICT solution. Training opportunities and time for liaison and review need to be considered if the use of ICT for an individual child is to be fully effective. An ICT solution must be matched to the needs of the individual. Physical difficulties, poor motor control or visual impairment can all combine with HI to affect the educational objectives for the student and thus influence the role of ICT in their learning. A full assessment of the child's strengths and weaknesses in the context of the classroom is an essential first step.

Becta and BT worked with Deaf@x to develop literacy skills in deaf children by partnering them with a hearing adult. The original project targeted seven schools and one college. Writing and communicating need to be an active process, and people talk and write better if they have a receptive audience and get some feedback. Staff reported improvements in grammar, drafting skills, syntax, punctuation and vocabulary. Social interaction became important. Many were writing to an adult as an equal for the first time, using language to convey and elicit information. In many cases they were exchanging personal information and asking questions instead of always trying to answer them! Now Deaf@x are working with children in India in a two-year programme to share good practice in the UK between teachers, parents and experts in the fields of literacy and total communication. They will be linking up to enclose the use of telecommunications and the Internet to train deaf children to improve the literacy and communication skills of deaf children around the globe. When you think that in the past some BSL users never communicated with anyone who was not in the same room as them, it is amazing the difference that technology has made.

The National Programme on School Standards and Evaluation (NPSSE), known as Shaala Sidhdhi is a comprehensive instrument for school evaluation leading to school improvement. Developed by the National University of Educational Planning and Administration (NUEPA), it aims to enable schools to evaluate their performance in a more focused and strategic manner and facilitate them to make professional judgments for improvement. The programme's objective is to establish and refer to an agreed set of standards and to provide clear pathways for each school for self evaluation, by focussing on key performance domains and their core standards for school evaluation. The structure of the Framework is simple yet flexible and lends itself to both self and external evaluation. A web portal for the framework has been launched by Hon'ble HRM on 7.11.2015 which will enable all schools to engage in self-evaluation in the 7 key domains under the Framework. The results of the evaluations will be available on a public platform along with the school report card.

E-Pathshala has been developed by NCERT for showcasing and disseminating all educational e-resources including textbooks, audio, video, periodicals and a variety of other print and non-print materials through website and mobile app. The platform addresses the dual challenge of reaching out to a diverse clientele and bridging the digital divide (geographical, socio-cultural and linguistic), offering comparable quality of e-contents and ensuring its free access at every time and every place. All the concerned

stakeholders such as students, teachers, educators and parents can access e-books through multiple technology platforms i.e. mobile phones (android, ios and windows platforms), and tablets (as e-pub) and on web through laptops and desktops (as flipbooks). All the NCERT books have been digitised and uploaded. Currently the e-contents are available in Hindi, English and Urdu. States/ UTs are being approached to digitise and share all textbooks in Indian languages through this platform, which will be done in a phased manner. The Web portal and Mobile App of e-Pathshala was launched by Hon'ble HRM during the National Conference on ICT in School Education on 7th November, 2015.

The first phase of "Shaala Darpan Project" to cover all the 1099 Kendriya Vidyalayas was launched on 05.06.2015. The same is presently under implementation through National Informatics Centre Services Inc. (NICSI). The objective of this project is to provide services based on School Management Systems to Students, Parents and Communities. The School Information Services includes School Profile Management, Student Profile Management, Employee Information, Student Attendance, Leave Management, Report Cards, Curriculum Tracking Custom, SMS Alerts for Parents / Administrators on student & teacher attendance.

With a vision to "Improve children's education by enhancing interaction between schools as well as parents and providing data driven decision support system to assist them in taking best decisions for their children's future", Central Board of Secondary Education (CBSE), has developed, a decision support system called 'Saransh'. This tool allows schools to identify areas of improvement in students, teachers and curriculum and take necessary measures to implement change by comparison of results. The mobile App for Saransh has been launched by Hon'ble HRM on 7.11.2015 at the National Conference on ICT. This will enable the parents and students also to look at and compare their results vis-a-vis school, state and national level. "Saransh" has also been conferred with the e-India 2015 Award for 'Best Government Initiative in Education', SKOCH Order of Merit for 'Smart Project' and SKOCH AWARD (Highest Independent Honour).

All states have conducted GIS mapping and shared geographical coordinates of schools with the NIC except the State of Jammu and Kashmir. This mapping has been linked to the UDISE data base to ensure that every school is mapped and is backed by a detailed school report card based on UDISE information. This effort of developing web enabled platform about school information (Spatial and Non Spatial data) will add to the quality of planning and better utilization of resources available under SSA and RMSA. GIS mapping of 11,29,250 schools (73.41%) across the country has been completed so far.

4.7 Future Technologies: Universal Design: Meaning & scope

Hearing aids have been around for centuries, but they weren't always as high-tech and sophisticated as the ones now available. While horn-style devices were popular back in the 1800s, the first electrical hearing aid was created in 1898, which led to hybrid aids using combined digital and analogue circuitry being patented in 1977. Digital signal processing chips also revolutionized the hearing aid industry and these days you only have to visit a site like Hidden Hearing to see sleek inner ear models that offer those with hearing impairments a more discreet alternative. Technology has greatly enhanced the hearing aid world, but what's next? Here are five bits of future hearing technology, might expect to see over the coming years:

- Ear-lens

Currently at clinical trial stage, the ear-lens could soon be a common form of treatment for those with hearing problems. Essentially, it's a transducer mounted on the eardrum that receives a laser signal from the external part of the aid mounted behind the ear. The transducer converts the laser signal into a physical vibration on the eardrum itself and has a much wider frequency range than many of the more conventional hearing devices.

- Inductive charging hearing aids

Within the next five to ten years, might expect to see hearing aids that are fully implanted into the ear meaning the user won't have to worry about taking it in or out or adjusting the settings. But how will it stay charged, these innovative devices will use inductive charging which quite literally means that the energy from the human body will be enough to keep it working.

- Hearing aids connected to audio products

It's thought that somewhere down the line, hearing aids will be wirelessly connected to a wide range of audio devices thanks to digital wireless technology being imbedded into various household devices. If a television was transmitting its audio wirelessly, for instance, then a wireless receiver could be added to the hearing aid so that a hearing aid user can listen to television audio that is not subject to room vibration. On a similar note, hearing aid companies are already creating Bluetooth accessories that plug into a hearing aid's direct audio input. These accessories provide wireless links between the hearing aid and cell phone devices making it easier for the user to hear what's being said.

❖ Smartphone compatible hearing aids

Imagine a world where hearing aids are connected to your smart phone! Well, this might not be too far off as the idea is already floating around. If you need directions, for instance, you wouldn't have to look at your map or phone to find out where to go as they could be spoken directly into your ear via your hearing device. Similarly if you got a call on your phone, it could be synched up with your hearing aid allowing you to hear the person speaking clearly. And this kind of tech is not exclusive to hearing aids only as it could work for other in-ear devices.

❖ Ear-to-ear connectivity

Hearing aids for individual ears are often considered separate entities, but wireless technology will help hearing devices for the left and right ear become more synchronised. While this functionality has already been introduced into the industry with the synchronisation of volume controls, the process will become a lot smoother with a pair of hearing aids being considered a single system.

Universal Design is the design and composition of an environment so that it can be accessed, understood and used to the greatest extent possible by all people regardless of their age, size, ability or disability. An environment should be designed to meet the needs of all people who wish to use it. This is not a special requirement, for the benefit of only a minority of the population. It is a fundamental condition of good design. If an environment is accessible, usable, convenient and a pleasure to use, everyone benefits. By considering the diverse needs and abilities of all throughout the design process, universal design creates products, services and environments that meet people's needs. Simply put, universal design is good design.

Universal design (close relation to inclusive design) refers to broad-spectrum ideas meant to produce buildings, products and environments that are inherently accessible to older people, people without disabilities, and people with disabilities. The term "universal design" was coined by the architect Ronald L. Mace to describe the concept of designing all products and the built environment to be aesthetic and usable to the greatest extent possible by everyone, regardless of their age, ability, or status in life. However, it was the work of Selwyn Goldsmith, author of Designing for the Disabled (1963), who really pioneered the concept of free access for people with disabilities. His most significant achievement was the creation of the dropped curb - now a standard feature of the built environment.

Universal design emerged from slightly earlier barrier-free concepts, the broader accessibility movement, and adaptive and assistive technology and also seeks to blend aesthetics into these core considerations. As life expectancy rises and modern medicine increases the survival rate of those with significant injuries, illnesses, and birth defects, there is a growing interest in universal design. There are many industries in which universal design is having strong market penetration but there are many others in which it has not yet been adopted to any great extent. Universal design is also being applied to the design of technology, instruction, services, and other products and environments.

Curb cuts or sidewalk ramps, essential for people in wheelchairs but also used by all, are a common example. Color-contrast dishware with steep sides that assists those with visual or dexterity problems are another. There are also cabinets with pull-out shelves, kitchen counters at several heights to accommodate different tasks and postures, and, amidst many of the world's public transit systems, low-floor buses that "kneel" (bring their front end to ground level to eliminate gap) and/or are equipped with ramps rather than on-board lifts.

Designing any product or environment involves the consideration of many factors, including aesthetics, engineering options, environmental issues, industry standards, safety concerns, and cost. Often, products and environments are designed for the average user. In contrast, UD is "the design of products and environments to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design" . For example, a standard door is not accessible to everyone. If a large switch is installed, the door becomes accessible to more people, including some wheelchair users. Applying UD principles could lead to the installation of sensors that signal the door to open when anyone approaches, making the building accessible to everyone a small child, a man carrying a large box, an elderly woman, a person using a walker or wheelchair.

When designers apply UD principles, their products and environments meet the needs of potential users with a variety of characteristics. Disability is just one of many characteristics that an individual might possess. For example, one person could be five feet four inches tall, female, forty years old, a poor reader, and deaf. All of these characteristics, including her deafness, should be considered when developing a product or environment she and others might use. The goal of UDI is to maximize the learning of students with a wide range of characteristics by applying UD principles to all aspects

of instruction (e.g., delivery methods, physical spaces, information resources, technology, personal interactions, and assessments).

Making a product or environment accessible to people with disabilities often benefits others. For example, sidewalk curb cuts, designed to make sidewalks and streets accessible to those using wheelchairs, are today often used by kids on skateboards, parents with baby strollers, and delivery staff with rolling carts. When television displays in noisy areas of airports and restaurants are captioned, they are more accessible to people who are deaf and everyone else.

Universal Design Principles:

- Equitable use: The design is useful and marketable to people with diverse abilities. Example: A professor's website is designed so that it is accessible to everyone, including students who are blind and using text-to-speech software.
- Flexibility in use: The design accommodates a wide range of individual preferences and abilities. Example: A museum, visited as a field trip for a course, allows each student to choose to read or listen to a description of the contents of display cases.
- Simple and intuitive use: Use of the design is easy to understand, regardless of the user's experience, knowledge, language skills, or current concentration level. Example: Control buttons on science equipment are labeled with text and symbols that are simple and intuitive to understand.
- Perceptible information: The design communicates necessary information effectively to the user, regardless of ambient conditions or the user's sensory abilities. Example: A video presentation projected in a course includes captions.
- Tolerance for error: The design minimizes hazards and the adverse consequences of accidental or unintended actions. Example: Educational software provides guidance and background information when the student makes an inappropriate response.
- Low physical effort: The design can be used efficiently, comfortably, and with a minimum of fatigue. Example: Doors to a lecture hall open automatically for people with a wide variety of physical characteristics.
- Size and space for approach and use: Appropriate size and space is provided for

approach, reach, manipulation, and use regardless of the user's body size, posture, or mobility. Example: A flexible science lab work area has adequate workspace for students who are left- or right-handed and for those who need to work from a standing or seated position.

Universal Design Scope:

- Universal Design helps teachers plan learning to meet the diverse and variable needs of all students. Flexible supports for learning can be embedded into an environment and made available to everyone. Hidden barriers to learning can be identified and minimised. Universal design can be used beyond the classroom to underpin the design of more inclusive home-school communications, professional learning options, and community events.
- Universal Design for learning helps teachers optimize their teaching and learning. Use it to create a more inclusive, flexible environment, where barriers to learning are minimized with supports and options available to all students.
- Overview of the value of using captioned or subtitled videos to support literacy across the curriculum. Provides all students with alternative access to content in videos.

4.8 Let Us Sum UP

Lot of modern technology is ideally suited for deaf culture. Text and instant messaging, for example, are beneficial to deaf people because they allow conversation between people regardless of whether or not they are deaf and they do not require the use of sign language. However, with in the deaf community not everyone is accepting or open to technology bridging the gap between the hearing and the non-hearing. There are two groups within the community with differing opinions on the matter. There are people who refers to themselves as deaf with the lower case "d" and there are the deaf with a capital "d". The deaf group is one that takes pride in traditional forms of communication amongst deaf people and limits the use of technology as a way of communicating. For the deaf, technology enhances deaf culture and is positively looked upon.

Deafness can have a major impact when it comes to learning, which makes deaf

education an area that greatly benefits from the use of technology. When in a classroom environment, speech-to-text systems can prove beneficial to students without hearing. These systems convert spoken words into real-time, displayed text that students can read on their computers or on a screen that is displayed to the class. In addition to the real-time display of text, these systems also provide a print out or text file of the lecture.

4.9 Check your progress

1. Explain the changing trends in teaching and learning.
2. Elaborate the technological impact on education.
3. Discuss about Information and communication technology and its impact on education of children with hearing impairment.
4. What is Universal Design? Explain its meaning and scope.
5. Briefly explain about the future technologies.
6. Write a short note on multimedia.
7. Broadly discuss technological products for educational purposes like listening, visual and audio-visual.
8. Point out in details various technology based educational services.

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Unit - 5 ◻ Resource Mobilization for Technology

Structure :

5.1 Introduction

Resource mobilization is the process of getting resource from resource provider, using different mechanisms, to implement the organization's work for achieving the pre-determined organizational goals. It deals in acquiring the needed resources in a timely-cost effective manner. Resource mobilization advocates upon having the right type of resource, at the right time, at right price with making right use of acquired resources thus ensuring optimum utilization of the same.

5.2 Objectives

After completion of this unit, the student will be able to:

1. Know about the various agencies for aids and appliances both government and non-government
2. Know about the criteria for availing funding under government scheme

3. Know about process for availing funding from various agent
4. Know about the challenges encountered with cost involved in maintenance of devices after availing funding and ways to overcome
1. Know about the various agencies to locate required human resources for various services and referrals

5.3 Agencies for Aids and Appliances: Government and Non-Government

It has been the constant endeavor of the Government to provide the disabled persons with aids/appliance, at minimum costs, which are essential for their social, economic and vocational rehabilitation. With the application of modern technology, a number of aids have emerged which can reduce the effects of disabilities and enhance the economic potential of the disabled. However, a large number of disabled persons are from the low income groups and are deprived of the benefits of these appliances because of their inability to find funds to acquire them and consequently of dignified independent living.

Scheme of Assistance to Disabled Persons (Adip Scheme)

In the light of the Government's commitment for enabling and empowering disabled persons, it has been decided to continue and modify ADIP Scheme in such a way that it becomes more user-friendly and the needy are not deprived of necessary aids /appliances for want of means to acquire them together with a transparent mechanism for checks and balances.

Objectives of Adip Scheme:

- To assist the needy disabled persons in procuring durable, sophisticated and scientifically manufactured, modern, standard aids and appliances to promote physical, social, psychological rehabilitation of Persons with Disabilities by reducing the effects of disabilities
- To enhance their economic potential.
- To improve their independent functioning by giving Assistive devices
- To arrest the extent of disability and occurrence of secondary disability
- To improve their independent functioning

- To arrest the extent of disability and occurrence of secondary disability
- The aids and appliances supplied under the Scheme must have due certification

Implementing Agency Under The Scheme:

- Societies and their branches, if any, registered separately under the Societies Registration Act, 1860
- Registered Charitable Trusts.
- Indian Red Cross Societies
- Other Autonomous Bodies headed by District Collector/Chief Executive Officer/ District Development Officer
- National/Apex Institutes, CRCs, RCs, DDRCs, National Trust, ALIMCO functioning under administrative control of the Ministry of Social Justice and Empowerment/Ministry of Health and Family Welfare
- National/State Handicapped Development Corporation
- Section 25 Companies in the Private Sector
- Local Bodies - Zilla Parishad, Municipalities, District Autonomous Development Councils and Panchayats etc
- Hospitals registered as separate entity, as recommended by State/UT/Central Govt
- Nehru Yuva Kendras
- Any other organization as considered fit by Department of Disability Affairs, Ministry of SJ&E

Eligibility of the Beneficiaries:

- An Indian citizen of any age
- Holds a 40% Disablement Certificate
- Has monthly income from all sources not exceeding Rs. 20,000/- per month.
- In case of dependents, the income of parents/guardians should not exceed Rs. 20,000/- per month
- Who have not received assistance during the last 3 years for the same purpose

from any source. However, for children below 12 years of age, this limit would be one year

- ❖ Income certificate of beneficiaries staying in orphanages and half-way homes etc. may be accepted on certification of District Collector or Head of the organization concerned. Such beneficiaries will be provided aids & appliances under this Scheme by ALIMCO

Quantum of Assistance:

- ❖ For aids and appliances costing upto Rs. 10,000/-. Aids/appliances which do not cost more than Rs. 10,000/- are covered under the Scheme for single disability. However, in the case of SwDs, students beyond IX class, the limit would be raised to Rs.12,000/- In the case of multiple disabilities, the limit will apply to individual items separately in case more than one aid/appliance is required

Cochlear Implant:

Ministry of Social Justice and Empowerment will recognize an institute of national stature from each zone to recommend children eligible under the scheme for cochlear implant, with a ceiling of Rs.6.00 lakh per unit to be borne by the Government. Ministry will also identify and recognize the Institutes in the zones wherein the surgery will be undertaken. Ministry will identify suitable agencies for providing cochlear implant (500 children per year) under the scheme. Income ceiling for the beneficiaries will be same as for other aids/appliances. Beneficiaries will be linked with Aadhar number or Ration Card or Voter Icard from 2014-15 and with Aadhar number from 2015-16

Amount of Assistance:

Total Income	Amount of Assistance
Upto Rs. 15,000/- per month	Full cost of aid/appliance
Rs.15,001/- to Rs. 20,000/- per month	50% of the cost of aid/appliance

Types of Aids/Appliances:

The following aids and appliances may be allowed for each type of disability. However, any other item as notified from time to time by the Ministry of Social Justice and Empowerment for the purpose will also be allowed.

Locomotor Disabled:

- ❖ All prosthetic and orthotic devices
- ❖ Mobility aids
- ❖ Surgical foot wears, MCR chappals
- ❖ All types of devices for activity of daily living as recommended by expert committee from time to time
- ❖ Motorized tricycles and wheelchairs for severely disabled and for Quadriplegic (SCI), Muscular Dystrophy, Stroke, Cerebral Palsy, Hemipeligia and any other person with similar conditions, where either three/four limbs or one half of the body are severely impaired. Extent of subsidy would be Rs.25,000/-. This will be provided to the persons of age of 18 years and above, once in ten years

Visually Disabled Including Deaf Blind and With Other Disabilities:

- ❖ Accessible Mobile Phone to visually impaired students of the age 18 years and above only, once in five years and to provide Laptop, Braille Note Taker and Brallier to school going disabled students (10th and above), once in 10 years
- ❖ Learning equipments
- ❖ Braille writing equipments
- ❖ Communication equipments, Braille attachments for telephone for deaf blind persons.
- ❖ Low vision aids
- ❖ Special mobility aids for visually disabled people with muscular dystrophy or cerebral palsy like adapted walkers as recommended by expert committee from time to time

Hearing Disabled:

- ❖ Various types of hearing aids, including BTE etc
- ❖ Educational kits
- ❖ Assistive and Alarm devices

Mentally Disabled:

- ❖ Any suitable device /kit/learning material as advised by expert committee from time to time

Multiple Disabilities, Including Leprosy Cured Wherever Required:

- ❖ Any suitable device as advised by expert committee from time to time

Research & Development:

1% of Budget under the Scheme may be used for Research in aids & assistive devices and seeking accreditation with international bodies of equivalent standard of ISI. Details to be worked out by expert committee in the Department from time to time.

Procedure for Receipt of Grant-in-Aid by An Implementing Agency:

The application should be accompanied with following documents/information (duly attested)

- ❖ A copy of Registration Certificate u/s 51/52 of Persons with Disabilities (Equal Opportunities, Protection of Rights and Full Participation Act (PwD Act), 1995
- ❖ A copy of Registration Certificate under Societies Registration Act, 1860 and their branches, if any, separately or Charitable Trust Act
- ❖ Names and details of the Members of Management Committee of the Organization
- ❖ A copy of Rules, Aims and Objectives of the Organization
- ❖ A copy of Certified Audited Accounts and Annual Report for the previous year (showing that the organization is financially sound)
- ❖ The Implementing Agencies already receiving grant-in-aid under the Scheme should also furnish the list of beneficiaries assisted from the grant-in-aid released to them in the previous year, as per proforma and summary of beneficiaries covered in hard copy not exceeding two pages.
- ❖ Utilization Certificate may be given.
- ❖ The Implementing Agencies shall provide one year free maintenance of the aids & assistive devices supplied by them
- ❖ The organization will provide reservation to SC/ST/OBC and disabled persons in accordance with instructions issued by Govt. of India from time to time if its employees are more than 20 persons on a regular basis
- ❖ Implementing agency should also maintain a website and upload details of grants received, utilized and list of beneficiaries along with photo and Ration Card

Number/voter ID Number/Adhar Card Number, as the case may be

Sanction/Release of Grant-In-Aid:

- ❖ The Implementing Agencies will be sanctioned grant-in-aid in a particular financial year after receiving recommendations from State Government/UT Administration/National Institute/any other agency authorized by Department of Disability Affairs. The subsequent financial assistance would be sanctioned after receipt of Utilization Certificate as prescribed
- ❖ Third party evaluation shall be done for the implementing agency. Expert Committee shall also be the Monitoring Committee and shall appoint the third party evaluation agencies. The Committee shall sit at least twice a year
- ❖ The recommending authority shall conduct sample checking of beneficiaries regarding utilization of grant-in-aid by the Implementing Agency. The sample checking would cover at least 15% (in case of GIA upto Rs. 10.00 lakh) and 10% (in case of GIA exceeding Rs. 10.00 lakh)
- ❖ The grant-in-aid would normally be released in one installment if GIA is less than Rs. 10 lakh. However, this limit will not apply for special camps held with the approval of Department of Disability Affairs. Quantum of 1st and 2nd installment will be decided by the Department keeping in view the provisions under General Financial Rules and also in consultation with Integrated Finance Division
- ❖ Implementing agencies shall use 5% of the grant-in-aid as administrative/ overhead expenses for conducting awareness, assessment and follow-up camps

Conditions for Assistance:

- ❖ The Implementing Agency shall obtain a certificate from the concerned competent authority regarding monthly income of beneficiaries
- ❖ The Implementing Agency will maintain a register in the prescribed proforma about the beneficiaries assisted under the Scheme
- ❖ The Implementing Agency shall maintain a separate account of funds received and utilized from the Ministry of Social Justice and Empowerment under the Scheme. The fund should be kept in a separate bank account, to be operated under ADIP Scheme duly certified by C.A.

- A certificate from the Head of the Implementing Agency to the effect that the funds have been utilized. A list of beneficiaries as per proforma assisted by the organization that the funds given by the Ministry will be furnished along with the yearly application
- The final accounts for a financial year will be rendered through utilization certificate and audited accounts signed by Chartered Accountant within six months of the close of the financial year along with bill & vouchers
- The Implementing Agency will obtain an undertaking from the beneficiary that he/she has not obtained such aid from any other agency/source during the last three years and that he/she will keep it for his/her bona fide use
- The Implementing Agency will be open to inspection by an officer/third party agency authorized by Union Ministry of Social Justice and Empowerment or the State Government/UT Administration/National Institutes/DRCs etc.
- When the Government of India has reasons to believe that the sanction is not being utilized for the approved purpose the amount would be recovered from the implementing agency with interest and no further assistance would be given to the agency. Ministry will be at liberty to blacklist such organization and to take legal action as per law
- The implementing agencies would not incur any liability under the Scheme, unless the funds have been sanctioned to them, except in the case of an implementing agency who has distributed approved aids and devices as per norms/ cost ceiling under the Scheme against loan as certified by Chartered Accountant and such money to be operated from a separate account limited to amount of last year's grant-in-aid. Department of Disability Affairs will not bear interest burden on the loan amount
- Reservation for SC/ST/OBC beneficiaries under the Scheme as per the Government norms and at least 25% of the overall beneficiaries need to be girl child/women
- All camps will display the details of the Scheme & assistance received there under and the website of the Ministry (www.socialjustice.nic.in). Photos of the camps held will also be uploaded on the website of the Implementing Agency

5.4 Eligibility Criteria for Availing Fundings Under Governments Schemes

State Disability Pension:

This scheme may be called as West Bengal Disability Pension scheme, 2010. The monthly grant for this scheme is Rs 750/- per month.

Eligibility Criteria:

- The Disabled person is a citizen of India and resident of the state namely West Bengal
- The Disabled person's family income, if any, does not exceed Rs. 1000/-(one thousand) per month
- The Disabled person is declared unsuitable for physical work by the respective Medical Officer
- Minimum 40% of disability
- The Disabled person has been a resident of the state namely West Bengal for not less than 10 years on the date of making application for Pension. Provided that in case of the disabled person whose age is below 10 years, the period of residence shall be limited to the period covered by the date of birth and date of submission of the application
- No age limit
- The Disabled person who is a recipient of "Widow Pension", "Old Age Pension" "Farmers Pension" or pension under "Family Pension Scheme" of the State Government / the Central Government / other concerns, shall not be entitled to the Pension under this scheme

Indira Gandhi National Disability Pension Scheme:

This scheme is implemented by the Department of Panchayat and Rural development. The monthly amount is Rs 300/-

Eligibility Criteria:

- The age of the disabled shall be between 18-79 years
- The applicant must belong to household below the poverty line (BPL) according to the criteria prescribed by the Government of India

- ❖ The applicant should be suffering from severe or multiple disabilities as defined in 'Persons with Disabilities Act, 1995 (PWD Act 1995)' and the 'National Trust for the Welfare of Persons with Autism, Cerebral Palsy, Mental Retardation and Multiple Disabilities Act, 1999 (National Trust Act 1999)' revised from time to time and any other guidelines issued by the Ministry of Social Justice and Empowerment in this regard
- ❖ The number of eligible beneficiaries to be assisted under IGNDPS will be determined as per the field report of all beneficiaries who satisfy the criteria

Educational Scholarship:

The state government is giving financial assistance to students with disabilities studying from 1st class onwards up to post graduate level. Scholarship grants upto 9th standard is administered by the department of woman and child development and social welfare whereas scholarship for class 9th onwards is administered by the directorate of Mass education and extension.

Scholarship Upto 8th Class:

The rate of scholarship for students studying up to class I-VIII standard is Rs 300/ - per month and the reader allowance is Rs 100/-

Eligibility Criteria:

- ❖ Applicant shall be a citizen of India and be resident of West Bengal
- ❖ Minimum 40% of disability
- ❖ Shall ordinarily be below 18 years in age which may be relaxed by the Commissioner for Persons with Disabilities, West Bengal or any other authority which may be prescribed in special circumstances
- ❖ Must not be in receipt of any regular financial help either from the State Government or Government of India. Provided that he / she signs a declaration to forego such facilities availing if sanctioned by the Department of Women & Child Development and Social Welfare
- ❖ The total income of both parents / guardian of the candidate must not exceed Rs.36, 000 /- per annum
- ❖ Shall have scored passing marks in the last annual examination

Scholarship for 9th Class to Higher Education:

Sl No	Type of Course	Rate per month for day scholar	Rate per month for hostellers	Reader allowance for blind only per month
1.	Class IX, X, H.S.(10+2)	Rs 85/-	Rs 140/-	Rs 50/-
2.	B.A./B.Sc./B.Com. etc.	125/-	180/-	75/-
3.	B.E./B.Tech./, M.B.B.S./L.L.B./B.Ed./ Diploma in Professional & Engineering Studies etc./ in Plant training	170/-	240/-	100/-
4.	M.A./M.Sc./M.Com./LLM/M.Ed. etc.	170/-	240/-	100/-

Eligibility Criteria:

- **Nationality:** A disabled person who is citizen of India may apply for scholarship under this scheme
- Scholarship is awarded to the students with all categories of disability (having at least 40% disability) for pursuing general, Technical & Professional Education from class IX onwards as detailed in the table above
- **Educational Requirements:** student with disability should have secured at least 40% marks in aggregate at the previous annual examination
- **Music course:** a student with disability should have passed Madhyamik or its equivalent examination at least in 2nd division from a college affiliated to a University or to an institution of All India character approved by the Central Government
- **Vocational Course :** a student with disability should undertake a vocational training course in any vocational training centre / workshop/ ITI or any other centre run by the Central /State Government/Local Body or any voluntary organization or Institution recognized by the Central/State Govt.. This will also include apprenticeship or training in a recognized Institution or in Industries. Lack of academic qualification need not be a bar to vocational training
- **Income Limit:** No scholarship will be admissible if the combined monthly

income of the parents/guardian of the candidate is more than Rs.2000/- (Rupees two thousand) only

Bus Concession:

The state transport provides facility of free travelling in tram, cars and buses owned by State Transport Undertaking to the person with vision impairment and their escort. They should have identity card issued by District Social Welfare Officer or Child development project Officer.

Eligibility Criteria:

- ❖ Above 40% of disability
- ❖ Resident of state

National Fellowship Scheme for PWDS:

National Fellowship for Person with Disabilities is a fellowship scheme for pursuing M.Phil/Ph.D. courses in any University recognized by University Grants Commission (UGC). Number of fellowships to be given is 200 per annum. The scheme is effective from 2012-13. However, selection of candidates of the year 2012-13 could be done only in 2013-14. The fellowship amount ranges from Rs. 25,000/- to Rs. 28,000/- per month. In addition, there are provisions of Escort/Reader Allowance and House Rent Allowance (wherever applicable). Duration of Fellowship: 2 years for M.Phil and 5 years for Ph.D. Selection of candidates is done by UGC. Disbursement of fellowship amount is done by the Department of Empowerment of Persons with Disabilities through Canara Bank who has been designated for this purpose. The Fellowship amount is remitted by the Canara bank direct to the bank accounts of the selected candidates.

Eligibility Criteria:

- ❖ Any student with disabilities who has been admitted to M.PhiI./Ph.D. degree in a University or academic institution by completing the required formalities for admission at that University or academic institution is eligible for the award of Fellowship subject to provision of the scheme
- ❖ After two years, if the progress in the research work of the awardee is found satisfactory, his/her tenure will be extended for a further period of three years as Senior Research Fellowship (SRF). The research work will be assessed by a three member committee set up by the University. The committee will consist of the Supervisor, Head of the Department and one outside expert in the subject.

JRF may be terminated in case the progress of the candidate is not found satisfactory by the committee. The SRF shall be sanctioned on year to year basis on the recommendation of the Supervisor of the candidate duly accepted/rejected by the Head of the Department and finally approved by the Vice Chancellor. The total period of award of JRF and SRF shall not exceed a period of five years. The fellowship is paid from date of registration of the students in M.Phil., Ph.D. course but not earlier than 1st April, 2012 i.e. date of effect of the scheme

- The students with disabilities once considered eligible for the fellowship shall not be entitled to any other benefits from Central or State Government or any other body like UGC offering similar benefit to avoid duplication and increased coverage. Only those doing regular and full time M.Phil./Ph.D. course of a University/Research Institution shall be eligible for the fellowship. Employees of any University/College/Educational Institution/Central/State/U'T Government shall be excluded from availing Fellowship, even if they are on Study Leave or EOL to pursue the M.Phil./Ph.D. course

National Overseas Scholarship for Students with Disabilities:

The scheme of National Overseas Scholarship for Students with Disabilities has been launched with the objectives of providing financial assistance to the students with disabilities for pursuing studies abroad at the level of Masters' Degree and Ph.D. Twenty (20) scholarships are to be awarded every year out of which six are reserved for women candidates. The scholarship amount includes Maintenance Allowance, Contingency Allowance, Tuition Fees, and Cost of Air Passage etc. The said scheme has been launched in the year 2014-15. In addition to the above, there is a "Passage Grants" to two Students with Disabilities every year. Only those Students with Disabilities who are in receipt of a merit scholarship for Post Graduate Studies, Research or Training abroad (excluding attending seminars, workshops, conferences), from a foreign government/ organization or under any other scheme, where the cost of passage is not provided, shall be eligible. The Passage Grant includes to-and-fro air-fare from home-station to the Institute abroad by economy class through Air India.

Scholarship Scheme from National Fund:

Under this scheme financial assistance is given to students with disabilities to pursue technical and professional courses from a recognized institution. There is provision of 500 scholarships every year. The rate of scholarship is Rs.1000/-p.m. for

hostellers and Rs.700/- p.m. for day scholars studying in professional courses at graduation and above level, and Rs.700/- p.m. for hostellers and Rs.400/- p.m. for day scholars pursuing Diploma /certificate level professional. Course fee is reimbursed up to ceiling of Rs.10,000/- per year. In addition, financial assistance can be given for computer with editing software for blind/deaf graduate and post graduate students pursuing professional courses and for support access software for cerebral palsy students.

5.5 Challenges encountered with cost involved in maintenance of devices after availing funding and ways to overcome

It is a waste of time and resources to provide a person with an assistive device if that device breaks down after a short period of time and cannot be repaired or replaced. Repair and maintenance of assistive devices is a crucial part of any strategy to achieve equality of opportunity for people with disabilities. The term "repair" refers to modifications made to a device when it is in poor or no working condition, in order to make it work properly again. "Maintenance" refers to the modification or replacement of parts made to prevent possible failures while the device is still working properly, in order to prevent repair from being necessary. Both functions can be performed by users themselves with or without the help of others with mechanical skills. Repair work is more likely to require the help of mechanics or technicians.

The ease of repair and maintenance depends partly on the design of devices, and partly on the availability of infrastructural and technical support near the users. Without some state aid, this support will grow only with time, economic progress and market demand which may not be primarily defined by the needs of disabled people. Imported devices are typically the most difficult to maintain and repair, partly for lack of components, but also because manufacturers often do not supply instruction manuals for this purpose. Users may not even know that such documents exist, especially when they purchase the devices. India has faced this problem with respect to braille presses and computerized braille printers. If people with disabilities and their helpers receive adequate instruction on the maintenance of their devices when they receive them, much less time and effort will have to be spent on repairs. Prolonged exposure to humidity, dust, sand, mud, heat, water and sunlight can cause problems such as corrosion, increased friction in moving parts and hardening of thermoplastics through ultraviolet radiation.

People with disabilities need a transition period to get used to their assistive devices

before they can accept the devices as a part of their lives. This period may vary from a few weeks to a few months, while an individual user decides whether a device is suitable for the way of life she or he wants to lead.

Many users of hearing aids, for example, stop using them when they have to replace batteries and cords, which are not easily available in rural areas. Similarly, breakage of orthoses among children is usually high. In itself, this may be a good sign, as it indicates that the children have really been using the devices. But if the breakages are not dealt with quickly, children may stop using the orthoses and revert to moving as they did before the orthoses enabled them to become more active. The use of orthoses requires even more follow-up, with closer attention to detail, than the use of prostheses. An old prosthesis will not work as well as it used to if a child wearing it outgrows it but an old orthosis, in the same situation, will not work at all.

In one case, a user brought prosthesis back to the rehabilitation centre after seven years, during which time he had been trying many different methods of repair, as he had access neither to a repair facility nor to replacement prosthesis. Living with limb disability is challenging. Many studies reveal that the quality of life of people with disabilities is lower than people without disabilities. Lower limb disabilities challenge the affected individual in many ways due to problems in mobility and stature. Fortunately, assistive device technology helps to overcome many challenges faced by people with lower limb disabilities. Assistive technology is an umbrella term used for a wide assortment of devices and services that support people with disabilities. Furthermore, it is an international priority to produce barrier-free societies for people living with disability.

Cost often deters many people with disabilities from getting their devices repaired or maintained. Many developing countries of the ESCAP region have schemes for providing assistive devices to people with disabilities, or at least those able to obtain the necessary official papers, at concessional rates. They do not, however, usually offer a similar subsidy for repairs. As a result, poor people with disabilities find it extremely difficult to afford new parts or new devices. If workshops are far away, the costs of transportation, board and lodging become a further barrier.

Malaysia and Thailand have adopted a policy of subsidizing the cost of repair, replacement and maintenance as well as that of the initial devices. This is helpful, and would be still more so if two more steps were taken to ensure the success of the policy. First, this support must be provided in a manner that is decentralized enough to reach

users. Second, people with disabilities need adequate information about where to receive the support. The cost of repairs is not only monetary. It also involves the time spent repairing devices. In Thailand, repairing hospital wheelchairs has typically taken days or even weeks while technicians wait for spare parts to be delivered. In the meantime, no temporary replacement is available, leaving users immobile for a long period. This results in severe disruption of users' lives. It could be prevented if wheelchairs were loaned to users while they awaited repairs. Loaning of prostheses and orthoses would be inappropriate, but loaning of less user-specific devices would be acceptable, as those devices would only be used for a short period.

Repair and maintenance are not, of course, entirely rural problems. Devices like computerized braille embossers, text reading machines, and stair lifts are often difficult to repair even in cities and towns. The reasons can be non-availability of spare parts, lack of local technical skills, or both. most people with disabilities in the region live in rural areas; rural areas are deprived of repair and maintenance services because it is more difficult for such services to reach them; and assistive devices are subjected to far more strain in rural than in urban areas. Local mechanics and artisans can repair some devices, although they may require additional equipment and training.

Another problem is that mechanic workshops are not always available near users in rural areas. The only alternative this leaves is for users to go to the rehabilitation centre where they obtained the devices, which is a deterrent. Ideally, it would be best to have such a workshop provide the requisite services within a radius of one to two kilometres from each user. While it is often not practical to set up that many new workshops specifically for this purpose, it may be feasible to identify enough existing workshops that, with proper technical inputs, could provide the services required by most assistive-device users. When local mechanics and artisans are not nearby or are not capable of repairing a particular device, mobile workshops may be of great help. Countries which use the mobile-workshop approach for repair and maintenance include Cambodia, India and Thailand. In Cambodia and India, NGOs provide their services through mobile workshops.

However, there are numerous barriers in using assistive technology by individuals with lower limb disabilities worldwide, and they appear to be of high intensity in low

income countries. One of the main barriers in accessing assistive technology in less resourced settings is the lack of funds. Limited financial resources in many countries has a major impact on availability and accessibility of assistive technology. In some countries, lack of leadership and governance are also barriers to the provision of assistive technology.

In addition, service delivery including referral, assessment, funding, ordering, product preparation, fitting, adjusting, user training, follow-up, maintenance and repairs, hinder the use of assistive technology. Lack of personnel with proper training in appropriate mobility device services is also a major barrier. In many developing countries, production of mobility devices is done only on a small scale, or perhaps not at all, due to limited access to materials, machinery and expertise. At the same time, there are physical and environmental barriers like accessibility problems, as well as cultural and social stigma in using assistive technology in low-income countries. Introduction of assistive devices such as wheelchairs into people's lives may bring about intense emotional responses. It calls for pragmatic, emotional adaptation as the person involved looks and feels different. An assistive device will only be adopted if he/she really thinks that it is useful.

Assistive technology can have a major positive impact on the lives of persons with lower limb disabilities, improving their independence via improved mobility and balance. Assistive devices reduce stress and improve quality of life, reducing the workload of caregivers. Therefore, in order to increase the use of assistive technology, there is a great need for those who prescribe it, including surgeons and occupational therapists, to understand the feelings and experiences of persons with disabilities. Although in recent times assistive devices have been extensively prescribed, there are few evaluations of the barriers to their utilisation.

Persons with lower limb disabilities have to adjust psychologically at the point of their first instance of using assistive devices, but the significance of their emotional adjustment and their attitudes to technology have not been discussed. According to Magnusson et al (2013), pain associated with the use of assistive devices and difficulties in ambulating on challenging surfaces were the main barriers faced by a population with disabilities in Malawi, who were using lower limb prosthetic or orthotic devices.

have pointed to the mismatch between the person and the assistive device as a major barrier in using assistive technology.

A study "Barriers in Using Assistive Devices among a Group of Community-dwelling Persons with Lower Limb Disabilities in Sri Lanka" conducted in Sri Lanka, the main purpose of the study was Rehabilitation with assistive devices is of great benefit to people with limb disabilities, enabling them to lead independent and productive lives. While assistive devices improve the quality of life of persons with lower limb disabilities by facilitating activities of daily living, there are also many barriers to their use. This study aims to describe these barriers among community-dwelling persons with lower limb disabilities in central Sri Lanka. Results showed that Participants described several barriers in using assistive devices, such as unaffordable assistive technology like wheelchairs and artificial limbs, unavailability of appropriate assistive technology, difficulties associated with repair and maintenance, and problems in accessibility. Limited knowledge of modern technology also restricted their choice of better devices. Psychological barriers and stigma in using assistive devices directly affected their social lives and day-to-day activities as well. People with lower limb disabilities face multiple barriers in using assistive devices. These barriers need to be addressed by improving local infrastructure and accessibility facilities, public awareness and funding, and ensuring continuous supply and maintenance services.

Challenges in maintenance of devices after availing:

- Lack of funds
- Low incomes
- Lack of donors
- Attitudes of donors
- Lack of quality of devices
- Accessibility problems
- Inadequacy of knowledge on newer assistive devices
- Social stigma in transport

❖ **Attitudes of user**

Persons with disabilities were afraid of getting injured if they used assistive devices, especially if they had already had that experience. In addition, most of them were worried about repair and maintenance costs of their assistive devices in the future. Magnusson et al (2013) reported pain associated with the use of assistive devices among persons fitted with lower limb prosthetic and orthotic devices in Malawi, and also described their difficulties in mobilisation on challenging surfaces. Importantly not only individual problems but also socio-economic and environmental problems associated with the use of assistive devices. People living with a disability have to cope with major changes in their lives and therefore need a lot of support. To make it easier, they should be given counselling, effective information when being prescribed assistive devices, and should have a good relationship with the prescriber throughout the entire process. In this context, their major expectation from the use of assistive devices is the ability to do things independently.

The barriers faced by among those waiting for assistive technology, there were participants who had used it previously and been forced to discontinue because their device had broken. They did not have enough money to buy a new device on their own. The first-time users faced economic barriers, availability barriers, awareness barriers and psychological barriers, whereas persons already using assistive technology faced repair and maintenance barriers, accessibility barriers and psychological barriers in addition to the barriers encountered by the first-time users. Those who were waiting for a new assistive device to replace the one used previously faced the barriers encountered by both the aforementioned groups.

Multiple barriers in using assistive technology by persons with Disabilities. These need to be addressed by improving local infrastructure and accessibility facilities, heightening public awareness, ensuring funding and a continuous supply of assistive devices supported by maintenance services. Those who prescribe these devices should communicate and convey information properly to the recipients. Persons with physical disabilities should be helped to gain more knowledge about assistive devices, especially about the availability of more modern ones. They should be given support to modify their physical and social environments. Their physical symptoms should be treated to

improve physical functioning, and their psychological health should be monitored to improve mental well-being when using assistive devices.

5.6 Agencies/ Strategies to locate human resources for various services and referrals

Human resources are the people who make up the workforce of an organization, business sector, or economy. "Human capital" is sometimes used synonymously with "human resources", although human capital typically refers to a more narrow view (i.e., the knowledge the individuals embody and economic growth). Likewise, other terms sometimes used include "manpower", "talent", "labour", "personnel", or simply "people". A human-resources department of an organization performs human resource management, overseeing various aspects of employment, such as compliance with labour law and employment standards, administration of employee benefits, and some aspects of recruitment and dismissal.

Ali Yavar Jung National Institute of Speech and Hearing Disabilities (Divyangjan):

Ali Yavar Jung National Institute of Speech and Hearing Disabilities (Divyangjan) (AYJNISHD) was established on 9th August 1983. The Institute has been established for manpower development, research, clinical and therapeutic services, outreach and extension services for the persons with hearing disabilities.

The Institute is responsible for development of manpower by undertaking or sponsoring the training of trainees and teachers, employment officers, psychologists, vocational counselors and such other personnel as may be deemed necessary by the Institute for promoting the education, training or rehabilitation of the hearing handicapped. The Institute sponsors, coordinates and subsidizes research into all aspects of the education and rehabilitation of the hearing handicapped. It is also developing model services for rehabilitation of the hearing handicapped.

Objectives of the Institutes:

- **Manpower Development:** To deal with the various aspects of rehabilitation of the Hearing Handicapped, various undergraduate and post graduate courses are being offered. The Institute is rated excellent by the RCI
- **Research:** Research in the areas of identification, intervention, educational

approaches, remedial teaching methods, jobs for the hearing handicapped and technology development have been carried out

- **Educational Programmes:** By studying the existing school for the deaf, curriculum followed, methods of teaching etc. and supplementing or strengthening them by way of improving existing educational facilities and developing new strategies wherever required, newer measures such as open school for the illiterate/drop out is being conducted as model activity
- **Service Facilities:** Strategies for early identification and rehabilitative procedures, films and audio visuals on vocational training and job placement, etc. are being developed
- **Community Programme:** Identification and intervention, home bound training, correspondence training and also tele-rehabilitation services are being rendered and evolved with emerging needs.
- **Material Development:** Required for (a) education, like teaching aids, audio-visuals etc. (b) public awareness and community education, literacy programme for adult deaf, Parent Counseling and Programme for strengthening voluntary organisations
- **Information and Documentation:** Documenting and disseminating the latest information and developments in the science of hearing, speech and related technology is being done

National Institute for Empowerment of Persons with Multiple Disabilities (NIEPMD), Chennai:

The Government has set up this new Institute at the total project cost of Rs.61.90 crores comprising of land cost of Rs.39.20 crores (notional), non-recurring cost of Rs.18.10 crores and a recurring cost of Rs. 4.60 crores. Government of Tamil Nadu has provided the land for this Institute. Government of India is providing the financial support for construction of the building of the Institute and other activities. The Institute has started clinical services and short-term training programmes for caregivers from July 2005.

Services Provided:

- ❖ Rehabilitation Medicine
- ❖ Physical therapy
- ❖ Occupational therapy
- ❖ Sensory Integration
- ❖ Early Intervention Services
- ❖ Prosthetics & Orthotics
- ❖ Special education
- ❖ Psychological Assessments and Interventions
- ❖ Speech, Hearing & Communication
- ❖ Vocational training
- ❖ Vocational Guidance & Counseling
- ❖ Deafblind
- ❖ Community based Rehabilitation
- ❖ Special Clinics (Psychiatric, Neurology & Ophthalmology)

Swami Vivekananda National Institute of Rehabilitation, Training & Research (SVNIRTAR), Cuttack:

NIRTAR, originally, started as an adjunct Unit of ALIMCO, Kanpur, NIRTAR was registered in 1984 under the Societies Registration Act, 1860 as a National Institute. The aims and objectives of the Institute are human resources development, implementation of service delivery programmes, research and outreach programmes.

It undertakes, sponsors or coordinates training for rehabilitation personnel and conducts research on bio-medical engineering and surgical or medical subjects for orthopaedically handicapped. The Institute produces and distributes aids and appliances. It develops models of service delivery programmes for rehabilitation. NIRTAR also undertakes vocational training, placement and rehabilitation of the physically handicapped.

Services Provided:

Patients with locomotor / orthopaedic disabilities due to various ailments like poliomyelitis, Cerebral Palsy, Congenital Deformities, Leprosy, Burn contracture, Paraplegia, Hemiplegia etc. and hearing and speech disabilities are treated and rehabilitated. Patients/ Persons With Disabilities requiring artificial limbs and other rehabilitation aids and appliances are provided to prevent the impairment leading to disability and to make them near normal and to carry on their activities for daily living. The rehabilitation is provided through the following infrastructure:

- 100 bedded hospital
- Two well equipped operation theatres for performing corrective and reconstructive surgeries
- Microsurgery
- Assessment Clinic consisting of Rehabilitation Specialists & professionals to evaluate the patients
- Radiological and Pathological investigation Units
- Cerebral Palsy Clinic
- Hand Clinic
- Speech Therapy
- Physiotherapy Unit
- Occupational therapy Unit
- Psychological Counselling
- Vocational Counselling, Training and Guidance
- Major Workshop for fabrication of Orthotic and Prosthetic Aids
- Workshop for Hand Splints
- Modern and Sophisticated Rehabilitation equipments

National Institutes of Locomotor Disabilities (Divyangjan):

National Institute for Locomotor Disabilities (Divyangjan) is an apex organization in the area of locomotor disability which came into the service since 1978 as an

autonomous body under the ministry of Social Justice and Empowerment, Government of India. It is located in the city Kolkata and expanding its services whole country wide.

Objectives:

- To develop Human Resource (manpower) for providing services to the Orthopaedically Handicapped population, namely training of Physiotherapists, Occupational Therapists, Orthotists & Prosthetists, Employment & Placement Officers and Vocational Counsellor etc. To conduct and sponsor research in all aspects related to the rehabilitation of the Orthopaedically handicapped. To provide services in the area of rehabilitation, restorative surgery, aids & appliances and vocational training to the persons with disability. To standardize aids and appliances and to promote their manufacturing and distribution
- To provide consultancy to the State Government and voluntary agencies. To serve as an apex documentation and information centre in the area of disability & rehabilitation

Rehabilitation Services:

- Disability Evaluation/Assessment
- Medical/ Surgical management
- Physiotherapy
- Occupational Therapy
- Prosthetic & Orthotics
- Socio-economic Rehabilitation
- Clinical Social work
- Vocational Counseling and Planning
- Special Education
    - Clinical Social work
    - Vocational Counseling and Planning
    - Special Education
- Out Reach Services

Diagnostics services as Radiology (X-Ray), Urodynamics, Pathology,

Electro-diagnostic tests (EMG, NCV)

Special Clinics

Geriatric clinic

Check Out clinic

- ❖ Indoor medical and surgical wards
- ❖ Operation Theatre

National Institute for the Empowerment of Persons with Visual Disabilities (Divyangjan):

The National Centre for the Blind was upgraded as National Institute for the Empowerment of Persons with Visual Disabilities (Divyangjan) in July, 1979. It was registered as an autonomous Institution under the Societies Registration Act, 1860 in October, 1982. The objective of the Institute is to conduct, sponsor and coordinate all aspects of education for rehabilitation of persons with visual disabilities and coordinate research in these areas. The Institutes also assisted in running a Composite Regional Centre (CRC) for persons with disabilities at Sundernagar in Himachal Pradesh.

This apex level Institute is engaged in education, vocational training, training of teachers and other personnel, research and development of service modules, production of Braille books, aids and appliances for the visually handicapped.

Objectives:

- ❖ To conduct, sponsor, co-ordinate and/or subsidize research in collaboration with other NGOs and research organizations including Universities into various dimensions of the education and rehabilitation of the visually impaired
- ❖ To undertake, sponsor, co-ordinate or subsidise research into biomedical engineering leading to the effective evaluation of special appliances/instruments or suitable surgical or medical procedures or the development of new special appliances/instruments
- ❖ To undertake or sponsor the training of trainees and various specialized professionals including Teachers, Employment Officers, Psychologists, Vocational Counsellors and such other personnel as deemed necessary

- ❖ To distribute, promote, or subsidise the manufacture of prototypes and to manage distribution of any or all devices designed to promote any aspect of the education, rehabilitation or employment of the Visually Impaired

Services:

- ❖ Department of Special Education
- ❖ Department of Vocational Training/Training Centre for the Adult Blind
- ❖ Department of Psychology: Counselling and Crisis Intervention
- ❖ Model School for the Visually Handicapped
- ❖ Braille Development Unit
- ❖ Design and Development Unit
- ❖ Rehabilitation and Consultancy Unit
- ❖ Placement Unit
- ❖ National Talking Book Library
- ❖ National Library for the Print Handicapped
- ❖ Central Braille Press
- ❖ Workshop for the Manufacturing of Aids and Appliances
- ❖ Mass Media Unit

National Institute for the Empowerment of Persons with Intellectual Disabilities (Divyangjan):

National Institute for the Empowerment of Persons with Intellectual Disabilities (Formerly National Institute for the Mentally Handicapped) established in the year 1984 at Manovikasnagar, Secunderabad (AP) is an Autonomous Body under the administrative control of Ministry of Social Justice & Empowerment, Government of India and thus the institute is fast approaching towards its silver jubilee to celebrate its dedicated services to persons with mental retardation in the national interest. The institute endeavors to excel in building capacities to empower persons with mental retardation. Since the quality of life of every person with mental retardation is equal to other citizens in the country, in that they live independently to the maximum extent possible and through constant professional endeavors, National Institute for the Empowerment of Persons

with Intellectual Disabilities (Formerly National Institute for the Mentally Handicapped) empowers the persons with mental retardation to access the state of the art rehabilitation intervention viz., educational, therapeutic, vocational, employment, leisure and social activities, sports, cultural programmes and full participation.

Objectives:

- ❖ Human Resources Development
- ❖ Research and Development
- ❖ Development of models of care and rehabilitation.
- ❖ Documentation and dissemination.
- ❖ Consultancy services to voluntary organizations
- ❖ Community Based Rehabilitation
- ❖ Extension and Outreach programmes

National Trust for the Welfare of Persons with Autism, Cerebral Palsy, Mental Retardation and Multiple Disabilities, New Delhi:

The main objectives of the National Trust are to enable and empower persons with disabilities to live as independently and as fully as possible, to extend support to registered organisations providing need based services, and to evolve procedure for appointment of legal guardians for persons with disabilities requiring such protection. The Government of India has provided Rs.100 crores toward the corpus of the Trust. The income generated from the corpus is utilized to implement its programmes.

The State Nodal Agency Centres (SNACs) provide coordination assistance at the State level to enable the National Trust to implement its programmes, disseminate information and train parents and professionals. The SNACs function as Information Centres, facilitators, project mentors, training centers, LLC activators and networkers.

Pandit Deen Dayal Upadhyaya Institute for Persons with Physical Disabilities (Divyangjan):

Pt. Deendayal Upadhyaya National Institute for Persons With Physical Disabilites is an autonomous organization under the administrative and financial control of Ministry of Social Justice & Empowerment, Government of India. The Institute for the Physically Handicapped came into being when the erstwhile Jawahar Lal Nehru Institute of Physical Medicine and Rehabilitation and other allied institution run by the council for the Aid

of crippled & handicapped were taken over by the Government of India on 22nd May 1975 and converted into an autonomous body in the year 1976. It was renamed after Pandit. Deendayal Upadhyaya in the year 2002.

Objectives:

- To undertake the training of Physiotherapists, Occupational Therapists and other such professionals needed for providing services to the disabled persons
- To offer education, training, work-adjustment and such other rehabilitation services as the society may deem fit to orthopedic disabled persons with or without associated mental retardation
- To undertake the manufacturing and distribution of such aids and appliances as are needed for the education, training and rehabilitation of the disabled persons
- To provide such other services as may be considered appropriate for promoting the education and rehabilitation of the disabled persons, including organizing meetings, seminars and symposia
- To undertake, initiate, sponsor or stimulate research aimed at developing more effective techniques for the education and rehabilitation of the disabled persons
- To co-operate with national, regional or local agencies in research or such other activities as may be designed to promote the development of services for the disabled persons
- To undertake or sponsor such publications as may be considered appropriate.
- To do such other things as may be necessary or incidental to the realization of the above objectives

Services:

- Assessment Clinic
- Occupational Therapy
- Physical Therapy
- Speech Therapy
- Workshop
- Social and Vocational
- Psychological Counselling

Outreach Services:

The workshop division is extending sophisticated Prosthetic, Orthotic & Rehabilitation aids and appliances to Persons with Disabilities through District Disability Rehabilitation Centre (DDRCs). The outreach comprehensive rehabilitation camp are organised in collaboration with other National Institutes, DDRCs, reputed Non-Governmental organisations. The support of District Administration is also taken. The tailor-made appliances are fabricated in the workshop with in the stipulated time frame. These services are provided at the doorstep of the disabled persons through camp approach. These activities are performed under the supervision & guidance of qualified Rehabilitation Professionals.

Composite Regional Centers for Persons with Disabilities (CRCs):

To overcome the lack of adequate facilities for rehabilitation of Persons with Disabilities, the Ministry of Social Justice & Empowerment has set up seven Composite Regional Centres for Persons with Disabilities at Srinagar (J&K), Sundernagar (Himachal Pradesh), Lucknow (U.P.), Bhopal (M.P.), Guwahati (Assam), Patna (Bihar), Ahmedabad (Gujarat) and Kozhikode (Kerala) to provide both preventive and promotional aspects of rehabilitation like education, health, employment and vocational training, research and manpower development, rehabilitation for persons with disabilities etc.

5.7 Let Us Sum Up

It is a major sociological theory in the study of social movements which emerged in the 1970s. It emphasizes the ability of a movement's members to 1) Acquire resources and to 2) Mobilize people towards accomplishing the movement's goals.

5.8 Check your progress

1. Explain about various government agencies for aids and appliances.
2. Explain about various non government agencies for aids and appliances.
3. Describe about various government schemes.
4. Elaborate the eligibility criteria for availing funding under government schemes.
5. Briefly explain procedure for availing funding from different agents.

6. Describe in details about challenges encountered with cost involved in maintenance of devices after availing funding and ways to overcome.
7. Point out in details about various agencies or strategies to locate required human resources for various services and referrals.

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