NETAJI SUBHAS OPEN UNIVERSITY

STUDY MATERIAL

M. Ed. Special Education
(Hearing Impairment / Intellectual Disability) - ODL

B 11 (I.D.)

THERAPEUTICS AND ASSISTIVE DEVICES

M. Ed. Spl. Ed. (H.I. / I.D.)
ODL Programme

AREA - B

B 11 I.D: THERAPEUTICS AND ASSISTIVE DEVICES

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

AREA - B
DISABILITY SPECIALIZATION
COURSE CODE: B 11 (I.D.)
THERAPEUTICS AND ASSISTIVE DEVICES

Chairman	**Prof. Subha Sankar Sarkar,** Vice Chancellor, Netaji Subhas Open University, Kolkata-700 064
Convenor	**Prof. Atindranath Dey,** Director, School of Education, Netaji Subhas Open University, Kolkata-700 064

RCI Expert Committee

sDr. Jayanthi Narayan	Former Deputy Director, NIMH, Secunderabad.
Dr. Varsha Gathoo	Head and Reader, Department of Education, AYJNISHD (D), Mumbai.
Dr. Sanjay Kumar	Assistant Professor, DSMNRU, Lucknow,
Shri Ashok Chakraborty	Ex- Chairperson, ZCC, RCI & Secretary, SHELTER.
Dr. Hemant Singh Keshwal	Assistant Prof. of Special Education and Centre In- Charge, NIEPID- RC, Kolkata.
Shri Suman Kumar	Assistant Professor of Speech & Hearing, AYJNISHD- RC, Kolkata.
Professor A. N. Dey	Director, School of Education, NSOU.
Smt. Antara Choudhury	Assistant Professor of Special Education, School of Education, NSOU.

NSOU Expert Committee [Board of Studies (BoS)]

Professor A. N. Dey	Director, School of Education, NSOU.
Professor Dulal Mukhopadhyay	Professor of Education (Retd), NSOU.
Shri Ashok Chakraborty	Ex- Chairperson, ZCC, RCI & Secretary, SHELTER,
Professor Debasri Banerjee	Professor of Education, Department of Education, University of Calcutta
Dr. Hemant Singh Keshwal	Assistant Prof. of Spl. Education and Centre In- Charge, NIEPID-RC, Kolkata.
Shri Suman Kumar	Assistant Professor of Speech & Hearing, AYJNISHD- RC, Kolkata.
Professor Swapan Kr. Sarkar	Head, SoE, NSOU
Prof. Sanat Kumar Ghosh	Professor of Education, SoE, NSOU.
Professor Sumanta Chattaraj	Professor of Education, SoE, NSOU.
Smt. Swapna Deb	Consultant, SoE, NSOU.
Smt. Antara Choudhury	Assistant Professor of Special Education, School of Education, NSOU.
Dr. Abhedananda Panigrahi	Coordinator, B. Ed., SoE, NSOU.
Shri Prabir Naskar	Assistant Professor of Special Education, SoE, NSOU.

Title : Therapeutics and Assistive Devices

Unit	**Name of the Unit Writer**	**Name of the Editor**
Unit-1	Mr. Joyanta Chandra Mandal, Audiologist & Speech Language Pathologist, AYJNISHD(D), RC, Kolkata	Dr. Hemant Singh Keshwal, Assistant Professor of Special Education and Centre In- Charge, NIEPID- RC, Kolkata. & Shri Suman Kumar, Assistant Professor of Speech & Hearing, AYJNISHD- RC, Kolkata
Unit-2	Mr. Pravin Kumar,Assistant Prof, Physiotherapy, NILD (D), Kolkata	
Unit-3	Mr. Thulasikanthan Mugesh , Faculty, Occupational Therapy, NIEPID, RC, Kolkata	
Unit-4	Ms. Rituparna Sarkar, Lecturer,Manovikash Kendra Kolkata	
Unit-5	Kamalika Chowdhury, Associate Professor Sree Aurobindo Institute of Medical Sciences, Indore, M.P.	
General and Format Editing		Smt. Swapna Deb, Consultant, SoE, NSOU. and Smt. Antara Choudhury, Assistant Professor of Special Education, School of Education, NSOU.
Programme Coordinator		Smt. Antara Choudhury, Asst. Professor of Special Education, School of Education, NSOU.

The Self Instructional Material (SIM) is prepared keeping conformity with the M.Ed.Spl. Edn.(HI/ID) Programme as prepared and circulated by the Rehabilitation Council of India, New Delhi and adopted by NSOU on and from the 2020-2022 academic session.

Mohan Kumar Chattopadhyay
Registrar

Prologue

I am delighted to write this foreword for the Self Learning Materials (SLM) of M Ed in Special Education (ODL). The M Ed in Special Education in ODL mode is a new academic program to be introduced at this University as per NOC issued by the Rehabilitation Council of India, New Delhi and subject to approval of the program by the DEB-UGC.

I must admire the emulation taken by the colleagues from School of Education (SoE) of NSOU for developing the Course Structure, Unit wise details of contents, identifying the Content Writers, distribution of job of content writing, editing of the contents by the senior subject experts, making DTP work and also developing E-SLMs of all the 16 Papers of the M.Ed Spl.Ed (H.I/I.D)–ODL program. I also extend my sincere thanks to each of the Content Writers and Editors for making it possible to prepare all the SLMs as necessary for the program. All of them helped the University enormously. My colleagues in SoE fulfilled a tremendous task of doing all the activities related to preparation of M.Ed in Spl Edn SLMs in war footing within the given time line.

The conceptual gamut of Education and Special Education has been extended to a broad spectrum. Helen Keller has rightly discerned that *"Have you ever been at sea in a dense fog, when it seemed as if a tangible white darkness shut you in and the great ship, tense and anxious, groped her way toward the shore with plummet and sounding-line, and you waited with beating heart for something to happen? I was like that ship before my education began, only I was without compass or sounding line, and no way of knowing how near the harbour was. "Light! Give me light!" was the wordless cry of my soul, and the light of love shone on me in that very hour."* So education is the only tool to empower people to encounter his/her challenges and come over being champion. Thus the professional Teacher Education program in Special Education can only groom the personnel as required to run such academic institutions which cater to the needs of the discipline.

I am hopeful that the SLMs as developed by the eminent subject experts, from the national as well as local pools, will be of much help to the learners. Hope that the learners of the M.Ed Spl Edn program will take advantage of using the SLMs and make most out of it to fulfil their academic goal. However, any suggestion for further improvement of the SLMs is most welcome.

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

First Edition : December, 2019

Printed in accordance with the regulations of the Distance Education Bureau,
University Grants Commission, Government of India

AREA - B

B 11 I.D.: THERAPEUTICS AND ASSISTIVE DEVICES

Unit 1: Language Speech and Communication

1.1 Nature, Definition, Scope, functions and development of language, Speech and Communication

1.2 Critical period and its importance in speech and language development

1.3 Modes of communication, (Aural, Oral, Finger Spelling, Sign and Sign Language, Cued, Speech and Total Communication)

1.4 Types of speech and language disorders in PwID

1.5 Enhancing and integrating speech and language into classroom context

Unit 2: Physiotherapy

2.1 Physiotherapy - Nature, Definition, objectives, Scope and functions

2.2 Modalities used in physiotherapy for persons with ID and its Associated Conditions

2.3 Movements and postures of human body

2.4 Specific conditions and physiotherapy management - Cerebral palsy, Spina bifida, Muscular dystrophy and Poliomyelitis

2.5 Integrating Physiotherapy into classroom context

Unit 3: Occupational Therapy

3.1 Occupational therapy- Nature, Definition, objectives, Scope and functions

3.2 Modalities of Occupational Therapy for persons with ID with associated Conditions

3.3 Hand Functions- Types of grasps, grip, development, and eye-hand coordination

3.4 Sensory Integration - Nature, Development & Importance

3.5 Integrating Occupational therapy into classroom context

Unit 4: Behaviour Modification

4.1 Aim, scope and importance of Behaviour Modification

4.2 Types of Behaviour- Adaptive and Maladaptive

4.3 Identification of Problem Behaviours, and Functional Analysis

4.4 Strategies for Behaviour Modification and Differential Reinforcement

4.5 Integrating Behaviour Modification in classroom context

Unit 5: Assistive Devices

5.1 Definition, Importance and types of Assistive Devices for Independent Living

5.2 Different types of assistive devices for ID, HI, VI &Locomotor disability

5.3 Assessment of PWID needs to identify the appropriate assistive devices

5.4 Selection & use of appropriate Assistive Devices for PWID and Maintenance

5.5 Schemes of MoSJE- ADIP Scheme, DDRS and SC/ST scheme

B 11 I.D.: THERAPEUTICS AND ASSISTIVE DEVICES (INTELLECTUAL DISABILITY)

Unit - 1 □ Speech, Language and Communication

Structure

1.1 Introduction

Communication is the essence of life. One cannot think of a life without communication. Imagine, what would happen if you are not allowed to talk or communicate for a long time? We would feel frustrated and suffocated.We need to communicate to deal with various concerns and problems of daily life. It is communication that helps us to express ourselves and reach out to other living being and form connection. We, humans spend 70% of our time in receiving and sending message. But, how do we do this? How this process of communication does take place?

An integral part of life which is intertwined with human existence is communication. It is an ongoing process of exchanging thought or idea between sender and receiver. In other words, communication is a way of intentionally putting across ones opinions and ideas and intentionally listening that of the others'. This process is called as communicative interactions that serves to maintain relationships among us by either giving or receiving the information every now and then throughout a day.

Speech and language are the means of communication. It is a common code shared and understood by the people in a community and which children learn through social interactions (Kumin,2003). The use of language comprises receiving and sending messages, ideas and thoughts.The most intensive period of language development in children is between 3-5 years of age. Typically developing children have acquired the basic components of language by the age of 3 or 4 years (Flusberg& Sullivan, 1998). Around that time, children with intellectual disabilityonly acquire few words, such as the names of family members and a couple of objects.

Communication takes many forms some verbal some non-verbal. Language is a major part of human communication system as it includes word and rules for organizing them. Speech is the process by which sound is shaped into meaningful units, and audition is the process of hearing what it is. A multitude of factors can interfere with normal development of speech, language and audition. Acquired damage may also affect a person's ability to use speech and language or to hear it. These constitute communication disorders.

1.2 Objectives

The objective of this unit is to understand about basics of speech language communication and gain knowledge regarding different disorders and classroom intervention related to it.

1.3 Nature, definition, scope, functions and development of speech, language and communication

The communicative interactions can be accomplished by many ways. The most important key tool for communication is language. Communication cannot be established without language. We can say that, communication and language are inseparable. There are many ways by which we can communicate. But the most efficient and unique way of communicating, that is given as a boon to humankind is speech. Language can be easily portrayed with the help of speech and which in turns help to establish a healthy communication.

1.3.1 Communication

The word "communication" is originated from "communicare" or "communis" which means "to impart", "to participate", "to share", or "to make common". The sense of '*sharing*' is inherent in the origin and meaning of communication. According to Murphy, Hilderbrandt and Thomas, "communication is a process of sending and receiving verbal and nonverbal information which is considered to be effective when it achieves the desired response or reaction from the receiver".

Communication process:

It is a two-way process which involves the following elements: a sender, a message, a medium, a channel, a receiver, a response, and feedback. Along with these elements, coordination between the sender and receiver of message is equally important for a good communication.

Components of communication:

- Context in which the communication takes place- Communication Environment.
- Idea or thought than arises in the sender's mind.
- Formal impulse of the idea or thought using a medium and a channel- Encoding.
- Interpretation of the message by the receiver- Decoding
- Reaction or response of the receiver.
- Conveying the response in the feedback using a medium and channel.
- Decoding the feedback received.

There are various different sensory modalities that can be used for the purpose of communication. These sensory modalities include: visual, hearing, touch and smelling.

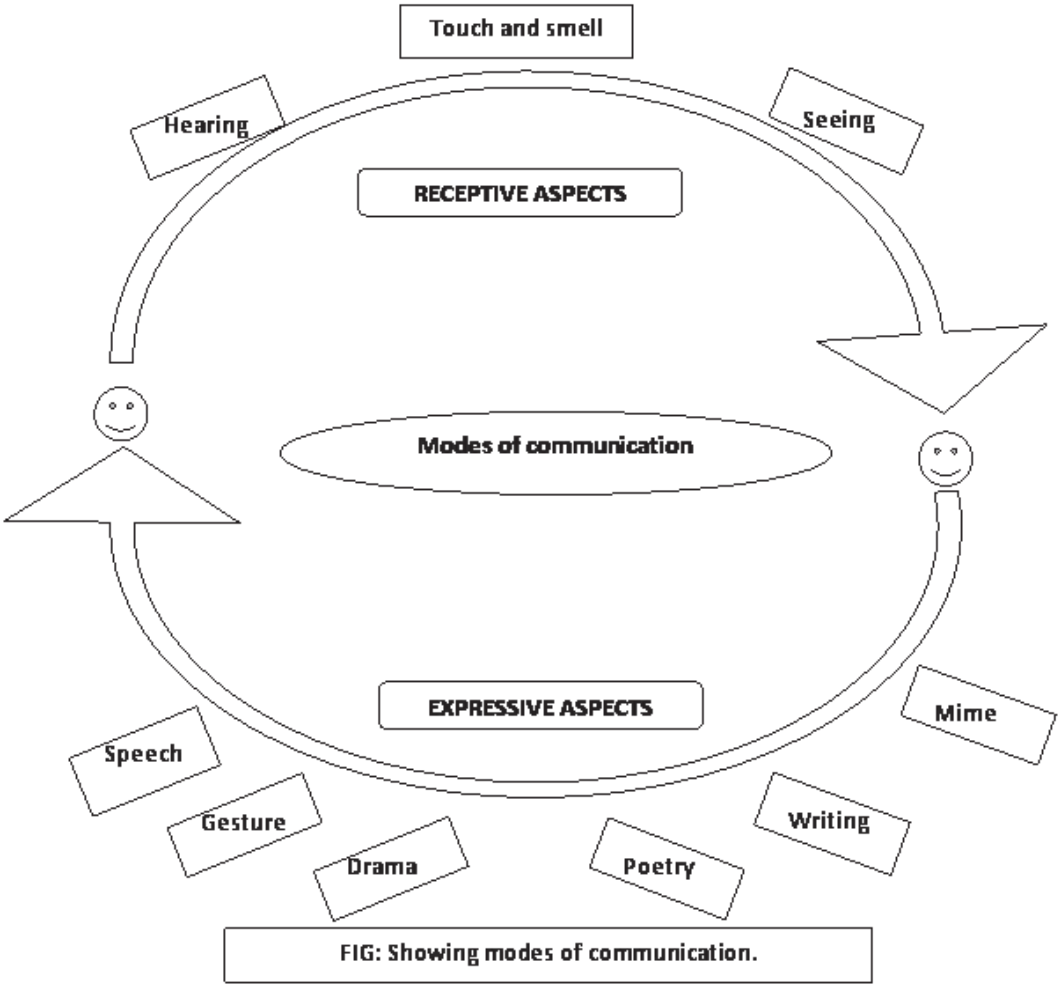


FIG: Showing modes of communication.

Nature:

Communication is a dynamic, continuous, irreversible, but at the same time, reciprocal in nature. Communication helps us to understand others and explain ourselves.

Communication can broadly be divided into 2 types:

- Verbal communication: by using spoken language
- Non-verbal communication: using Sign language, gestures, writing, etc

Communication not only involves speaking/talking, rather it take place in many forms. Sometimes, we communicate by 'talking' about our ideas, thoughts or emotions; at other times, we may wish to communicate through the written word or even non-verbally. Whatever form we choose, getting the message across is what communication is all about.

Communication occurs at various levels like, at personal level and social communication. For examples a child pulling his mother's dress for attention, confidential talk between two professionals (personal), group or community meetings, cultural meetings and programs (social).

Scope:

A life without "talking" or "communicating" is nothing but suffocating and frustrating. We use communication for satisfying our needs. These needs keep on changing on time to time for infancy to adulthood. And as we grow old, communication is then not only restricted to satisfying needs but also gives us opportunity to interact, learn, gather knowledge about the world, etc.

1.3.2 Language

Language is the key to communication. It is the most important instrument for establishing successful communication. According to Wardaugh (1972), language can be defined as set of arbitrary symbols used to represent thoughts and ideas by humans to communicate. It can be defined as a principal system which can be shared as a convention to combine specific sounds and make meaningful units of speech and used by a particular group of people using that language to communicate (Lyons, 1970).

Nature:

Noam Chompsky said language is the inherent capability of human beings to understand and form grammatical sentences in their native language. It is the system of symbols containing set of finite and infinite set of elements used to construct sentences, shared by a community or group of people. A symbol is a code that represents a person, an object or a code. These symbols are arranged in an order making a set of rules. These set of rules are shared by the community and are arbitrary in nature which means there is no one to one relationship between the particular spoken, written or signed words and the corresponding object, ideas or class of the objects it symbolizes. The reason we

fail to understand the strange speech of an unknown language is that we do not know the words, the sounds, or the rules of that language.

Thought and language:

Thought may be defined as an internal or mental representation of experience. Jerome Bruner has suggested that the representation can be in the form of images, action, or language.Representation of thought in language seems to be important in the mental activities of language users. Although it is apparent that we can think without any formal language, it is equally apparent that those who do know a language use it to aid their thinking.

As the communication has different modes; language has different components which deals with

- How to say (form),
- What to say (content),
- When to say (use).

These components of language make the communication more efficient and effective.

The inter-relationship between form, content and use and how it constitutes the base of language is depicted in figure-2

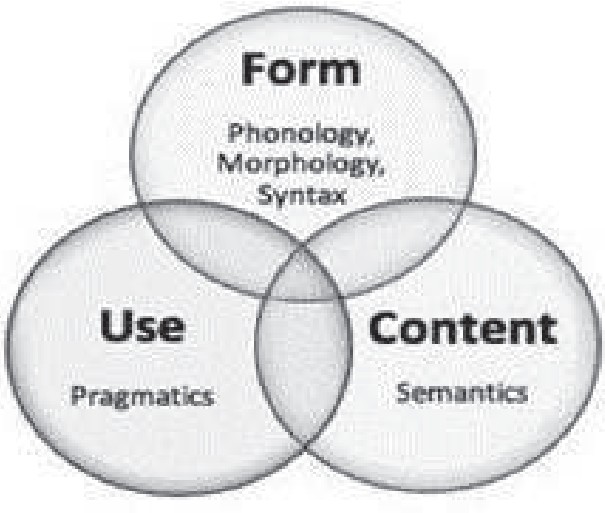
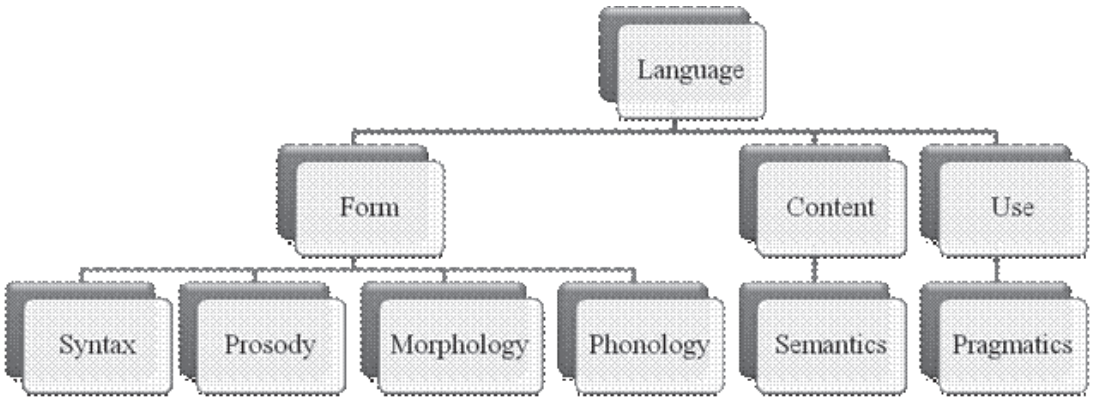


Fig : Diagram representing relationship between components of language.



Example of form, content and use:

"*I am Riya."* Here, form of sentenceis: "*pronoun+verb+noun"*

Content: to convey one's name

Use: to fulfil the purpose of communication.

Components of Form

Syntax: Syntax comes from a Greek origin which means "arrange together". It refers to the rules that govern the ways in which words combine to form phrases, clauses or sentences. It is the study of syntactic grammatical properties of language. The syntactic rules specify those cords of word which are acceptable and those cords of words which are not acceptable. Without the syntactic rules and organization, language would be an incomprehensible and disconnected jumble of words.

Example*: "Pandas like to eat bamboo"* is syntactically acceptable sentence.

Prosody: Another component of form which deals with the impact of melody on speech is prosody. It includes accent, intonation, stress or emphasis, rhythm, etc which is further elaborated as suprasegmental aspects.

Morphology: It deals with the internal structure of words. It is the study of rules that governs creating the words from roots, prefixes and suffixes. The rule for combining speech sounds or small units of speech into meaningful words is called morphology. These small units of speech are called as morphemes.

Some morphemes do not have meaning on their own, but becomes meaningful when combined or attached with words. Like, *un_, _ful, _ed, etc.* these morphemes cannot stand alone with meaning. Such morphems are called as *Bound Morphemes*.

Some morphemes can be used independently, having their own meaning, like, *chair, boy, box, etc.* Such morphemes are called as *FreeMorphemes*.

Other forms of morphemes are grammatical morphemes (which mark grammatical categories of language, like, tense, numbers, gender, aspect) and lexical morphemes (which specify nouns, adjectives, verbs). Grammatical morphemes are bound morphemes while lexical morphemes are free morphemes.

Phonology: it deals with the rules using speech sound in a language. Phonology is the branch of linguistics that involves study of the speech sounds (phonetic or phonemic) in language or a language with reference to their allocation and patterning and to implicit rules governing pronunciation. Although there are many speech sounds that are commonly found across various languages, every language has different set and number of speech sounds.

Component of content:

Semantics: Semantic is the study of meaning of language and its acquisition. Semantic is the component of language that includes meaning and rules for linking meanings of word in order to form phrases and sentences.

A word does not represent any object; rather it represents the idea or thought about the objects. Hence, when we say a word "*cup*"; it means *an open-top container used to hold liquids, like tea, for pouring and drinking*. Semantic is mainly concerned about the relationship between language and the knowledge of objects or events.

Component of use:

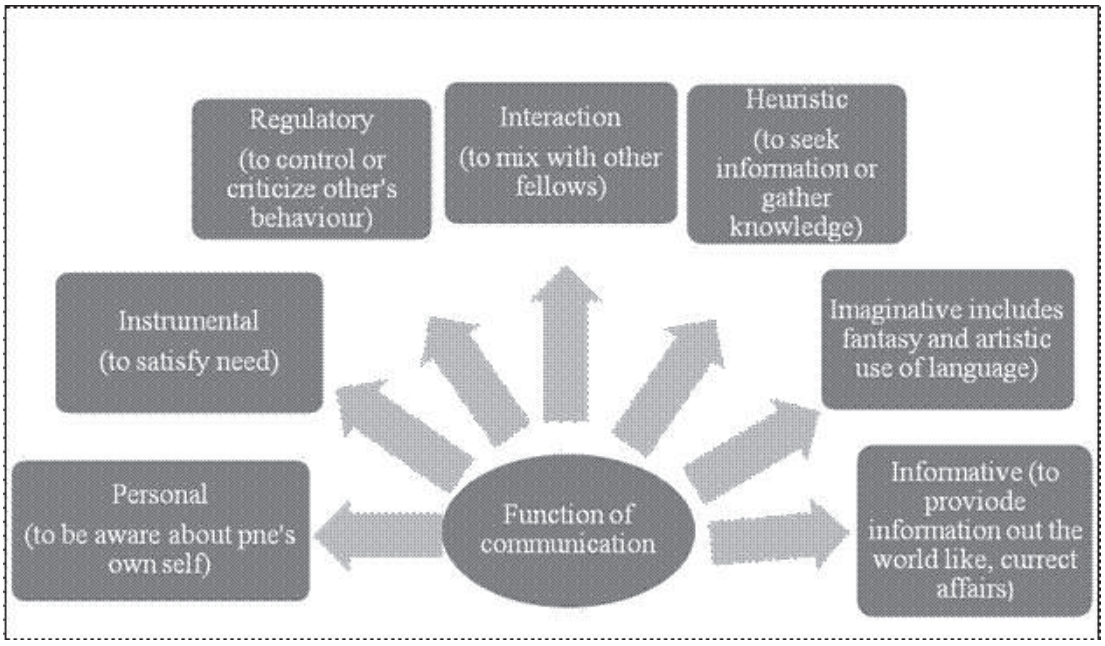
Pragmatics: Set of rules for the use of language in social context is governed by pragmatics. Pragmatics is a subfield of linguistic and semiotics that study the relationship between the form of language and its use. It deals with how to use language in different circumstances. Pragmatics defines the intended meaning of the speaker.

For example: "Tomorrow is Friday". This statement may imply suggestion, providing information, invitation, etc

Function of communication and language

Communication and language essentially has the same function. These functions commonly occur in communication situations of our day to day life.

Functions of communication and language are as follows:-



1.3.3 Speech

Speech is the efficient and unique way in which most human communicate with each other. Human being uses this unique skill to give a physical form to thoughts for its expression and reception in the environment, essentially to accomplish the process of learning unlike any other form of life.Speech is defined as the audible manifestation of language (Van & Erickson, 1996). It is language dependent, i.e., without language, speech would be meaningless.

Need of speech:

There are many reasons humans use speech as their primary mode of communication. Most important reasons relate to the fact that speech was selectively advantageous in the evolution of human species.

- First, the vocal– auditory channel of speech permitted communication under conditions in which the other channels of communication would fail. Speech can be used to send messages in the dark, around corners, or when visibility is limited for other reasons.

- Second, using speech allowed communication to occur at the same time that manual tasks, such as tool making or food gathering, were being performed.
- Third, as we shall see, because of the way speech is produced by the human vocal tract, it is both efficient and redundant.

Physiology of speech: - Speech is produced by the speech mechanism structures, in complex coordination with the nervous system. The four main body subsystems responsible for production of efficient speech are:

1. Respiratory system:- It is responsible for the movement of air in and out of the body i.e., the intake of oxygen and exhalation of carbon dioxide. Production of speech would be impossible with the respiratory system. Respiratory system has two key parts – lungs and diaphragm. Lungs store and expel the inhaled air and serves as a power supply to produce speech. Diaphragm contract and determine the power (intensity or duration) of the vocal sound produced. Hence, respiratory system is responsible for breath support.

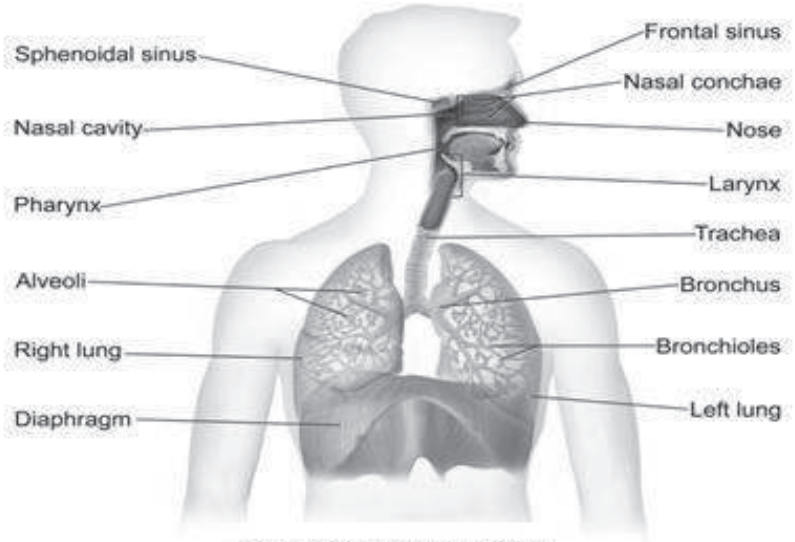


Fig: Respiratory System

2. Laryngeal system:- Larynx plays the vital role in production of speech. It is responsible for phonation, that is, production of voice. The movement of vocal folds take place in four phases - opening, open, closing, and closed. This movement of vocal folds helps to produce voice. When the glottis is closed, the subglottic

air that comes from the lung builds subglottic air pressure. When the glottis opens, the air pressure is released from the vocal folds. The continuous movement of vocal folds then produce voice.

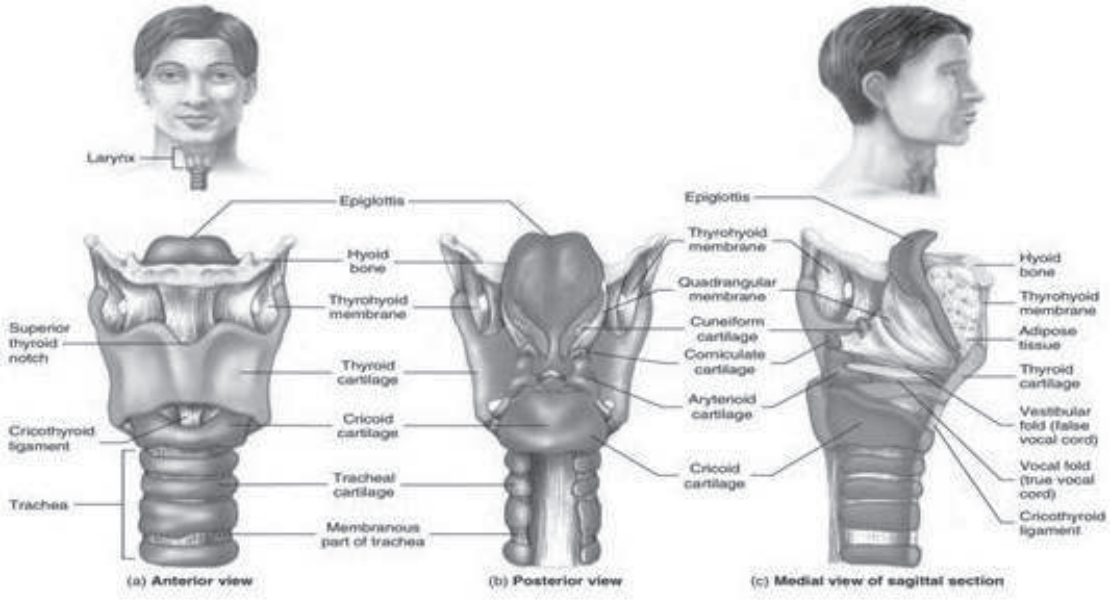


Fig: Phonatory System

3. Articulatory system:- Articulatory system is responsible for the nuances of speech sounds when we talk. Structures of articulatory system are called as articulators. Articulators are broadly divided into two categories:

- Fixed articulators: Anatomical structure of these articulators is fixed in their place, such as, hard palate, alveolar ridge and teeth.
- Movable articulators: These articulators are flexible and can move in the oral cavity to produce various complex speech utterances. Some movable articulators are tongue, lips, pharynx, soft palate and mandible.

4. Resonatory system: It deals with the resonance of sound produced by regulating the vibration of air flow as it moves from the larynx. It contains three cavities:

- Oral cavity
- Nasal cavity
- Pharyngeal cavity

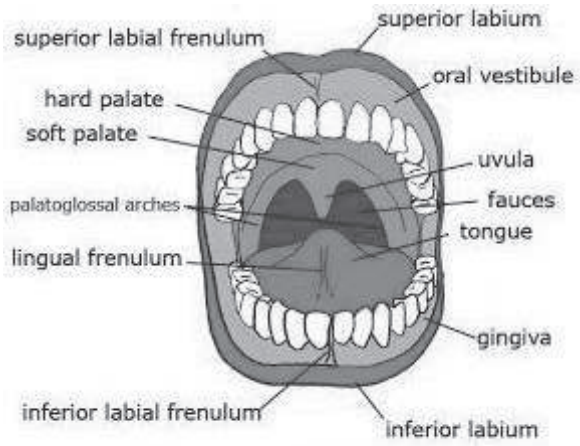


Fig: Articulatory System

If the produced sound is nasal, then the subglottic air will release from the nasal cavity by passing the air from the velopharyngeal port. This is called as nasal resonance. On the other hand, for oral sounds, the velopharyngeal port will be closed and the air will pass from the oral cavity giving an oral resonance.

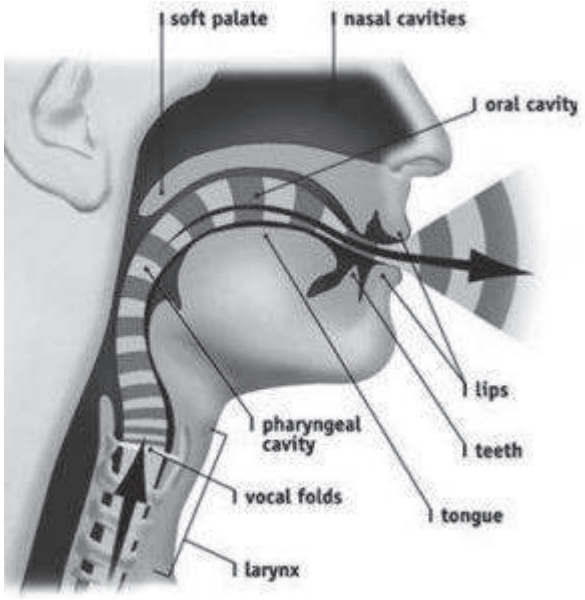


Fig: Resonatory System

Nervous system: - Nervous system is responsible for coordinating the functions of respiratory, laryngeal and articulatory systems for production of speech. Some conscious

aspects or functions are governed by central nervous system, for example, conscious movements of lip. While, unconscious aspects are dealt by the autonomous nervous system. It affects the oscillations of muscles associated with respiratory, phonatory and articulatory functions which influence the quality of sound waves produced, while speaking.

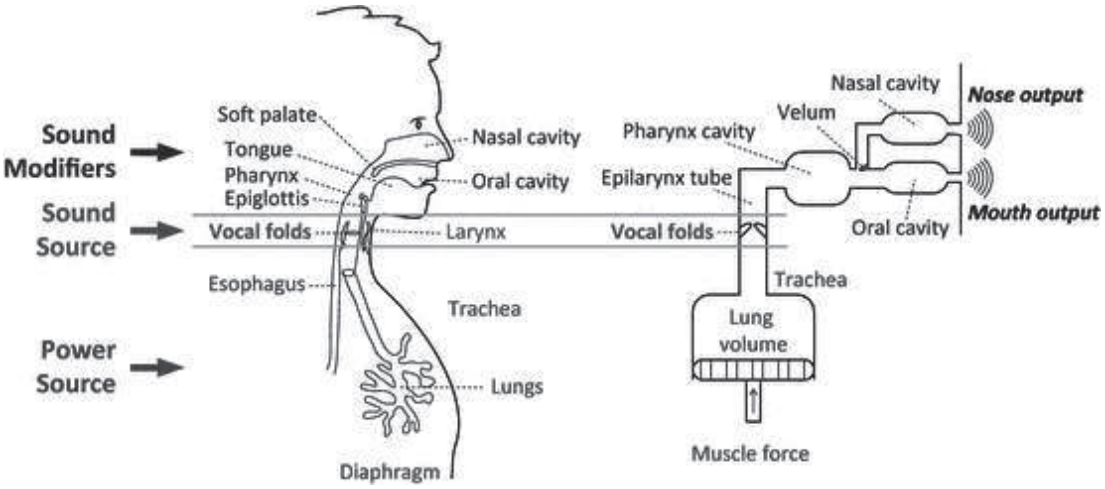


Fig: How the Subsystems of speech works

Speech is an overlaid functionbecausethere are no organs whose primary function is to produce speech.

Speech, language and communication

Communication, speech and language are inter-related to each other. Communication is much broader term than language and speech and it has much more use than language and speech. Communication involves exchange of information, which is not possible without an essential tool that is common for both receiver and speaker, this common tool is language which has been invented to make the communication easy. Language involves more than speech and speech without language is meaningless. A person can talk only to the level of his language ability, essentially makes speech dependent on its language. As per the definition of speech, it is the verbal manifestation of language. Hence, it is just one of the modes to convey language and establish communication; among the other modes like sign, gestures, written form, etc. Speech is the most frequent way in which language can be used for communication despite hindrance by different physical barriers.So, the inter-relationship between speech, language and communication can as understood from the following figure.

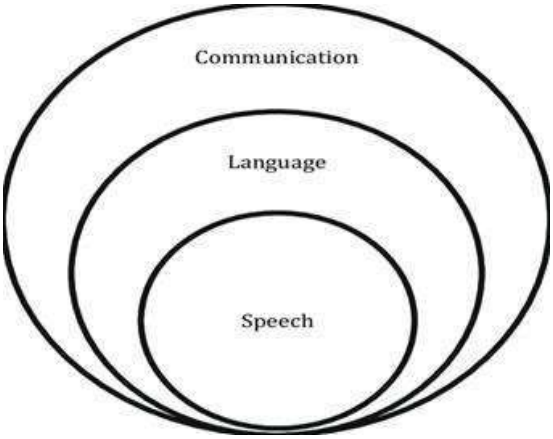


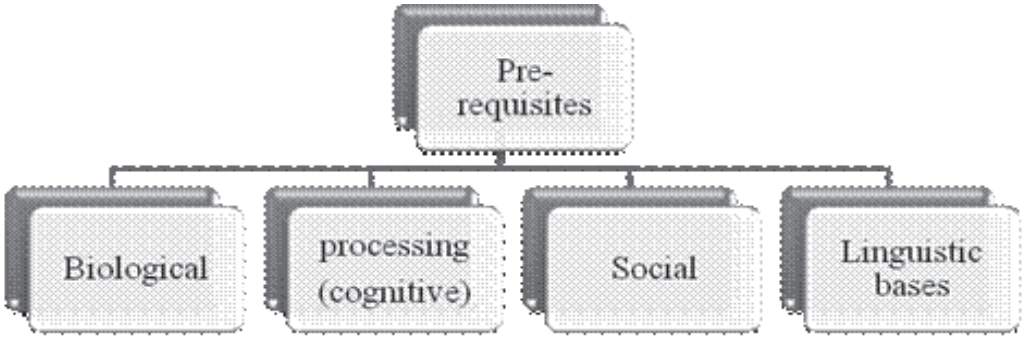
Fig: Inter- relationship between speech language and communication

Speech is a physical event. Thoughts are not always formed in orderly sequences.Language helps make an idea or an experience available. Expressing a thought verbally allows it to be recorded in various forms for analysis. Language also aids thinking by providing a frame to hold information in memory. It enables us to communicate ideas about people, places, activities, qualities, or things when they are not present.

1.3.4 Development Of Speech, Language And Communication

A child can learn to speak a language without any formal instruction. They acquire speech and language just by listening the people around them speak. From their birth to adulthood, children learn speech, language and communication in a systematic process.

Communication begins from the infantile state, when a baby reflexively cries for hunger or pain. Acquisition of these skills is not an easy task for the children. In order to learn the communication skills, children need to have some pre-requisite skills.



Role of audition in development of speech, language and communication

Hearing or audition refers to the process of reception of sound from ear and transmitting them to the brain for understanding the meaning. The exposure of sounds in a child's environment helps the child to acquire language. In order to develop spoken language, a child should be able to hear the speech sounds clearly and also should be hearing their voices.

Hearing impairment creates deprivation to the essential verbal stimulation, necessary for child to acquire language. Hearing and listening is not the same thing. Development of speech and language does not only depend on hearing the sound, but also on listening skills of the child. Listening involves attending the signals and interpreting their meaning. Hence, listening is a psychological process while hearing is physiological process. But both are equally important for development of speech and language skills and communication.

Milestones of language development:

Milestones of language development are universal to all languages so a normally developing child goes through similar milestones of a language development. This development gradually and continuously progress from non-speech sound to speech sound and then the speech sounds increase in number, length and complexity.

- According to Van & Erickson (1996) at 1-3 months the infant has little ability to comprehend speech where mostly crying is present. At this stage there may be presence of different types of cries for expressing needs like pain and hunger.
- At 3-6 months, the crying reduces and the cooing is more prominent. Vocalization may be present in response to parental speech.
- At 6-9 months, the child goes through a period called babbling where the child produces consonant-vowel combinations (canonical babbling) frequently similar to adult speech timings. The consonant-vowel combination shortly followed by repetition of syllables which is called reduplicated babbling.
- At 9-12 months, practice of syllable strings may be present which are meaningless utterances also called jargon.
- At 12-15 months, the development of meaningful words are usually achieved which is termed as first word. Some monosyllables or repeated syllable production may appear.

- At 15-20 months, there may be regular production of words and short phrases. Combination of simple words may be seen resembling simple sentences.
- Regular production of short phrases and simple sentences may appear to express needs at 20-30 months.
- By the age of 5 the typically developing children masters the fundamental structural aspects of language and acquire a knowledge of pragmatics which is the ability to determine how to use verbal and nonverbal communicative signals to comprehend and convey a wide variety of different context dependent messages.

Table: ***Speech, language & communication development***

Age	**Language Understanding**	**Langage Expression**	**Speech Sounds**	**Use/Rules Of Language**
0-1 YEAR	*Understand what sounds are in their environment. *Begins to understand language in familiar context. *Begins to understand the names of common objects.	*Coos by 2 months old. *Babbles by 8 months old. *Echoes some sounds. Waves bye-bye.		*Starts interaction by using eye contact. *Vocalizes in response to being spoken to.
1-2 YEARS	*Understand single word object words. *Begins to understand action words used in context.	*Child has single words and learned phrases continue to develop. *Has 50 single words by 2 years.	m, n, p, b, t, d, w	*Uses gestures, vocalizations an utterances to: seek attention; request; reject; greet; name; comments.
2-3 YEARS	*Understands 2 words structure, e.g. Baby's nose	8 Uses 2 word combinations. *Uses a range of action words. *Begins to use some 3 word combinations.	m, n, p, b, t, d, w, h, k, g, f, y, ng, s	*Take part in short conversations. *Uses language imaginatively. *Makes simple requests and statements.

Age	Language Understanding	Langage Expression	Speech Sounds	Use/Rules Of Language
3-4 YEARS	*Understands 3 word structures, eg, give big spoon to teddy. *Begins to understand colour and early concepts, eg. Big/little.	*Develops 3 and 4 word combinations. *Develops use of articles (a, the), pronouns (he, she) and plurals (cars).	m, n, p, b, t, d, w, h, k, g, f, y, ng, s, l	*Initiates conversation verbally. *Retails simple stories.
4-5 YEARS	*Understands 4 word structures. *Understands colour and size vocabulary. *Understands question forms, prepositions (in/out) tenses and pronouns.	*Uses complex constructions. *Begins to use irregular grammatical constructions.	M, n, p, b, t, d, w, h, k, g, f, y, ng, s, l, sh, ch, j, z, v, r, th, zh	*Uses language to pain and anticipate what will happen next. *Begins to tell joke. *Requests clarification *Uses language to imaginary situations.

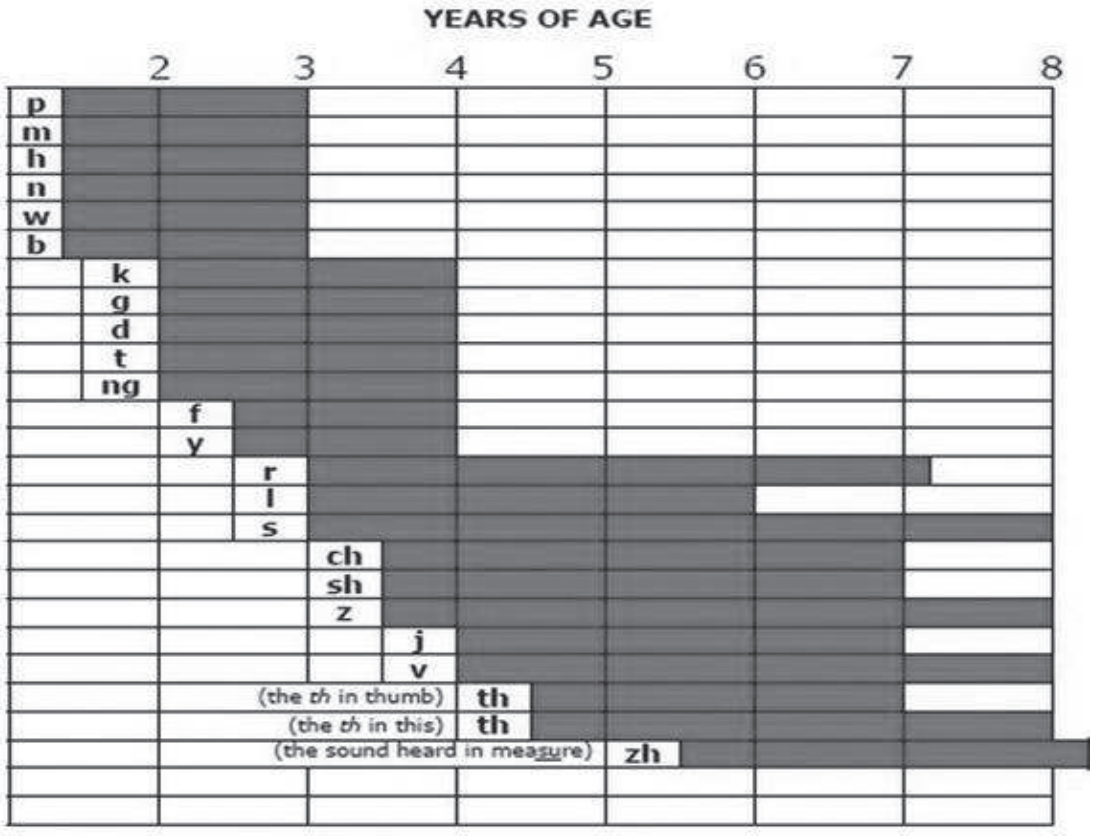


Fig: Speech Sound development

Conclusion:

Children grow and develop rapidly in their first five years across the four main areas of development. These areas are motor (physical), communication and language, cognitive, and social and emotional.Communication and language development is about more than talking. It means all the different ways a child understands and communicates, only part of which are spoken words.Communication and language development is important, because speaking is an indicator of fine motor skill development and a reflection of cognitive development.

The first 3 years of life is considered as the critical age for language learning, because the brain is developing and maturing during this age. So, it is the most intensive period for acquiring speech and language skills. There are various factors the influence the speech and language development during this period such as exposure of child to the speech and language skills. If the critical periods pass without exposure to language, it will be more difficult to learn.

Children vary in their development of speech and language skills. However, they follow a natural progression or timetable for mastering the skills of language. These milestones help to determine if a child is on track or if he or she may need extra help. Sometimes a delay may be caused by hearing loss, while other times it may be due to a speech or language disorder. Children who have trouble understanding what others say (receptive language) or difficulty sharing their thoughts (expressive language) may have a language disorder. Specific language impairment (SLI) is a language disorder that delays the mastery of language skills. Some children with SLI may not begin to talk until their third or fourth year. Children who have trouble producing speech sounds correctly or who hesitate or stutter when talking may have a speech disorder. Apraxia of speech is a speech disorder that makes it difficult to put sounds and syllables together in the correct order to form words.

There are many other factors and disorder that hinders the speech and language development in children and developing speech, language and communication needs. Come common examples are neurological disturbances, congenital anomalies, autism spectrum disorder, etc. It is important that these disorders or factors affecting speech and language skills should be known as soon as possible. Early identification and intervention of these disorders will help the child to acquire speech, language and communication and fulfil their communication needs.

1.4 Critical Periods and its importance in Speech and Language Development

A principal task for the field of speech language pathology is to identify variables that influence the effectiveness of intervention efforts. One variable that might influence treatment outcome is the age of the person receiving treatment. The presence of developed cognitive and processing skills might facilitate rapid treatment gains in older children and adults. On the other hand, the existence of a neurologically determined critical period for language acquisition might inhibit or prevent optimal results in older clients.

1.4.1 Critical period:

A critical period can be characterized as a maturational time frame during which an organism has heightened sensitivity to external stimuli that are necessary for the full unfolding of a particular skill. During this time period, if the organism is not exposed to the appropriate stimuli, then the dependent skill may be suboptimal or, in extreme cases, even unattainable.

It is a "maturational time period during which some crucial experience will have its peak effect on development or learning, resulting in normal behavior attuned to the particular environment to which the organism has been exposed."

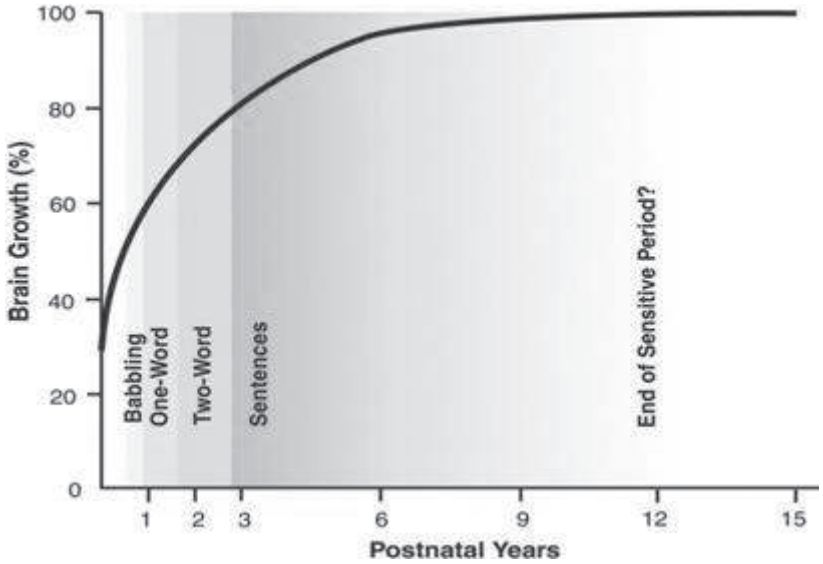


Fig: Brain growth and language development

History of Critical period :

The concept of critical period among human beings was developed by analogy with the learning mechanisms in other species and was proposed by Penfield and Roberts (1959). Lenneberg (1967) used three main sources of evidence to support the notion of a critical period for language acquisition.

a. Feral children and victims of severe neglect who were reared with minimal exposure to language and who subsequently were unable to fully acquire the formal properties of language, specifically the phonology and syntax.

b. Children born profoundly deaf who had delayed exposure to a spoken language up to puberty and then presented incomplete language acquisition.

c. Studies of children with aphasia or severe brain damage who had significantly better recovery of language than aphasic adults.

Concept of critical period:

Critical periods are limited stages in brain maturation which must coincide with exposure to certain experiences; these results in seemingly effortless and rapid acquisition of new skills which are much harder to acquire or are not acquired at all at other stages. The inter-relationship of degree, duration and timing of temporary hearing loss in a young child is the key issue in assessing the effect of recurrent otitis media on language acquisition. Whether critical periods exist for exposure to speech sounds and the acquisition of language remains an open question (Clopton, 1980).

1.4.2 Importance of critical period in speech and language development:

Language is an important skill that allows a person to communicate. A child begins to develop language even before he can use words, as seen by a baby who cries to get his need met. A delay in language skills can cause frustration for the child as well as miscommunication about what he may be trying to convey. Language development is important to a child in order to adequately exchange information with others in a meaningful way.

According to ASHA, language is not the same as speech. Language consist of a set of social standards that shows comprehension of the meanings behind words, putting words together in a sentence in order to communicate and understanding commands, direction and information given by others. Children must develop language skills to

relate with their parents and peers, as well as to grow into a person who can socially interact with others through life.

Each child follows his own milestone for development of language, but overall he should be exhibiting certain behaviors by a specific age. By 12 months, a baby recognizes and reacts to the sounds. By 2 years, a child has a vocabulary of almost 300 words and can respond to simple commands. By 3 years, he has almost 1000 words, 90 % of which is understandable and can give his name and age. By 5 years, he can understand the concept of opposites and can speak in sentences of up to nine words.

A parent can encourage the development of language skills with a child by interacting regularly, singing songs and reading simple stories. As a child grows, she can talk about her day or explain her likes and dislikes. A parent can play games with the child, such as naming objects or practicing concept of direction.

First language acquisition:

The critical period hypothesis states that the first few years of life constitute the time during which language develops readily and after which language acquisition is much more difficult and ultimately less successful. The age of the critical period is sometime between age of 5 years and puberty.

As stated earlier, Lenneberg's formulation rests upon notion of neural plasticity and upon observation others have made about the nature of recovery from neural assaults in children and adults.

Other evidence comes from neuropsychology where it is known that adults well beyond the critical period are more likely to suffer permanent language impairment from brain damage than are children believe to be due to youthful resilience of neural reorganization. The discussion of language critical period suffers from the lack of a commonly accepted definition of language. Some aspects of language, such as phoneme tuning, grammar processing, phonology, articulation control and vocabulary acquisition can be significantly improved by training at any age and therefore have weak critical period. Other aspects of language, such as prefrontal synthesis, have strong critical periods and cannot be acquired after the end of the critical period.

Second language acquisition:

If we consider competence in acquiring a second language to be the composite of various language skills, it appears that the older learner may actually have an advantage over the younger learner. Burstall (1975), in one of the few longitudinal designs

addressing the hypothesis and its pedagogical ramifications, reported on the results of a 10 years study conducted on second language instruction in French for English speaking school children in Great Britain. Subjects were followed for as many as 8 years and included over 6000 children. Achievement measures included standardized tests as well as teacher's assessment and student questionnaire. The research findings showed that people taught at the age of 8 or earlier failed to perform substantially better in terms of final achievement than those who began instruction 3 to 5 years later.

This result of 'no difference' or 'difference in favor of the older learner' has been replicated in cross-sectional designs, in which the performances across language skills are collapsed into a composite performance measure (Asher and Garcia 1969).

Recently, a connectionist model has been developed to explain the changes that take place in second language learning assuming that sensitive period affects lexical learning and syntactic learning parts of the system differently, which sheds further light or how first and second language acquisition changes over the course of learner development

At the brain level, research by Neville and Bavellier has shown that variation in age of exposure to second language results in different neural representations. Acquisition of first language in native speakers results in strongly left-lateralized processing; however, second language acquisition results in more variability in neural activity for processing that language as well as less lateralization. If this is due to age or to maturation of cortical lateralization is not clear. In general, there is evidence for reduction in ability over time on average but not for a critical period as such overall.

1.5 Modes of communication

Communication is the process of transmitting information from one person to another. It is the act of sharing of ideas, facts, opinions, thoughts, messages or emotions to the other people, in and out the organization, with the use of the channel to create mutual understanding and confidence.

ELEMENTS OF COMMUNICATION:

Communication is a two-way process, wherein interchange of message connects the sender and the receiver, towards an agreed direction, consisting seven elements.

- Sender
- Encoding

- Message
- Medium
- Receiver
- Decoding
- Feedback

All the seven elements of communication have a great role to play in the entire process, as there can be some deformation between the intended message and the received one.

1.5.1 Modes of Communication:

Verbal communication: Communication, in which spoken words are used to transmit information, is called verbal communication. It can be done in two ways.

a. Oral communication

b. Written communication

Non-verbal communication: communication between people in which words are not used as a means for interchanging message is called as a non-verbal communication. It can be various types.

a. Body language

b. Paralanguage

c. Sign language

1.5.2 Different Modes of Communication:

Aural communication:

Aural communication includes all communications that rely on the recipient hearing the communication. This includes spoken words, siren, alarm bells, and so on.

Aural communication can be useful over long distances. They are useful for communicating to several people at once and also in situations where the exact recipient of the communication is not known.

Aural communication can be very effective for gaining attention of people, perhaps as a prior warning for another type of communication. As with visual communications, aural communication relies on the recipient understanding the meaning of the communication.

Oral communication:

Oral communication implies communication through mouth. It includes individuals conversing with each other; it can be direct conversation or telephone conversation. Speeches, presentation, discussions are all forms of oral communication. Oral communication is generally recommended when the communication matter is temporary kind or where a direct interaction is required.

Types:

a. Face to face conversation

b. Telephone conversation

c. Discussion

More formal type of oral communication includes classroom lectures presentation in any topic etc.

Advantages:

- High level of understanding and transparency in oral communication as it is interpersonal.
- There is no element of rigidity in oral communication. There is flexibility for allowing changes in the decision previously taken.
- The feedback is spontaneous in case of oral communication.
- Oral communication is an essential for team work and group energy.
- Oral communication can be best used to transfer private and confidential information.

Auditory-oral educational approach:

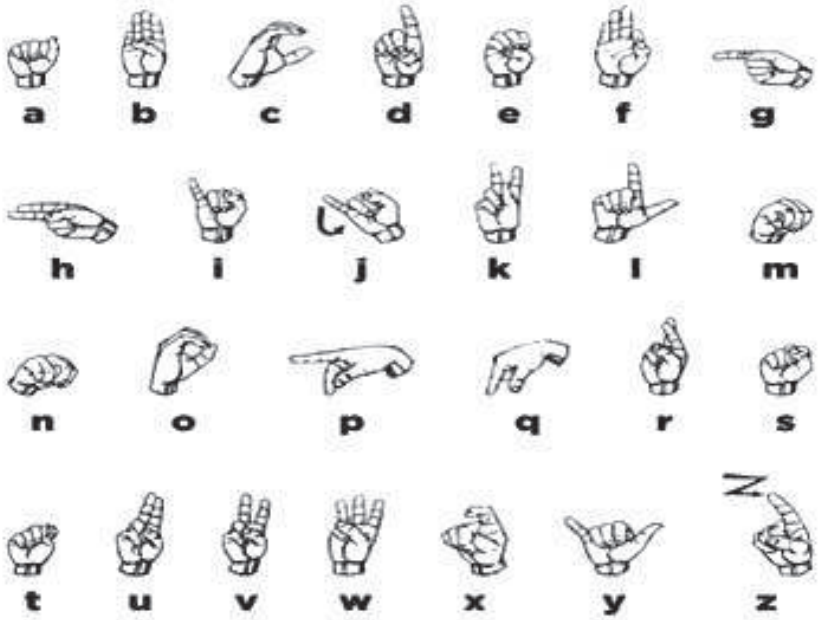
The goal of the auditory methods is to teach a child how to use his residual hearing so that he may have access to spoken language. "most deaf children have some residual hearing. The brain, which develops rapidly in the first few years of life, needs rich language input during that time". "The speech signal is redundant. Since it carries excess information, it is not necessary to hear every sound to understand a message". Additionally, there is also a great emphasis on speech and speech reading. The ultimate educational goal is to place the child in a mainstream school environment.

Finger spelling:

Another method of communicating manually is to have senders spell the words with their fingers. That is, instead of pencil and paper, speakers spell their message in the air by using various hand shapes to represent the letters in the English alphabet. This mode of communication, finger spelling, represents the 26 letters of the English alphabet by 22 hand shapes and two hand movements. Collectively, these are also referred to as the manual alphabet. The letters i and j are produced by the same hand shape, with the j being produced by moving the hand in a hook or j-like motion. The letter z is made by moving a unique hand shape.

It is a very simple form of MCE for English speaker to learn, and is often the first 'point of contact' for hearing person before learning a sign language. Finger spelling is also used by Deaf people as a part of sign language, for some proper nouns, or when quoting words or short phrases from English.

Exclusive finger spelling is rarely used for extended communication, as it is a very slow method of representing English. It still has currency in some deaf blind settings. Exclusive finger spelling has a place in the history of deaf education; in the US it is known as the Rochester Method. Elderly deaf people in the UK and Australia may also use a lot of finger spelling as a result of their education.



Cued speech:

Cued speech is unique modes of communication among all. It does not use borrowed or invented sign in an attempt to convey English. Instead, cued speech uses eight had shapes, none of which are derived from signed languages, to represent consonant phonemes, and four hand placements around the face to represent vowel phonemes. R. Orin Cornett, who developed cued speech in 1966 at Gallaudet University, sought to combat poor reading skills among deaf college students by providing deaf children with a solid linguistic background. Cued speech must be combined with mouthing, as the hand shape, hand placement, and information on the mouth combine as unique feature bundles to represent phonemic values. Cues are not intended to be understood without mouthing, however, many deaf native cuers are able to decipher the cues alone without the use of the mouth. Similarly, they tend to be able to perform well at deciphering the information on the mouth without the use of the hand. Cued speech has been adapted for language and dialects around the world.

Cued speech is a form of communication that turns the spoken word into a form that is visible and easily understandable. Although it was first used in conjunction with English, it is now familiar to individuals in a number of different countries and has been adapted to a number of languages. Use of cued speech is often in conjunction with other types of communication, and helps differentiate between similar sounds.

Benefits:

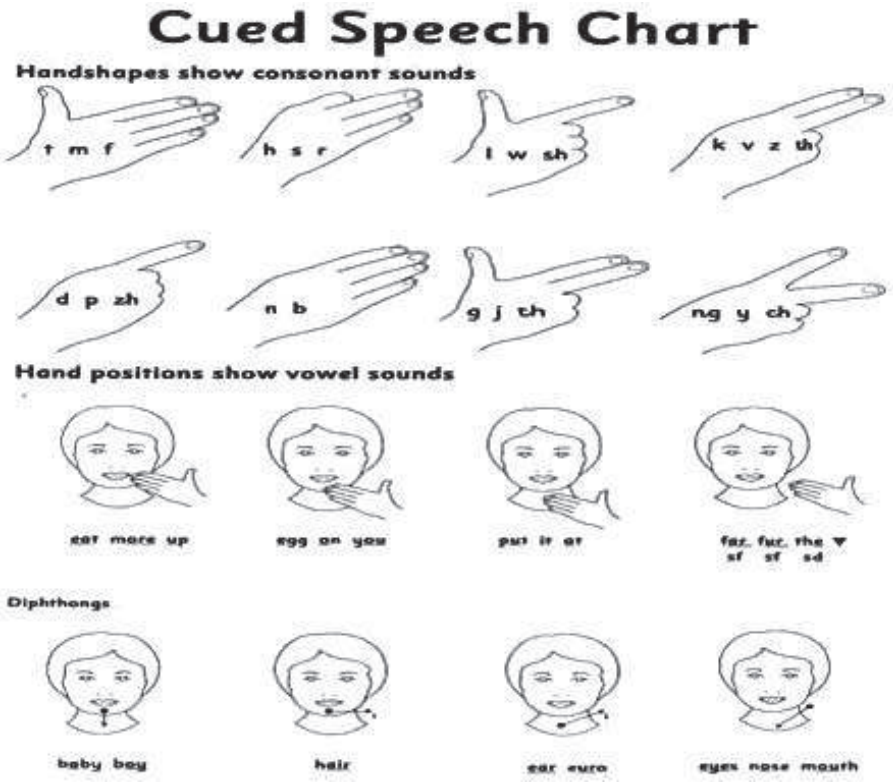
Cued speech has quite a number of benefits. It can be learned in a relatively short period of time. Most parents can learn the system in a weekend. It takes about three to twelve months of consistent cueing to achieve fluency.

Most of the professional respondents felt that both deaf children and their parents would benefit from learning both ASL and cued speech. Professionals and parents expressed concern that parents who do not have a native grasp of ASL will be poor language models for their deaf children. Cued speech buys valuable time for the parents. They can begin the process of learning ASL while literally pouring the language they do know into their children during the critical language learning years.

Cued speech positively affects literacy. “Hearing children become literate because they have a strong language base and an internal understanding of the syntax of spoken language long before they ever see the written word”.

Disadvantages:

Cued speech users confront some frustrations. One of the greatest frustrations is that it is not used as commonly as other methods. Deaf users are dispersed geographically. Many individuals who cue also sign for companionship with other deaf individuals. They find this association to be really important.



Total communication:

Total communication is an educational philosophy. "Total communication can best be defined as elastic, borrowing techniques from a variety of different methods". 110 ideally teachers can use sign, writing, mime, speech, pictures or any other communication method that works. The method of communication should depend upon the needs of the student and the situation. In actual practice, most total communication programs use some form of simultaneous communication. Children are encouraged to work on speech and listening skills. "All children are encouraged to develop skill in all areas, although children are allowed to develop a mode of communication that is best for them."

Benefits:

A benefit of total communication is that it can provide a 'safety net' for children who have difficulty following oral methods by using English that is supported by sign. It also allows the child some form of expressive communication.

Disadvantages:

One of the big disadvantages associated with total communication is that it tends to limit a child's language experience. Children are never exposed to complex English or complex ASL. "Dumbing down" both languages prevent children from attaining fluency in either language.

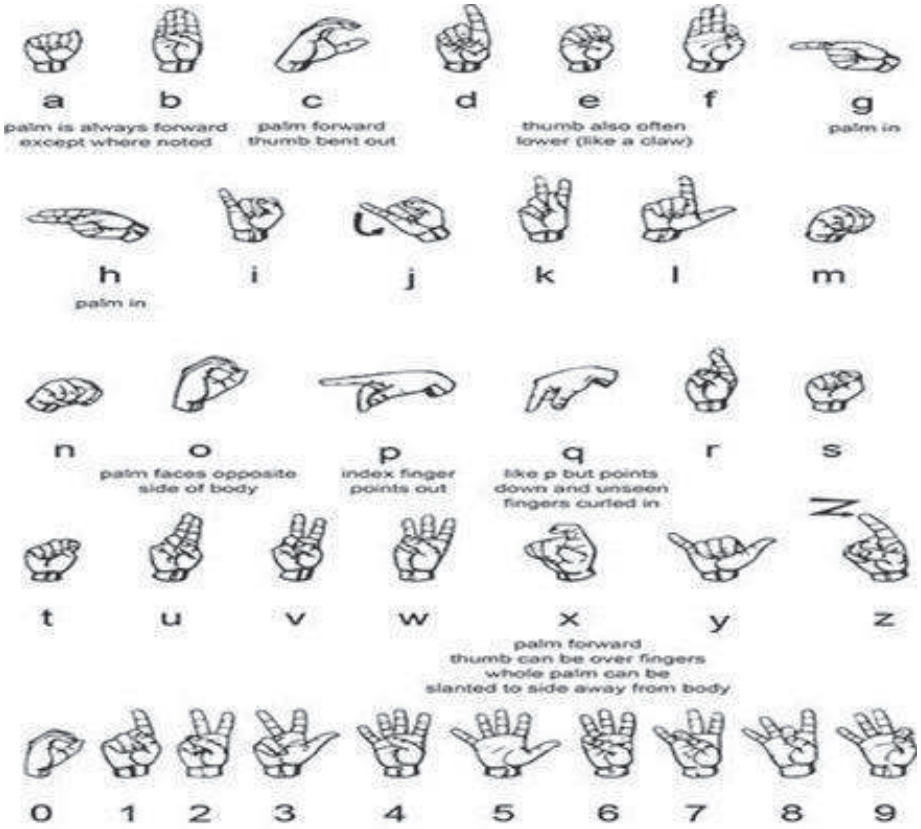
Sign language:

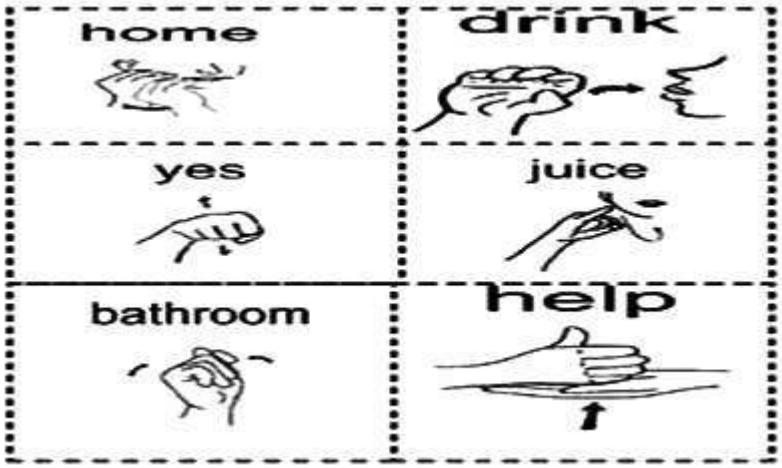
Sign languages are languages that used the visual-manual modality to convey meaning. Sign languages are expressed through manual articulations in combination with non-manual elements. Sign languages are full-fledged natural languages with their own grammar and lexicon. Sign languages are not universal and they are not mutually intelligible with each other, although there are also striking similarities among sign languages.

American Sign Language:

American sign language, also referred to as ASL or Ameslan, was the first form of manual communication established, independent of existing oral languages, by the deaf. Consequently, the original sign language was indeed a unique 'natural' language. Approximately 500000 to 2000000 persons with either hearing loss or normal hearing use this language today (Lane, Hoffmeister (1996). This widespread usage is due, in part, to an increasing number of basic introductory courses in sign language now offered at many universities and in communities. However, the emergence of cochlear implant as a common component of a spoken language intervention with many deaf infants may result in a reduction in this number in the future. Interestingly, some individuals learn ASL mainly via their deaf peers and professionals rather than from their parents. The signs associated with ASL possess four identifying physical characteristics; hand configuration, movement, location, and orientation. In fact, Stokoe (1978) claims that there are 19 basic symbols for hand shapes, 12 basic symbol for locations, and 24 basic symbols for movement. Although these parameters, referred to as cheremes by Stokoe, Casterline and Croneberg (1965), are different from spoken lexical items, they may be

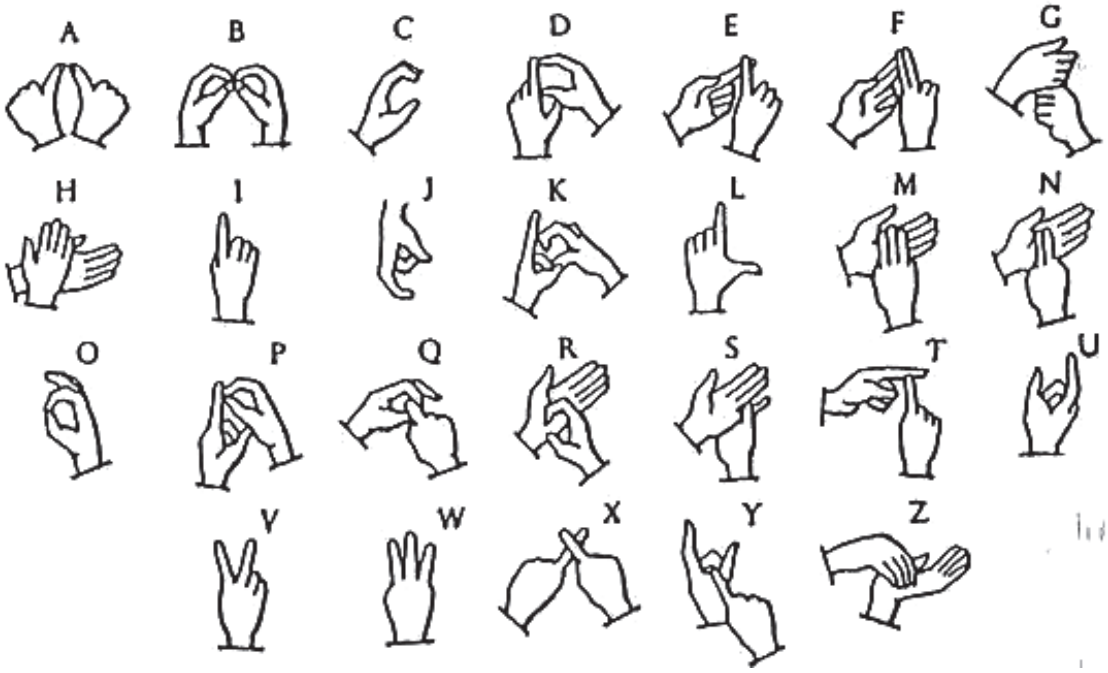
viewed as analogous to the distinctive features of speech. The prosodic features of ASL are provided by facial expressions, head tilts, body movement, and eye gazes (Vernon and Andrews, 1990).





Indian sign language:

Indian sign language is predominant sign language in South Asia. As with many sign languages, it is difficult to estimate numbers with any certainty, as the census of India does not list sign languages and most studies have focused on the north and on urban areas. Deaf schools in the region are overwhelming oralist in their approach. Unlike ASL and sign languages of European countries, ISL is rudimentary stage of its development. The deaf communities of India are still struggling for ISL to gain the status of sign language as a minority language.



1.6 Types of Speech and Language Disorders in Persons with Intellectual Disability (PwID)

Intellectual disability has a detrimental effect on language development and prevalence of speech and language disorders is much higher, with estimates being around 55% (Lesser & Hassip,1986). It is important to note that children with different etiologies of intellectual disabilities have different impairments of speech mechanisms. For example, children with Down syndrome have slower development of prelinguistic vocalizations and impairments in speech pragmatics are one of the main traits in child with autistic spectrum disorders (Tager Flusberg & Sullivan, 1998).

Diagnostic and Statistical Manual 5th Revision (DSM-V) has replaced the older term mental retardation with Intellectual Disability and definitions of ID have changed from being strictly intelligence quotient (IQ)–based to including strengths in adaptive behavior (Schalock, Luckasson, & Shorgren, 2007).

The term intellectual disability is increasingly being used instead of mental retardation because of following reasons:

- Reflects the change construct of disability described by the AAIDD and WHO
- Aligns better with current professionals' practices that focus on functional behavior and contextual factors
- Is less offensive to persons with disability
- Is more consistent with international terminology

1.6.1 Intellectual Disability (aaidd, 2013)

Intellectual disability is a disability characterized by significant limitations in both **intellectual functioning** and in **adaptive behavior**, which covers many everyday social and practical skills. This disability originates **before the age of 18**.

Intellectual Functioning

Intellectual functioning—also called intelligence—refers to general mental capacity, such as learning, reasoning, problem solving, and so on.

One way to measure intellectual functioning is an IQ test. Generally, an IQ test score of around 70 or as high as 75 indicates a limitation in intellectual functioning.

Adaptive Behavior

Adaptive behavior is the collection of conceptual, social, and practical skills that are learned and performed by people in their everyday lives.

- Conceptual skills—language and literacy; money, time, and number concepts; and self-direction.
- Social skills—interpersonal skills, social responsibility, self-esteem, gullibility, naïveté (i.e., wariness), social problem solving, and the ability to follow rules/ obey laws and to avoid being victimized.

- Practical skills—activities of daily living (personal care), occupational skills, healthcare, travel/transportation, schedules/routines, safety, use of money, use of the telephone.

Age of Onset

This condition is one of several developmental disabilities—that is, there is evidence of the disability during the developmental period, which in the US is operational as before the age of 18.

Classification of Intellectual Disability

Two different systems for **classifying intellectual disability** (ID) used in the United States are that of the American Association on Intellectual and Developmental Disabilities (AAIDD) and the *Diagnostic and Statistical Manual of Mental Disorders, 5th Edition* (DSM-5), which is published by the American Psychiatric Association. Both of these systems classify severity of ID according to the levels of support needed to achieve an individual's optimal personal functioning.

Table : Classifications of Intellectual Disability

Severity Category	**Approximate Percent Distribution Cases by Severity**	**DSM-IV Criteria (severity levels were based only on IQ categories)**	**DSM-5 Criteria (severity classified on the basis of daily skills)**	**AAIDD Criteria (severity classified on the basis of intensity of support needed)**	**SSI Listings Criteria (The SSI listings do not specify severity levels, but indicate different standards for meeting or equaling listing level severity.)**
Mild	85%	Approximate IQ range 50–69	Can live independently with minimum	Intermittent levels of support. support needed during transitions or periods of uncertainty.	IQ of 60 through 70 *and* a physical or other mental impairment imposing an additional and significant limitation of function.

Severity Category	**Approximate Percent Distribution Cases by Severity**	**DSM-IV Criteria (severity levels were based only on IQ categories)**	**DSM-5 Criteria (severity classified on the basis of daily skills)**	**AAIDD Criteria (severity classified on the basis of intensity of support needed)**	**SSI Listings Criteria (The SSI listings do not specify severity levels, but indicate different standards for meeting or equaling listing level severity.)**
Moderate	10%	Approximate IQ range 36–49	Independent living may be achieved with moderate levels of support, such as those available in group homes.	Limited support needed in daily situations.	A valid verbal, performance, or full-scale IQ of 59 or less.
Severe	3.5%	Approximate IQ range 20–35	Requires daily assistance with self-care activities and safety supervision.	Extensive support needed for daily activities.	A valid verbal, performance, or full-scale IQ of 59 or less
Profound	1.5%	IQ <20	Requires 24-hour care.	Pervasive support needed for every aspect of daily routines.	A valid verbal, performance, or full-scale IQ of 59 or less.

Incidence & prevalence -Approximately 70% of individuals with severe intellectual disability and 50% of individuals with mild intellectual disability have an organic or biological basis for their disorder (McLaren & Bryson, 1987). Estimates of intellectual disability range between 1-3%, with male to female ratio of 6:1(Marrus & Hall 2017).

Etiology-Causes of ID include genetic abnormalities (Down's syndrome, Fragile X syndrome) as well as pre-natal(PKU, rubella, fetal alcohol syndrome), peri-natal (prematurity, anoxia) and postnatal environmental factors (Meningitis, lead poisoning,

malnutrition). Suspicion of ID can arise during infancy, although children under 5 years of age are typically diagnosed with global developmental delay, which requires delays in 2 or more functional domains and shows some correlation with ID

Speech and language characteristics

Speech and Language People with intellectual disabilities may have delayed speech, language comprehension and formulation difficulties. Language problems are generally associated with delays in language development rather than with a use of language (Beirne-Smith et al., 2006; Moore-Brown & Montgomery, 2006). People with intellectual disabilities may show delayed functioning on pragmatic aspects of language, such as turn taking, selecting acceptable topics for conversation, knowing when to speak knowing when to be silent, and similar contextual skills (Haring, McCormick, & Haring, 1994; Yoder, Retish, & Wade, 1996).

Frequency of language disorder is about 100% below IQ 20 around 90% between IQ 21-50 and 45% in mildly retarded group.

Cause of delay

Cognitive deficit / problem in processing skills and poorly stimulating environments are the main cause of difficulty/ delay in speech and language development (Rao & Srinivas, 1989).

Speech and language defects can be classified into 4 groups

- Language Disorder
- Articulation Disorder
- Voice Disorder
- Fluency Disorder

Language Disorder

Language delays are seen in both aspect of comprehension and expression. No children with ID have same problem. Some of common problem are as follows-

Problem in Expression

No development of Phonological system – About 40% ID children are non-verbal, some learn to use basic gestures for food, toileting& for other basic needs and the number and variety of gestures used are also limited.

Problem in syntactic aspect of language

Verbal IDs mostly uses one-wordresponse as they generally fail to combine words into sentences and when the sentence is used, they resemble as telegraphic message.

Semantic Difficulty

Children with ID mostly present with echolalia as they repeat question instead of replying. They also have problem in asking questions using negatives & complex sentences, they fail to describe actions, need, asking for information, telling lies & jokes so on.

Problem in pragmatic aspect

Children with ID shows severe problem in learning how to participate in a conversation with others in spite of knowing what to speak.

Problem in Comprehension

IDs have limited knowledge of objects, persons and actions in their environment So, they have difficulty in understanding others speech except for routinely used commands &actions. They also have difficulty in comprehending questions and series of commands. Comprehending abstract or imaginative vocabulary such as for space, love and affection is generally poor.

Difficulty in understanding indirect questions, quiz, riddles, jokes, and humor are common in ID. Multistep instructions and commands may be difficult for ID to comply with.

Articulation disorder

There are two kinds of problem with phonology part of language. First phonemes are inconsistently produced second phonemes are not acquired at all. Some ID children speak in sentences and phrases but they may be unintelligible due to defective articulation. The type of misarticulation mainly present as distortions of target phonemes simplification of consonant cluster, omission of final consonant and substitution of another phoneme with target phoneme. Many IDs show problem in using appropriate suprasegmental features resulting in monotonous and unintelligible speech.

Voice Disorder

The common voice problem is feeble or weak voice. voice problems including hoarse voice, pitch breaks and monotonous voice causes difficulty in speech clarity.

Fluency Disorder

Speech intelligibility also affected in ID due to defect in fluency or rhythm and speech is characterized by hesitations, pauses, repetitions. so, as a result speech become dysfluent.

Other problems

Some ID children have problem of ear infections, sensory deafness, poor listening skills. They are also poor in their reading and writing skills but it is dependent upon language development.

Co-occurring Conditions and Disorders

Individuals with ID are a heterogeneous group, and communication skills can vary due to factors such as severity, co-occurring conditions, and other behavioral, emotional, and social factors.

Conditions that either commonly co-occurs with ID include ASD, cerebral palsy, Developmental Delay Down syndrome, fetal alcohol syndrome, and Fragile X syndrome. Other conditions that may also co-occur with ID include anxiety disorder, attention-deficit/hyperactivity disorder, depressive and bipolar disorder, impulse-control disorder, and major depressive disorder (APA, 2013).

1.6.2 Developmental Delay:

ID is a subset of developmental disability (DD). DD is defined as follows:

Developmental Delay is when a child does not reach their developmental milestones at the expected times.Delay can occur in one or many areas—for example, gross or fine motor, language, social, or thinking skills.It can be severe, chronic disability in an individual 5 years of age or older.

Results in substantial functional limitations in three or more areas of life activity (self-care, receptive and expressive language, learning, mobility, self-direction, capacity for independent learning, economic self-sufficiency (Developmental Disabilities Assistance and Bill of Rights Act, 2000).

Speech and language Disorder associated Developmental delay

- Delayed receptive and expressive language commonly co-occurs, and difficulties with comprehension are present in children with DD.
- Delayed speech and language skills, particularly syntax, with relative strengths in vocabulary and language comprehension (Roberts, Chapman, & Warren, 2008).
- Difficulties with articulation, fluency, and oral motor skills (Roberts, Hennon, & Anderson, 2003); prolonged unintelligible speech, particularly in connected speech (Paul, Cohen, Breg, Watson, & Herman, 1984).

1.6.3 Down Syndrome

Down syndrome or Down's syndrome, also known as trisomy 21, is a genetic disorder caused by the presence of all or part of a third copy of chromosome 21.

It is typically associated with a delay in cognitive ability (mental retardation) and physical growth, and a particular set of facial characteristics.Genetic syndrome associated with intellectual impairment, limitations in adaptive skills, and anatomical differences in tongue size (relative macro-glossia).

Speech and language Disorder associated with Down's Syndrome

- Language comprehension is better than production, particularly syntax (Roberts, Price, & Malkin, 2007).
- Problem with speech intelligibility, which may result from disturbances in voice(hoarse voice), articulation, resonance, fluency, or prosody (Kent &Vorperian, 2013).
- Stuttering is more prevalent (Kumin, 2012).
- Persistent otitis mediaand conductive hearing loss are common (Shott, 2006).
- Morphosyntax is more difficult than semantics (Fidler, Most, &Philofsky, 2009), with variability in vocabulary development (Kumin, Council, & Goodman, 1999).
- Strengths are present in social and pragmatic skills; however; individual has difficulty with more complex pragmatic skills (e.g., figurative and abstract language, conversation and narrative discourse, and metalinguistics [Kumin, 2010])

1.6.4 Cerebral Palsy

Cerebral Palsy (CP) is a group of permanent disorder of the development of movement and posture, causing activitylimitation. It is a motor disorder, the conditioninvolves disturbances of sensation, perception,communication, cognition and behavior, secondarymusculoskeletal problems and epilepsy.It may affect speech, language, and swallowing. Variable difficulties, depending on the area of the brain affected and the severity.

Speech and language Disorder associated with Cerebral palsy

- Increased risk for language disorders (Pennington, Goldbart, & Marshall, 2005; Richardson & Kertoy, 2006).
- May have hearing loss (Rosenbaum & Rosenbloom, 2012).
- Dysarthria is the most common speech disorder (McNeil, 2009)
- May have childhood apraxia of speech.
- Feeding and swallowing may be compromised (Sullivan, 2009).

1.6.5 Autism Spectrum Disorder

Autism Spectrum Disorder is neurologicallybased heterogeneous disorder with the core features of impairment of social communication, impairment of language, and presence of restricted, repetitive behaviors, which are present in early childhood.

Speech and language Disorder present in ASD

- Social communication impairment (e.g., joint attention, social reciprocity, nonverbal and verbal language skills, social interaction, initiation of conversation; APA, 2013).
- Restricted and repetitive use of language (e.g., echolalia, perseveration; APA, 2013).
- Delay or absence of verbal communication (Anderson et al., 2007).
- Difficulty with abstract language (Tager-Flusberg&Caronna, 2007).
- Difficulty with narrative discourse (Tager-Flusberg, 1995).
- May have a speech sound disorder (Shriberg, Paul, Black, & van Santen, 2011)

- May have feeding problems (Twachtman-Reilly, Amaral, & Zebrowski, 2008)

1.7 Enhancement and Integration of speech and language into classroom context

Audiologist and Speech Language pathologists constitute professionals who play primary habilitative and rehabilitative role for children and adults with communication disorders who often work in multidisciplinary settings hospitals, nursing homes, community clinics, rehabilitation centers, private practice and school system like with various other professionals such as physicians, neurologists, ENTs, dentists, surgeon, physical therapists, occupational therapists, special educators, classroom teachers etc. As per recent surveys (ASHA,2003) about 56% speech-language pathologists work in school settings, 35% are employed in healthcare facilities such as hospitals and other residential facilities and remaining 10% in private practice or university setting.

The classroom serves as a communication channel for listening and learning. Unfortunately, the typical classroom can provide a hostile listening and learning environment for both teachers and students. Sound-ûeld ampliûcation is an educational tool that allows control of the acoustic environment in a classroom.

Educational problems of children with disabilities

In education for children with disabilities, schools, teachers, parents and the children themselves face several problems which need to be resolved for successful rehabilitation.

Major problems faced by children with disabilities includes:-

- Difficulty in understanding the environment in school.
- Difficulty in communication which will cause many problems in the educational setup such as acquisition and learning lessons, socialization with friends and other in school, transferring the school experience in home and home experience in school.
- Wrong labeling as hyperactive and disobedient. The child shows behavioral problems like spitting other. The individuals suffer from low self-esteem and low self-confidence.
- Heterogeneity in classroom. Heterogeneous in case of adaptive, language skill, hearing ability, intelligence.

- Non-availability of special schools in towns, villages.

Major problems faced by the parents: -

- Lack of awareness on early identification and early intervention. Most of parents are not educated, for this reason they are not aware about the primitive rehabilitative services like early identification and early intervention. They are not aware of the impact disability in speech and language development.
- Rural-Urban imbalance on educational services. Children in rural areas will find it difficult to maintain therapy.
- Non-involvement of parents in educational services.
- Financial constraintsfaced by the parents.

Major problems faced by the special educators: -

- Non-availability of educational facilities and supportive services.
- Faces heterogeneous native of children in classroom.
- Lack of parental support and at time over support.
- Difficulty in imparting the existing curriculum.

Major problems faced by Resource teachers:-

Resource teachers are one of the important team members in educational rehabilitation process of the disabled students. They provide extra special input for the ID students along with other educational help in the school setup. They also look after the care and maintenance of different devices such as hearing aids, assistive devices, wheel chairs etc. They also meet the parents of the disabled children at regulation intervals for counseling and guidance while discussing about the educational problem, it is worthwhile to mention the problems faced by the resource teachers as well.

- Lack of expertise: -
- The resource teachers tough needed to be expert in the field are actually found to be as par to the layman/not experts all.
- Lack of resource room and other facilities.
- Lack of co-operation from parents and other professional:-

Often the resource teachers need to discuss the educational problem of the child in a specific educational setup and that reason the parents are called for. In many cases the parents don't turn up. There is a lack of co-operation the other professionals too.

Problems faced by teachers in regular class: -

The teachers can't pay individual attention since in a regular class, there may be more than 30 students or may be 60. There is a large number of students in class room hence providing extra attention to the disabled child i.e. impossible. The regular teacher faces a problem that there is a

i) Lack of disability specific infrastructure facility.

ii) Teacher of regular school face difficulty in communication.

iii) Difficulty in impacting the existing curriculum (difficulty in completing syllabus)

Problems faced by special schools: -

A special school is special because

i) Children with special need are provided with educational services.

ii) It's special because the teacher : student = 1:10 for HI and blind; 1 : 6 for MR and multiple disability.

It's special because the building is special. The building is located in an isolated place. The structure of building is special. The infrastructure of building is special in terms of accessibility, special in terms of acoustics for HI, special in terms of lighting arrangement.

iii) Its teachers are special because they are specially trained to do the work.

iv) Its special because it has special team of experts serving for rehabilitation in case of disabled children, the team are

- Speech and language pathologist
- Audiologist (educational audiologist)
- Couple of special educators
- Technicians (Hearing aid technicians, ear mold technicians)

- Rehabilitation/educational psychologist
- Physical instructors/special personality
- Vocational counselors and vocational instructor

Problem of individual with ID:-

Bilingualism and Multilingualism

To develop speech and language in a poor cognitive ability, speech and language acquisition becomes a challenging job normally in Indian cities' children are exposed to more than 1 language. Because of the less IQ condition acquisition of 2nd and 3rd language becomes next to impossible/difficult.

Central board for secondary education (CBSE) and Tamil Nadu board of secondary education, Maharastra Board of secondary education have exampled 2nd and 3rd language for individual having poor IQ, studying in respected school considering the fact that acquisition of 2nd language is difference exemption of this is required.

Other problems: -

i) Resource and infrastructure

ii) Social structure

iii) Geographical condition and communication facilities

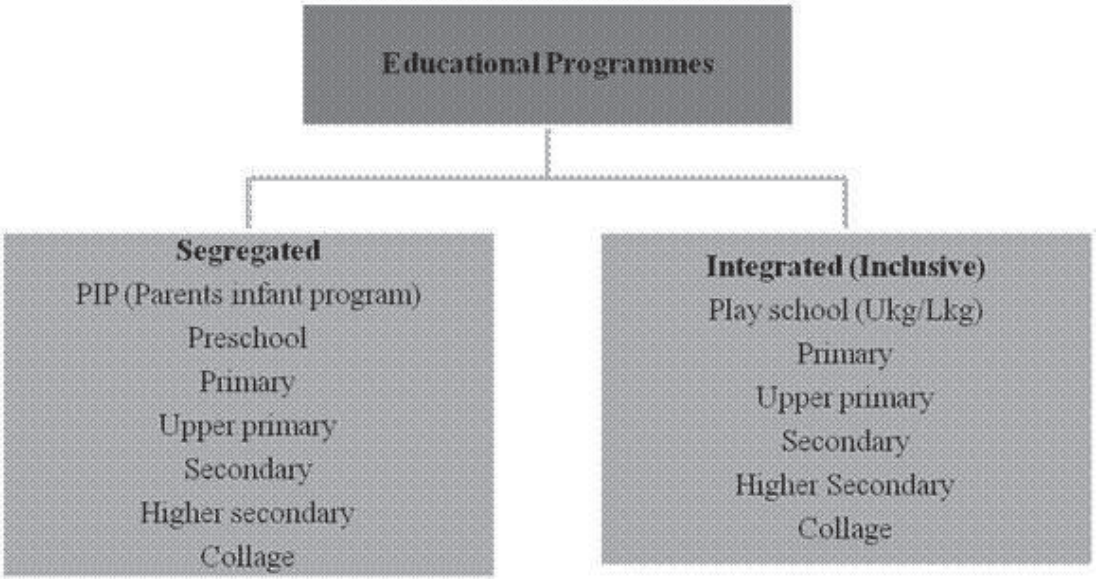
iv) Literacy, awareness and attitude of community

Language in the classroom:

In every classroom, communication is the name of the game. Teachers and students transfer information back and forth all day long, either effectively or ineffectively primarily through formal language.

Language Arts: The typical language arts curriculum too often addresses the "science" of language rather than its "art". To have a truly complete language arts program, the curriculum must incorporate all three components of language (content, form, and use) in all four modalities (listening, speaking, reading and writing). Language arts also need to include instruction focusing on aesthetic purposes, for the sheer "joy" of using language.

Educational placement:



Factors for recommending the various educational placements:

- Amount of the Problem.
- Teacher taught ratio: Inclusive education is highly recommended in a regular setup when there are less than 30 children in a classroom.
- Training and orientation of the regular school teachers: In a school where the teaching staff is aware of the problems encountered by the child is a better place for inclusive education than an institution where the teacher have not knowledge regarding the cognition and communication problems of the ID children. The NPE where the inclusive education is emphasized indication that the regular school teachers where the ID children are studying need to be trained in short-term bases by the national institutes.

Early intervention & early identification leads to acquisition of good oral communication skill and therefore the child with ID can successfully be integrated when there is provision for early identification & early identification.

- Attitudes of the teacher of the school.
- Intelligence of the child.
- Language skills.
- Estimate of parental participation in the rehabilitation program.

In infancy parents are the first teacher. Parents play an important role in development in all stages.

Various attitudes of the parents towards child-

- Over protective parents
- Neglect the child
- Leave the job for professionals

Language of Instruction:

Language is a part of the classroom in all subject areas used to increase child's exposure to new information and vocabulary.

- ✓ Language is the teacher's most valuable tool used to help students to organize experiences, to develop a knowledge base and to express their unique personalities.
- ✓ Language can motivate through reinforcement, or it can alienate through sarcasm.
- ✓ Language can explain and enlighten, or it can confuse and muddle.

Language Problems:

Language differences or problems arise from a variety of sources are manifested in varying patterns and degrees of severity, and require varied strategies for accommodation. The student who does not develop as per normal speech language milestone-

- ➢ May have different but not necessarily abnormal language development.
- ➢ May be delayed in language acquisition.
- ➢ May demonstrate severe language disorders.

Overt language problems in infants may become covert or more subtle as they get older. Unrecognized early language problems may later show up in listening, speaking, reading, and writing. If these are not acknowledged and addressed the student may be at risk of developing long-term educational or social handicaps.

Language-Based Classroom Problems:

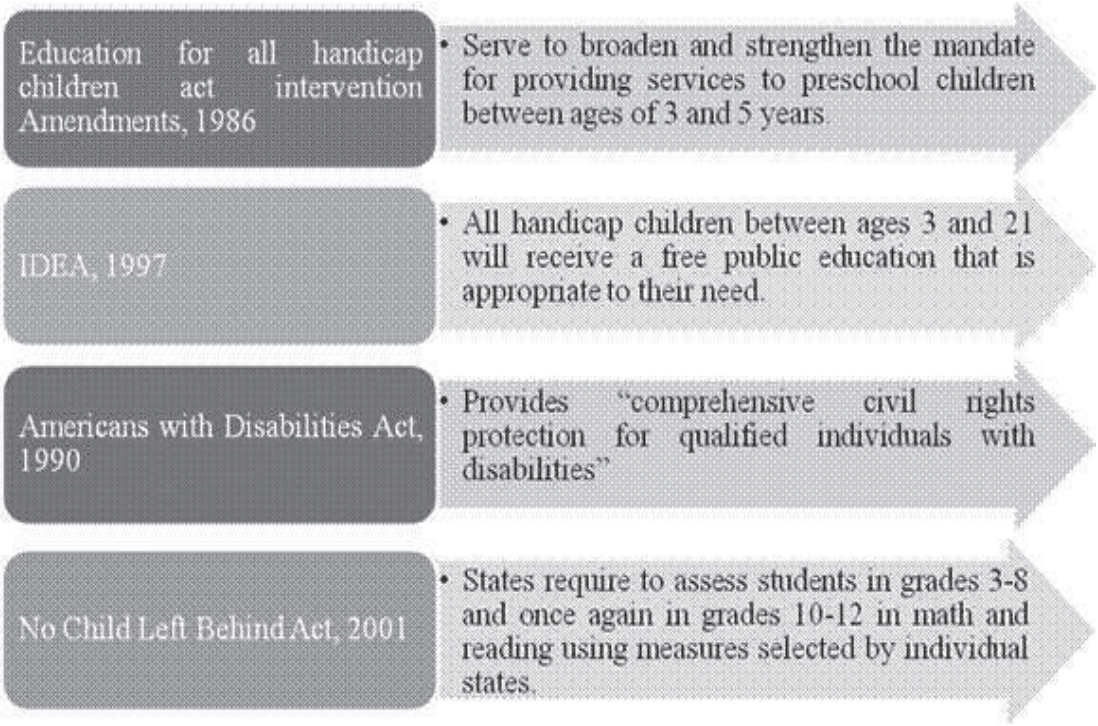
Language deviations affect both academic and social development of students representing extreme end of the continuum with regard to a negative impact on their success.

Public Laws for students with communication disorders:

State and local education agencies must follow federal mandates to provide the disables with appropriate and free education.

Several public laws:

- PL 94-142: Education for all handicap children Act includes the Individuals with Disabilities Act (IDEA).
- Section 504 of the Rehabilitation Act.
- Pl 99-457: Education for all handicap children Act Early Intervention Amendments of 1986.
- Americans with Disabilities Act, 1990.



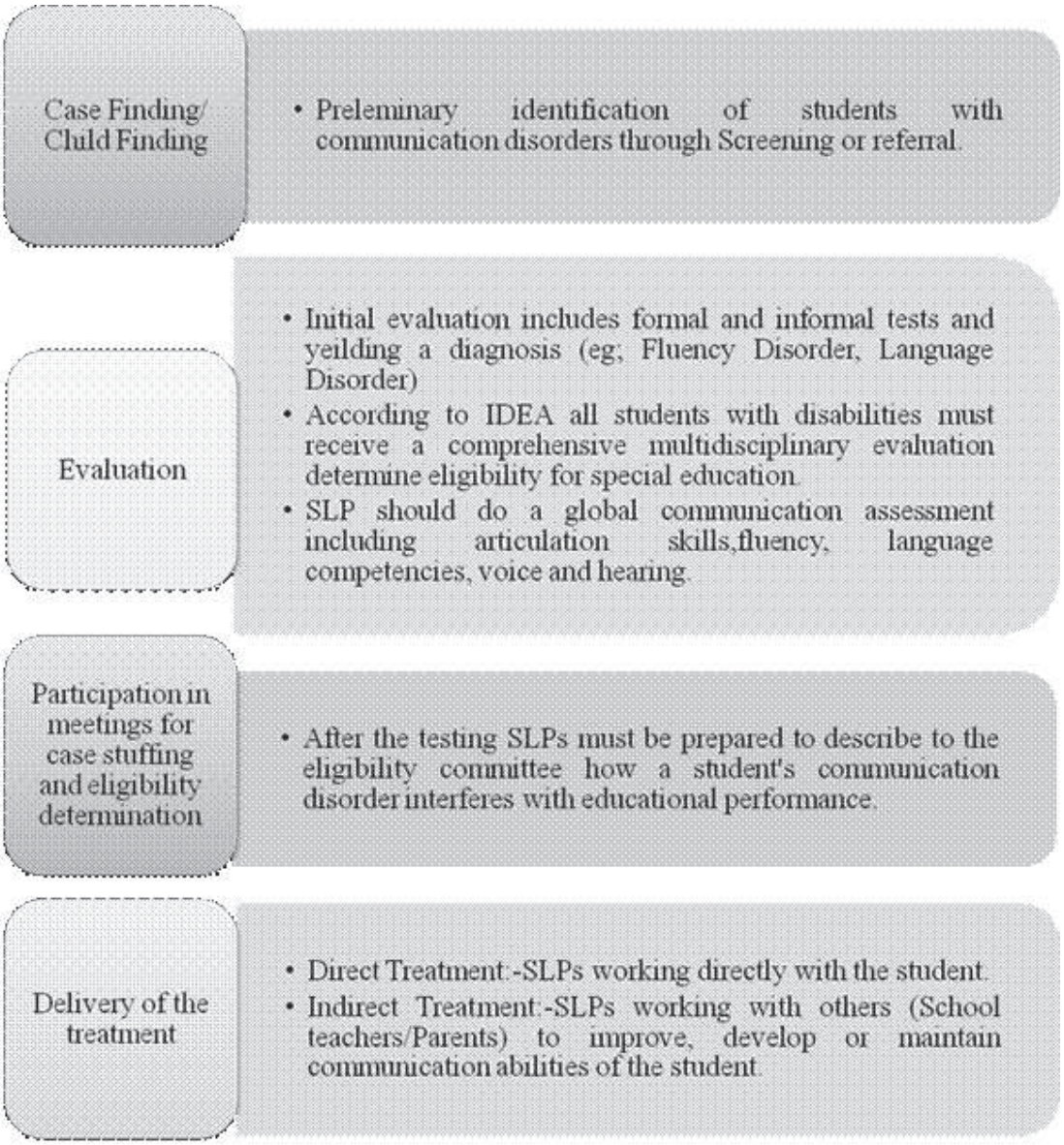
The Role of SLPs in school system:

Public school SLPs hold interesting and unique positions within the school system hierarchy.

- Under the Special Education Director in large school systems, that employ 10 or more SLPs, usually one will be designated as speech pathology coordinator who would manage speech pathology stuff and services throughout the school system.

- In small school system, a senior SLP may be designated for leadership purposes, but usually all SLPs report directly to the special education coordinator who would then be responsible for the speech pathology program as well as other special education services.

Specific Responsibilities for providing services to the communication disordered students:



Teacher Accommodation:

- Teachers are provided with a series of checklist to identify the strengths and weakness of the students and with suggestions to accommodate individual in the classroom acoustics.
- Teachers may also refer to the SLPs.
- Teacher may gather valuable information to use for criterion-referenced measures, academic programming, ongoing assessment, goals and objectives.

Four informal teacher checklists and sections include:-

- ✓ Listening comprehension
- ✓ Oral expression
- ✓ Reading Comprehension
- ✓ Writing Expression

Team Models:

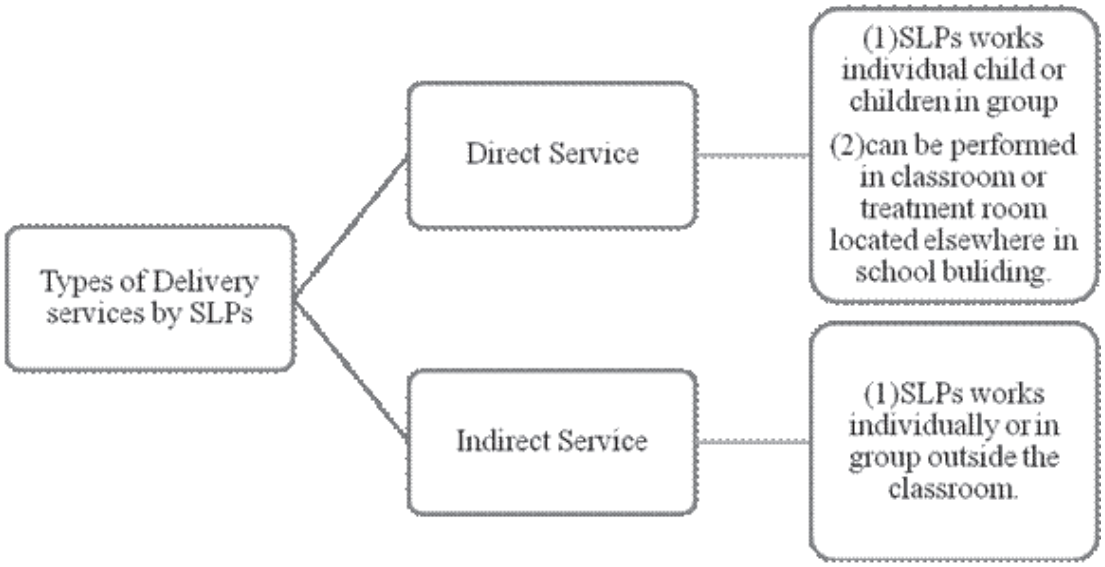
Intervention assistance teams (IAT) differs from building to building. Many school employ a core team concept comprise of those persons participating on all cases such as principal. The size of IAT depends on team composition. When a team receives a referral, it is imperative that the team include a language expert, or a SLP.

Service Delivery Models:

A team effort is required to provide treatment for child with communication disorder. More severe the case more team member will get involved. Public Law 94-142 and Rules state that to be eligible for services, a speech/language handicapped student must have a significant deviation from the developmental norm. It signifies that the SLPs. Intervention assistance teams and individualized education program teams must consider the student's level of educational functioning and decide best model that affords student for success from a continuum of delivery models. At the same time SLPs are charged providing preventive services to the overall student population.

Three models of Team Approach:

MULTIDISCIPLINARY MODEL	TRANSDISCIPLINARY MODEL	INTERDISCIPLINARY MODEL
• Less corporation among team members in terms of planning services. • Less communication among team members. • Child "fractionalizing": child is taken out for speech, for work on a learning problem etc.	• More group coordination in planning and implementation. •More communication goals exists. •Other team members worked with classroom teacher. •Accomplishment of educational objective without constantly removing the child.	• Maintains independence of each discipline in terms of evaluation and treatment sessions. • Makes several set of goals and short term objectives.



Direct services:

- ❖ SLP can work with children in a barrier free environment which helps in establishing many communication behaviors.
- ❖ Certain therapy approaches involving drills or specialized equipment can be more easily implemented outside the classroom.

- ❖ SLPs can help teacher by assisting with classroom activities, giving them a communication slant that is beneficial to all members.
- ❖ Direct services in the classroom assist in the generalization of the goals gained in a therapy room into natural environment.

Indirect services: A consultative or collaborative approach:

SLPs use a variety of assessment-treatment models to deal with both children and adult with communication disorder (Damico, 1987; Superior & Mayers, 1983). A critical component of the integrated therapy is consultation or communication between adults about a child with whom they work. There are two types of Consultative style: Expert and collaborative. In Expert style the specialist independently (1) assess child's needs (2) recommends strategies or solutions (3) evaluates prognosis.

The collaborative model involves specials, teachers and family identifying needs, developing solutions and evaluating progress together.

Myths surrounding the consultative and collaborative method:

- ❖ Individual therapy services are always better than services delivered in the context of classroom or home environment.
- ❖ Certain problems are best dealt with by specific professional who has expertise in definite areas.
- ❖ Professional collaborative system has a territory which must be protected from others.
- ❖ People who advocate are just trying to get out things they want.

Intervention assistance teams (IAT):

Guidelines for Intervention Assistance teams define IATs as "school-based problem-solving groups whose purpose is to assist teachers with intervention strategies for dealing with the learning needs and interests of pupils".

The SLP participate as a member of a team of professional on IAT. IAT include SLP, regular or special educator, principal, classroom teachers, and other service professionals. As part of the team provide information to other team members regarding the sequential steps of language development and the impact of language with the curriculum and other services.

Implementation example:

IAT review information gathered about a student's performance. There SLP helps the team to make further recommendations regarding intervention.

Advantages:

SLPs provide information about language development and intervention strategies to other members so their knowledge impact greater number of students.

SLPs have the opportunity to educate and collaborate with other school personnel.

Collaboration:

The SLP collaborates with the teacher and/or parents regarding a specific student, group, or class of students.

Implementation Example:

- Demonstrate specific remediation techniques that the Team uses to assist the student in carrying over language skills to everyday life.
- Provide "language packets" that includes pictures, word list etc., for parents and other volunteers to use with preschool, kindergarten or high risk students.
- Provides language/ speech enrichment sessions in classroom.

Advantages:

- SLPs can influence their expertise on greater number of students.
- All students can benefit from this model regardless of any category.
- SLPs share techniques with other members.
- A strong language orientation can be established and incorporated into the curriculum.

Pull-out intervention:

The SLPs remove the student from the classroom to provide direct therapy in a separate room. This is a primary model used by SLPs to deliver service in a school setting. Pull-Out intervention aimed at an individual student or groups of student grouping them as per criterion age, grade level, type etc.

Implementation Examples:

- v Traditional Scheduling-
- ❖ It provides direct service for an average of twice per week to an individual or groups of student.
- ❖ Group size may average from 2 to 4 students but may include up to 10 students.
- ❖ The number of sessions per week, length, number of students, per session are influenced by the nature and degree of student's problem and SLP's caseload demands.
- v Block Scheduling
- ❖ It involves servicing a particular site for a concentrated period of time, averaging 5 to 10 and scheduling students 3 to 5 times per week.
- ❖ The block is then alternated with a time block at another school.
- ❖ A minimum of two cycles per year is scheduled at each school.

Advantages:

- ❖ Individualized Direct therapy is given.
- ❖ Accommodation of group language interaction.
- ❖ It also accommodates articulation, fluency and voice disorder, especially in the early stages of remediation.

CLASSROOM-BASED INTERVENTION:

The SLPs provide direct therapy in the classroom setting to one or more students and uses the team approach with classroom teachers. The SLPs conduct classroom activities and the teacher team up with pathologist to work with the students. The SLPs conduct individual assessment, may provide materials and ideas to the teacher about classroom activities and interaction styles.

Implementation Examples:

- v Small Group (Regular or Special Education)
- ❖ The SLPs provide services to the language disordered students through a weekly group activity lesson in the classroom which addresses student's specific language needs and links language development with the academic or vocational curriculum.

- ❖ The teacher observes the lesson and attempts to reinforce the targeted concept/ skill during daily classroom activities and interactions.

v Special Education:

- ❖ Orthopedically Handicapped- the SLP and an interdisciplinary team of professional may serve an orthopedically disabled student who is learning to use an augmentative communication device by combining collaboration, Pull out intervention and classroom-based intervention.
- ❖ Multiple handicapped Class/ Developmentally Handicapped Class- The SLP, teacher, and support staff determine the communicative skills necessary for the student to function independently. Objectives, vocabulary exercises, and developmental activities are planned and implemented in the classroom.
- ❖ Developmentally Handicapped Secondary Units- The focus is on the development of pragmatic communication skills that would impact the student's future vocational and social abilities. The SLP and teacher work as a team.

v Junior or Senior High School for Credit

- ❖ The course might be titled "Communication Skills". During the class period, the SLP services students whose language learning/ remediation needs would benefit from this type of scheduling. Content include vocabulary development, problem-solving techniques, listening skills, conversational speech, non-verbal communication skills, study skills related to language and pragmatic language.

Advantages:

- ➢ Greater number of students can be served.
- ➢ Service is provided in a more natural environment.
- ➢ Non language handicapped students also may benefit.
- ➢ Language Skills are incorporated into the academic curriculum.
- ➢ Enhanced opportunity exists for generalization and carryover of language skills into everyday life.

Counseling is an ongoing process which is needed in every step of rehabilitation. Starting from prevention till the individual is vocationally placed. Every step of counseling has its own implication and various techniques for counseling.

1.8 Let us sum up

1.9 Unit end exercises

1.10 References

Achenbach, T. M., & Edelbrock, C. S. (1981). Behavioral problems and competencies reported by parents of normal and disturbed children aged four through sixteen. *Monographs of the Society for Research in Child Development*, 46.

Schalock, R. L., Borthwick-Duffy, S. A., Bradley, V. J., Buntinx, W. H., Coulter, D. L., Craig, E. M., ... & Shogren, K. A. (2010). *Intellectual disability: Definition, classification, and systems of supports*. American Association on Intellectual and Developmental Disabilities. 444 North Capitol Street NW Suite 846, Washington, DC 20001.

American Association on Mental Retardation (Ed.). (2002). *Mental retardation: Definition, classification, and systems of supports*. Amer Assn on Intellectual & Devel.

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders (DSM-5®)*. American Psychiatric Pub.

Bernie-Smith, M., Ittenbach, R. F., & Patton, J. R. (2002). Mental retardation (6th ed.). Upper Saddle River, NJ: Merrill.

Bernie-Smith, M., Patton, J. R., & Kim, S. (2006). Mental retardation (7th ed.). Upper Saddle River, NJ: Pearson Education.

Brickell, C., & Munir, K. (2008). Grief and its complications in individuals with intellectual disability. *Harvard Review of Psychiatry*, *16*(1), 1-12.

Browder, D. M., Wakeman, S. Y., Spooner, F., Ahlgrim-Delzell, L., & Algozzinexya, B. (2006). Research on reading instruction for individuals with significant cognitive disabilities. *Exceptional children*, *72*(4), 392-408.

Department of Health. (2001). Valuing people: a new strategy for learning disability for the 21st century.

Ditchman, N., Werner, S., Kosyluk, K., Jones, N., Elg, B., & Corrigan, P. W. (2013). Stigma and intellectual disability: Potential application of mental illness research. *Rehabilitation Psychology*, *58*(2), 206.

Drew, C., & Hardman, M. (2007). Mental retardation: A life cycle approach (9th ed.). Upper Saddle River, NJ: Pearson Education.

Erez, G., & Peled, I. (2001). Cognition and metacognition: Evidence of higher thinking in problem-solving of adolescents with mental retardation. *Education and Training in Mental Retardation and Developmental Disabilities*, 83-93.

Fletcher, K. L., Huffman, L. F., & Bray, N. W. (2003). Effects of verbal and physical prompts on external strategy use in children with and without mild mental retardation. *American journal on mental retardation*, *108*(4), 245-256.

Gargiulo, R. M. (2009). Special Education in Contemporary Society (3rd ed.). Thousand Oaks, CA: Sage.

Hallahan, D. P., & Kauffman, J. M. (2006). Exceptional learners: Introduction to special education (10th ed.). Boston:

Ohio Statewide Language Task Force, & Ohio. Division of Special Education. (1991). *Ohio handbook for the identification, evaluation, and placement of children with language problems*. Ohio Department of Education.

Nerbonne, M. A., & Show, R. L. (2002). *Introduction to audiologic rehabilitation*. Boston: Allyn and Bacon.

Asher, J. J., & García, R. (1969). The optimal age to learn a foreign language. *The Modern Language Journal*, *53*(5), 334-341.

Basser, L. S. (1962). Hemiplegia of early onset and the faculty of speech with special reference to the effects of hemispherectomy. *Brain*, *85*(3), 427-460.

Bench, R. J. (1971). The rise and demise of the critical period concept. *British Journal of Audiology*, *5*(1), 21-23.

Burstall, C. (1975). French in the Primary School: The British Experiment. *Canadian Modern Language Review*, *31*(5), 388-402.

Curtiss, S. (1977). Genie: A psycholinguistic study of a modern day 'wild child'. New York: Academic press.

Lieberman, P. (1984). The biology and evolution of language. Cambridge, MA: Harvard University Press.

LaSasso, C. J., Crain, K. L., & Leybaert, J. (2010). *Cued Speech and cued language development for deaf and hard of hearing children*. Plural Publishing.

Chute, P. M., & Lucas, C. (2002). *Turn-taking, fingerspelling and contact in signed languages* (Vol. 8). Gallaudet University Press.

Reagan, T. (2003). LINGUISTICS OF AMERICAN SIGN LANGUAGE: AN INTRODUCTION . Clayton Valli and Ceil Lucas. Washington, DC: Gallaudet University Press, 2001. Pp. xvi+ 493. *Studies in Second Language Acquisition*, *25*(1), 157-158.

Tompkins, P. K., & Anderson, E. V. B. (2015). *Communication Crisis at Kent State: A Case Study*. Routledge.

McKnight, J. C. (1984). Total Communication: A Signed Speech Program for Nonverbal Children. *American Annals of the Deaf*, *129*(3), 300-301.

Unit - 2 ❑ Physiotherapy

Structure

2.1 Introduction

2.2 Objectives

2.1 Physiotherapy

Physiotherapy involves the holistic approach to the prevention, diagnosis and therapeutic management of pain, disorders of movement or optimisation of function to enhance the health and welfare of the community from an individual or population perspective. Physiotherapy help people at any stage of life, when movement and function are threatened by ageing, injury, pain, diseases, disorders, conditions or environmental factors. An integral part of physiotherapy is interaction with the patient/client/family or caregiver to develop a mutual understanding of their needs. This kind of interaction is necessary to change positively the body awareness and movement behaviours that may promote health and wellbeing.

Physiotherapists work within a wide variety of health settings to improve a broad range of physical problems associated with different systems of the body. In particular they treat neuromuscular (brain and nervous system), musculoskeletal (soft tissues, joints & bones), cardiovascular and respiratory systems.

2.3.1 Definition:

Physiotherapy is a health care profession concerned with human function and movement and maximising physical potential. It is concerned with identifying and maximising quality of life and movement potential within the spheres of promotion, prevention, treatment/intervention, habilitation and rehabilitation by using physical agents, activities & devices including exercise, mobilization, manipulations, electrical & thermal agents and other electro therapeutics. It uses physical approaches to promote, maintain and restore physical, psychological and social well-being, taking into account variations in health status.

As per the World Health Organization (WHO); Physiotherapists assess, plan and implement rehabilitative programs that improve or restore human motor functions, maximize movement ability, relieve pain syndromes, and treat or prevent physical challenges associated with injuries, diseases and other impairments. They apply a broad range of physical therapies and techniques such as movement, ultrasound, heating, laser and other techniques. They may develop and implement programmes for screening and prevention of common physical ailments and disorders.

2.3.2 : Objective of this Chapter

- To understand about Physiotherapy, it's scope & functions
- To understand Physiotherapeutic Modalities used for persons with ID and Associated Conditions.
- To understand movement and postures of human body
- To understand role of physiotherapy in Cerebral palsy, Spina bifida, Muscular Dystrophy and Poliomyelitis
- To understand importance of physiotherapy in classroom context

2.3.3 Scope & Function:

Physiotherapy is an essential part of the health and community/welfare services delivery system. Physiotherapists practice independently of other health care/service providers and also within multidisciplinary rehabilitation/habilitation programmes to prevent, gain, maintain or restore optimal function and quality of life in individuals with loss and disorders of movement.

Physiotherapists are guided by their own code of ethical principles and having following purposes:

1. *The physical health related approach aims to improve the global physical health of patients.*
2. Promoting the health and well-being of individuals and the general public/society, emphasizing the importance of physical activity and exercise.
3. Preventing impairments, activity limitations, participatory restrictions and disabilities in individuals at risk of altered movement behaviours due to health or

medically related factors, socio-economic stressors, environmental factors and lifestyle factors.

4. Providing interventions/treatment to restore integrity of body systems essential to movement, maximize function and recuperation, minimize incapacity, and enhance the quality of life, independent living and workability in individuals and groups of individuals with altered movement behaviours resulting from impairments, activity limitations, participatory restrictions and disabilities.
5. Modifying environmental, home and work access and barriers to ensure full participation in one's normal and expected societal roles.

Physiotherapists may also contribute to the development of local, national and international health policies and public health strategies.

2.4 Modalities used in Physiotherapy for Persons with ID and its Associated Conditions

The terms used to describe a person with Intellectual disability or Mental retardation or learning disability has been changing with time. The World Health Organisation (WHO) in 1992 defined a learning disability as ''a condition of arrested or incomplete development of the mind, which is especially characterized by impairment of skills manifested during the developmental period, which contribute to the overall level of intelligence, i.e., cognitive, language, motor, and social abilities''.

The current definition of a learning disability is defined by Valuing People, the 2001 White Paper report on the health and social care of people with learning disabilities."A learning disability includes the presence of:

- a significantly reduced ability to understand new or complex information, to learn new skills (impaired intelligence), with;
- a reduced ability to cope independently (impaired social functioning);
- which started before adulthood, with a lasting effect on development."

Internationally, three criteria have to be met before a Intellectual disability can be identified or diagnosed

1. Intellectual impairment (IQ<70);
2. Social or adaptive dysfunction combined with IQ; and

3. Early onset.

Intellectual Disability is classified into following types based on Intelligent Quotient (IQ):

Profound: Individuals with an IQ score under 20, with severely limited understanding. They have difficulty communicating, require support with mobility and may need support with their behaviour. They may have multiple disabilities such as visual impairments, hearing impairments and difficulty with movement. They may also have extensive health needs, epilepsy and autism.

Severe: Individuals with an IQ score of 20-35. They often use basic words and gestures to communicate their needs. They may need a high level of support with activities of daily living. Some may have additional medical needs and require more support with mobility.

Moderate: Individuals with an IQ score of 35-50. They are able to communicate their day-to-day needs and wishes. They may need some assistance and guidance with their personal care and may require longer time to learn new skills.

Mild: Individuals with an IQ score of 50-70. They are able to hold a conversation and communicate their needs effectively. They are often independent in caring for themselves and have basic reading and writing skills. They may require support to understand complex ideas.

2.4.1 Factors resulting in Intellectual disability:

According to the British Institute for Learning Disabilities in 2011, these are key factors of learning disability:

Chromosomal conditions: Chromosomes make up the genetic blueprint for humans. Everyone has 46 chromosomes in their cells. Abnormality in their chromosomes can result in a intellectual disability. Such conditions include Down's syndrome, Fragile-X syndrome, Williams Syndrome, Wolf-Hirschhorn syndrome and Prader-Willi Syndrome.

Maternal factors: Infections such as Cytomegalovirus and Toxoplasmosis, factors such as diet deficiencies and excessive alcohol consumption during pregnancy can cause intellectual disability in the unborn child.

Metabolic disorders: A person's metabolism controls all the chemical reactions in the body. Certain conditions affecting metabolism can result in a learning disability. For example, Phenylketonuria is a disorder that increases the levels of a substance called Phenylalanine in the blood. Phenylalanine is an amino acid which is normally obtained through the diet. If untreated the abnormally high levels of phenylalanine can cause severe intellectual disabilities.

Events during birth: A intellectual disability can occur if a baby's oxygen supply is disrupted during labour, if a child is born extremely premature or becomes very ill after birth.

Events after birth: Some childhood infections such as encephalitis and meningitis can cause intellectual disabilities. A severe head injury can also cause a learning disability.

2.4.2 Common Associated Conditions:

Down's Syndrome:

Down's Syndrome occurs when there are three copies of chromosome 21 in the cells of the body. This is also known as trisomy 21. Having three copies of chromosome 21 disrupts the normal course of development and causes the characteristics of Down's Syndrome and the associated health risks. Strong associations have been found between maternal socioeconomic status, maternal age and chromosome 21-nondisjunction, the cause of 95% of Down's syndrome cases. There are three types of Down's Syndrome: Trisomy 21 (95%), Translocation (4%) and Mosaic (1%).

People with Down's syndrome have:

- Distinct facial features such as a flat face, a small broad nose, upward slanting eyes and a large tongue, as well as common physical traits of low muscle tone, small stature and a single deep crease across the center of the palm.
- A higher risk of developing respiratory conditions, leukemia, heart defects, gastrointestinal obstruction, hearing loss and eye abnormalities.
- A moderate to severe intellectual disability and often develop much slower than their peers.
- Communication difficulties.

Autism

Autism is a lifelong developmental disability. It is known as a spectrum condition as it affects people differently and to varying degrees. Some people with autism will lead independent lives while others will need lifelong support. Some people have intellectual disability (44-55%) while others have average to above average intelligence. Some people also have mental health issues and other health conditions.

Autism is defined as affecting social communication and social interaction.

Social Communication: People with autism have difficulties with interpreting verbal and non-verbal language, tone of voice and gestures. They have a literal understanding of language. They may find it difficult to understand facial expressions and jokes and sarcasm. Some of them may not speak while others may have limited speech. They may use alternate methods of communication such as sign language and symbols.

Social Interaction: This means that people with autism have difficulty 'reading' other people. They may appear insensitive, not seek comfort from other people, prefer time alone when overloaded by other people and appear to behave strangely. It may be hard for people with autism to make friends.

People with autism may also have repetitive behaviours and specific routines. As the world is an unpredictable place for autistic people they tend to have a daily routine so they know what they are going to do every day. For example, they may want to travel to school/work the same way every day or eat the same meal for breakfast every day. Some of them have a highly-focused interest which starts from an early age. These can change or be lifelong. Some examples include, music, computer games, train, movie or books. Some of them may also be hyper- or hypo-sensitive to sound, taste, touch, smells, lights, colours, pain or temperature. This can cause anxiety or on the other hand they may be fascinated by certain lights or colours.

Cerebral Palsy (CP):

Cerebral palsy is defined as "A group of permanent and non-progressive damage or lesion of developing/immature brain up to first two years of life leading to disorders of movement and/or posture and motor function. It is caused by trauma to the brain or complications that occur before, during or shortly after birth. CP primarily affects mobility and coordination, but may cause intellectual disabilities in severe cases, as well as an

inability to speak. Severe cases are usually diagnosed by the age of two, while milder manifestations may not be diagnosed until a child is 5 years old.

Most symptoms of CP, such as impairments to cognition, speech and movement, are difficult to recognise until a child is of age to learn how to speak and walk. Other common symptoms include seizures, and impaired bladder and bowel control. Learning disabilities in patients with CP can be complicated by the fact that symptoms of CP include vision, hearing and communication impairments, which can make it difficult for them to express themselves and for others to know whether the patient comprehends the information.

Evidence showed that babies of 20-32 week gestation have significantly higher risk of both cerebral palsy and intellectual disability. A systematic review carried out by Odding et al. revealed that 23-44% of the CP population have a cognitive impairment and 30-41% with a severe impairment (IQ<50).

2.4.3 Role of Physiotherapy:

Physiotherapist plays a challenging and important multifaceted role in the management of person with intellectual disability. Aim of physiotherapy management is to assess the needs of the patient and carers, maintain good general health of the patient, prevent or minimise contractures and prevent fixed positional deformities and maximize the patient's functional movement, ability and independence as much as possible.

Physiotherapist's provide an assessment and treatment of physical problems and are involved in improving mobility, movement and function, and where appropriate, advising on the provision of specialist equipment. Physiotherapy outcomes can be achieved through alterations in physiological and learning processes involving the cardio-respiratory, musculoskeletal and neurological systems. Physiotherapy treatment interventions include but are not limited to muscle exercise and rehabilitation, strengthening and stretching, training of specific skills, aquatic therapy, gait education, helping to decrease the risk of falls and improving balance strategies. These approaches are aimed at symptom relief, enhancement of self-confidence and improvement in quality of life.

Commonly, Physiotherapy works to assist an individual to improve their level of gross motor skills which every person attains during their physical development. The

gross motor skills commonly attained are rolling, sitting, standing, walking, running and ball skills and usually most are attained during the first five years of life. Pervading intellectual disability with and without physical debility can impede the attainment of gross motor skill, resulting in increased need for carer support with daily activities, decreased independence, a greater likelihood for pain and other health issues related to a relative lack of movement. The physiotherapy goals are based on the SMART principles (Specific, Measurable, Acceptable/Attainable, Realistic/Relevant and Time bound). The treatment is patient-centered and the ultimate physiotherapy goal is to change unhealthy habits and promoting an active lifestyle and healthy posture.

A different approach is taken to help & support the individual with intellectual disabilities as well as ensuring their needs are being met. When communicating, language should be simple and slowed down. If providing exercise sheets, it can help to have pictures along with simple language. Photographing the patient doing the exercises themselves and putting this on the sheet can sometimes be of benefit as they recognise themselves and are therefore more likely to do the exercises. See figures 2.1 below for examples of exercise sheets including text and photographs.

Knee Exercise
Do these Exercises 2 Times a day

Knee Bends

- Sit on Bed
- Leg Straight
- Slide your heel towards your bottom
- Bend knee as far as you can
- Straight Leg
- Repeat 10 times

Fig. 2.1 Example Exercise Sheet

There are several important elements to remember when designing effective treatment programs for children with intellectual disabilities. Physiotherapist must recognize the importance of selecting activities that accommodate the mental age of the child, but that are also as age-appropriate as possible. Activities in the treatment program should be interesting, fun and meaningful. Because children with intellectual disabilities often

have a poor attention span, so therapeutic activities should be chosen that most effectively and efficiently meet the identified goal. Rather than asking a child to do a standard exercise regimen for strengthening, the necessary therapeutic activities can be translated into a functional task or social game. The approach not only sustains interest, cooperation and enthusiasm, but it emphasizes carryover into activity of daily livings. It may also promote achievement of goals in other areas, such as social, emotional, self help and cognitive skills. Physiotherapist must be imaginative and should integrate many different approaches in order to develop an effective treatment approach for a particular child in a particular situation. Repetition and consistency are crucial aspects of any treatment plan in which learning is expected to occur. Because repetition is important for learning any task, the therapist must design several activities that teach the same component task, do so in different ways. This approach to treatment planning ensures not only the necessary repetition of activities, but also offers the dimension of interest and fun for a child with limited comprehension or attention.

The needs of carers/family members, especially for those who are semi-dependent or totally, dependent cannot be ignored. Cooperation is essential in order to achieve goals and carry out treatment plans. To address their needs, there must be good communication between the physiotherapist and all concerned with the delivery of care to the patient.

When we consider health we often focus more on physical health than social, emotional or mental health. It is important that we equally consider the person's social, emotional and mental health needs. People with intellectual disabilities are at an increased risk of developing mental health problems compared to the general population. By working in a person centered way, and supporting a person in a holistic approach, we can help to decrease the risk of mental health problems developing. By getting people to engage in activities they enjoy and want to do to lead more active lives, we can help reduce the risk of mental health problems.

24-hours Postural Care:

People who are physically able can adjust and correct their position and posture if they become uncomfortable, however, some people with ID, especially those with profound and multiple disabilities, may not be able to do so. They may be physically incapable of moving themselves and not be able to communicate their discomfort. As a result, they tend to end up in a poor position which can have adverse effects on their

health. These effects include pain, contractures, spinal deformities (such as scoliosis, kyphosis), an increased risk of fractures, loss of function, breathing difficulties and an increased likelihood of surgery.

As physiotherapists, we can use postural care to prevent poor positioning. Postural care aims to protect and restore body shape by using appropriate equipment and positioning techniques. Additional information should be written to describe the patient's position and also explain how this may impact the patient. Following the assessment of body symmetry, equipment such as wheelchairs, specialised seating, orthotics and sleep systems can be used to maintain a good position over a full 24 hour period.

As posture care needs to be provided essentially 24 hours a day, families and carers will often need to help with maintaining a good position. This requires them to be well educated and trained in the proper technique. Physiotherapists can help provide this by involving family members and/or carers in appointments so that they can practice in a setting where support is provided.

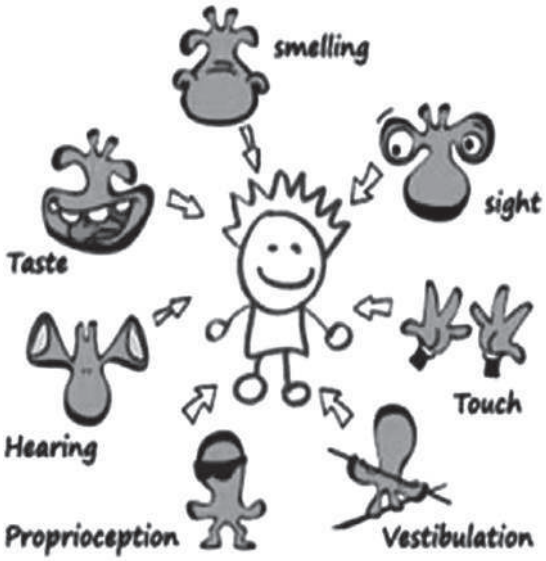
Neurodevelopmental Treatment (Bobath Approach):

Problem-solving approach developed by Karel and Berta Bobath advocating that every person with neurological dysfunction have a potential to improve and have a need to improve the functional skills not only to develop compensation as a result of neurological damage. By functional movement analysis and identifying deficits in motor control and task performance and through highly skill handling techniques allowing inhibition of abnormal postural reflex mechanism (righting, equilibrium, protective extension reactions) and facilitating the postural alignment, stability and normal movement. Facilitation of key points of control and sensory stimulation is the most commonly used techniques.

Sensory Stimulation & Integration Therapy:

Sensory Integration is the primary treatment approach with children who have learning disorders, attention deficits, and autism. Tactile, proprioceptive, visual, or vestibular sensory deficit impacts systems ability to move and learn new activities. Through sensory stimulation we aim to improve attention and arousal level and enhance sensory perception, selection and discrimination.(Fig. 2.2)

Techniques used to stimulate sensory system include:



- Light touch
- Slow, repetitive stroking
- Slow vestibular stimulation like rocking, swinging on the gym ball or in hammock
- Rapid vestibular stimulation like spinning on the chair.
- Maintained pressure can be manual
- Neutral warmth like towel wraps, gloves
- Prolonged cooling like cold water bath, ice massage

Fig. 2.2: Sensory Integration Therapy

The intensity of the stimuli needs to be carefully picked to prevent overstimulation and consideration given to the area where the stimuli is applied, as some areas like face, especially around mouth, sole of feet or palm have high receptors concentration and big cortical representation.

Range of Motion Exercise:

Range of motion must be sufficient for optimal recruitment, normal alignment and effective functional movement. Inactivity and immobility reduce the joints mobility, tissues flexibility and physical ability. Tissue malnutrition and local pain increase might be also related to the loss of ROM flexibility. Physiotherapy techniques improving mobility include:

- Range of movement exercises (passive or active depending upon condition of patient)
- Passive stretching through positioning, splinting, serial bracing
- Joint mobilisation
- Use of heat

Strength Training:

Strength training is not only helping in improving muscle power but also improve the self-esteem and self confidence of individuals. For efficient training the following needs to be considered:

- Goals and optimal outcome measures
- Type of muscle contraction (concentric, eccentric, isometric)
- Model of training (opened versus closed chain, circuit training, aquatic training etc.)
- Resistance type (free weight, elastic bands, water resistance, manual resistance etc.)
- Frequency, intensity, duration, number of repetitions
- Warm up / cool down protocol

Falls Prevention:

There is a high incidence of falls and injuries in those with intellectual disabilities making it a serious problem. Injuries in those with a learning disability are twice as likely to occur, compared to the general population, and they are 6-8 times more likely to die as a result. 25% to 40% of people with ID experience at least one fall (with or without injury) a year, with approximately one-third of falls reported to result in injury. With falls being the most common cause of injury for people with ID, and injuries having more serious consequences within the population, it is a priority to have effective falls prevention. With balance and gait problems increasing the risk of falls, physiotherapists help to improve these issues by developing tailored exercise interventions. The programme involves individuals with ID completing exercises like warm up, general/strengthening, balance training and aerobic exercises. The exercises are selected by the physiotherapist suited to the individual's needs helps in:

- Promoting and providing increased opportunities for weight bearing to reduce the risk of osteoporosis
- Helping to rebuild confidence and overcome fears of falling/causing injury
- Promoting physical activity and exercise

Physical Activity Promotion:

Promoting physical activity is a key part of the physiotherapist's role. The majority of people with ID do not meet the physical activity recommendations. Leading a sedentary lifestyle increases the risk of developing obesity, diabetes, hypertension and cardiovascular disease. Person with ID are less likely to participate in physical activity due to:

- Poor motor coordination
- Poor balance
- Inability to perform multiple tasks simultaneously
- Short attention span
- Hyperactivity
- Poor lifestyle orientations
- Poor self-esteem
- Inability to handle a situation

Persons with ID are already at risk of developing numerous conditions and being sedentary will only increase this risk. As physiotherapists, we should be getting people with ID to engage in physical activity where possible which will help in:

- Improve muscle strength & endurance
- Improve lung capacity
- Reduce resting heart rates and blood pressure
- Decrease body fat mass
- Increase lean body mass and muscle strength
- Maintain bone mass and reduce trauma-induced fractures by carrying out weight-bearing activities
- Reduce depression and anxiety levels and improve self-image, mental health and social skills.

Rebound Therapy:

Fig. 2.3 Trampoline

Rebound therapy is the therapeutic use of trampolines.(Fig. 2.3) It is currently used with people with a wide range of abilities including those with a mild physical and ID, to those with multiple and profound ID. It helps in:

- Challenges balance to help improve dynamic balance issues
- Raise low tone or lower increased tone
- Increase body part awareness, spatial awareness, proprioception and sensory awareness
- Promote relaxation
- Increase vocalisation in those with reduced vocal ability, creating a gateway to communication sometimes giving squeals of delight
- Gasps and intakes of breath can also stimulate the cough reflex.

As with any physiotherapy intervention, there are contraindications that need to be considered before any treatment can occur. The Rebound Therapy Association for Chartered Physiotherapists has produced guidelines on rebound therapy and states 3 absolute contraindications consisting of:

- Cranio-vertebral Instability: including Atlanto-Axial Instability (AAI) and Atlanto-Occipital Instability (AOI). AAI is a condition experienced by 10-20% of people with Down's Syndrome and occurs due to weakened ligaments causing slack joints.
- Detaching retina
- Pregnancy

Balance & Postural Control Training:

Balance or Postural control refers to an individuals ability to maintain their line of gravity within their Base of support or ability to maintain equilibrium. The following systems provide input regarding the body's equilibrium and thus maintain balance.

1. Somatosensory / Proprioceptive System
2. Vestibular System
3. Visual System

The Central Nervous System receives feedback about the body orientation from these three main sensory systems and integrates this sensory feedback and subsequently generates a corrective, stabilizing torque by selectively activating muscles. In normal condition, healthy subjects rely 70% on somatosensory information and 20% Vestibular & 10% on Vision on firm surface but change to 60% vestibular information, 30% Vision & 10% somatosensory on unstable surface.

The mechanisms involved in maintaining balance are:

1. Sufficient power in the muscles of the lower limbs and trunk to maintain the body erect and during movement.
2. Normal postural sensibility to convey information concerning position & movement.
3. Normal impulses from the vestibular & visual system concerning position, movement & environment.
4. The activity of higher centers concerned in the willed maintenance of posture, movement & stability.

Fig. 2.4: Exercise Ball & Balance Board

For improving balance following physiotherapy intervention & modalities are used:

- Dynamic and Strengthening exercise: Squats, two-leg stance and one-leg stance, jogging end to end, sideways walking or running with crossovers, forward walking or running in a zigzag line, backward walking or running in zigzag line, lower limb and core strength training.
- Co-ordination and functional tasks
- Exercise Ball (Fig. 2.4)
- Balance Board
- Computerized balance programs or virtual reality based balance training or vibration plates.

- Even versus uneven base of support like balance pads and inclines

Coordination and Agility Training:

Coordination is the ability to execute smooth, accurate, and controlled movements. Agility is the ability to perform coordinated movements combined with upright standing balance. (Fig. 2.5)

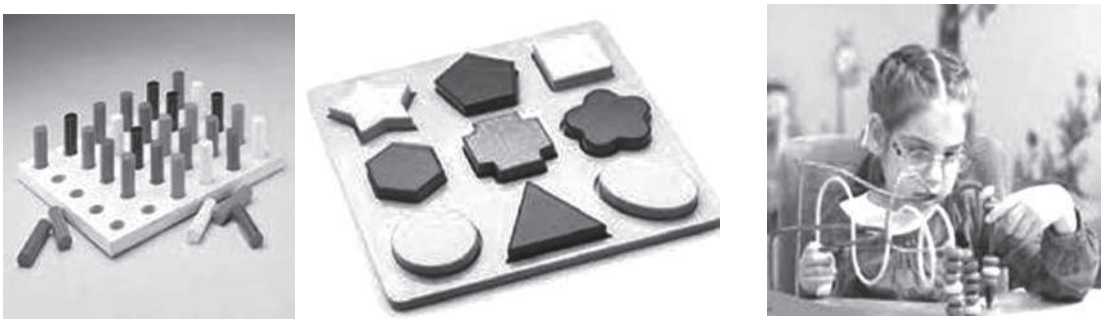


Fig. 2.5: Peg Board Activities for Coordination training

Hydrotherapy:

Water environment improves neuromuscular re-education and enhances strengthening. (Fig. 2.6) The buoyancy allows freedom of movement in the case of weakness or paralysis whilst water resistance provides strengthening medium. Warm water allows increased tone normalisation whilst water viscosity and buoyancy allows postural control and balance training in sitting and standing and also help in:

Fig. 2.6: Hydrotherapy

- relieve pain
- Promote relaxation
- Improve cardio-respiratory system
- Provide resistance to help strengthen muscles
- Improve confidence and promote independence

Contraindications of Hydrotherapy:

- Acute vomiting and diarrhea

- Skin conditions or infections
- Hypotension or hypertension
- Cardiac conditions
- Decreased vital capacity
- Uncontrolled epilepsy
- Fear of water

Gaming Technology:

Virtual reality and console based gaming therapy has shown an overall improvement in patient motivation. It has been seen there is an increase in compliance, playfulness, and endurance and were better able to cope with the repetitive nature of rehabilitation. It has been found that consoles are an appropriate means to assist in the ongoing needs of those requiring neurological rehabilitation of all ages. By using a console as an adjunct to traditional rehabilitation, patients are able to enhance and self direct the pace of their rehabilitation at home. This is vital for any individual with a neurological condition that must live with long term disability. The rehabilitation process may take months to years before the patient is able to function to their full capacity. Therapy may be necessary for the lifetime of the individual if their condition is chronic. With technological and medical advances, individuals who would previously have had a shortened lifespan are surviving longer with a better quality of life.

2.5 Movements and Postures of Human Body

Every movement starts from a posture and ends on a posture. Roberts in his Neurophysiology of Postural mechanisms (1967) states that a movement may be thought of as a change of posture. Posture is the more fundamental function; it is below the level of consciousness, is concerned with physical forces and the principles of mechanics, and is active in the absence of movement. Posture has no need of voluntary movement, but (within the gravitational field) voluntary movement normally requires the support of posture.

2.5.1 Postures

Posture is the attitude assumed by body either when the body is stationary or when it is moving. Posture is attained as a result of coordinated action of various muscles working to maintain stability. Posture in easy terms can be understood as the position in which you hold your body when standing, sitting or lying. Postures are basically divided into two types:

1. ***Inactive-*** These are postures or attitudes adopted for resting or sleeping. They require theoretically minimal muscle activity, and are usually assumed in need of relaxation.
2. ***Active-*** The integrated action of many muscles is required to maintain active postures, they are basically divided in two types:

a. Static Postures- Body segments are aligned and maintained in fixed positions. This is usually achieved by co-ordination and interaction of various muscle groups which are working statically to counteract gravity and other forces. Examples of static postures are standing, sitting, lying, and kneeling.

b. Dynamic Postures- In this type of posture body segments are moving. It is usually required to form an efficient basis for movement. Muscles and non-contractile structures have to work to adapt for changing circumstances. Examples are walking, running, jumping, throwing, and lifting.

The balanced posture of the body reduces the work done by the muscles in maintaining it in an erect posture. Good postural habits in the child & adult are necessary to avoid postural pain syndrome and postural dysfunction. Posture training exercises is important following trauma or surgery to prevent dysfunctions from contractures and adhesions.

Examples of different Common Faulty postures (Fig. 2.7):

Lordotic Posture: It is characterized by an increase in the lumbosacral angle, an increased lumbar lordosis and an increase in the anterior pelvic tilt and hip flexion. Common causes of lordotic posture are muscle imbalance (weak abdominal muscle) sustained faulty posture, pregnancy, obesity etc.(Fig.2.7 a)

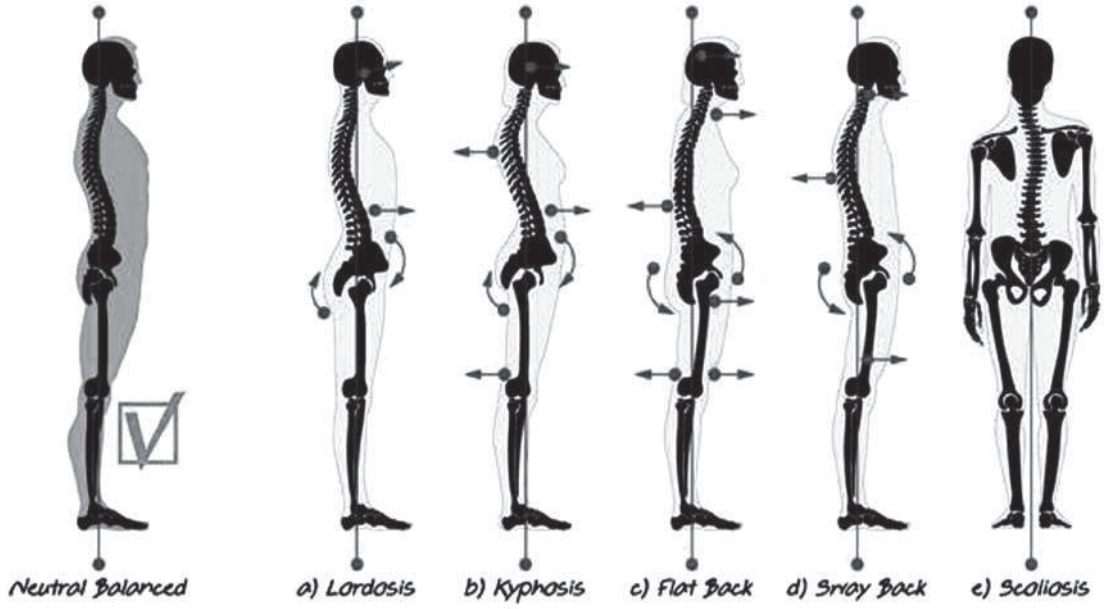


Fig. 2.7: Common Faulty postures

Kyphotic Posture: There is an increase in the posterior convexity of the dorsal spine. The back is rounded, head is carried forward and chest is flattened. (Fig. 2.7b)

Flat Low back Posture: This posture is characterized by decreased lumbosacral angle, decreased lumbar lordosis, hip extension and posterior tilting of the pelvis. (Fig. 2.7c)

Swayback or Slouched Posture: It is characterized by an excessive shifting of the pelvic segment anteriorly, resulting in hip extension and shifting of thoracic segment posteriorly, resulting in flexion of the thorax on the upper lumbar spine. This result in an increased lordosis in the lower lumbar region, an increased kyphosis in the lower thoracic region and usually a forward head. (Fig. 2.7d)

Postural Scoliosis: It is characterized by increased lateral curvature of the spine. It may be due to impairment of postural reflex mechanism, wrong postural habits etc. (Fig. 2.7e)

2.5.2 Movements

Movements are normally 'goal directed' (i.e. happen in order for us to do something) and start with the body's need to move. "Normal movement may be considered as a skill acquired through learning (or development) for the purpose of achieving the most

efficient and economical movement or performance of a given task and is specific to the individual."

Various systems in our body allow us to have 'normal movement', these are:

Motor system: The nerves and muscles that control movement.

Sensory systems: The information the body gets from itself and its surroundings, its senses: Skin (touch, pain, pressure, temperature), Proprioception (information gained by sense organs in muscles and tendons that tell the brain what position joints, and different parts of the body are in), Vestibular (includes the balance organ in the ear), Visual (information gained by the eyes)

Perception: It concerns things such as judging distances and depth, knowing where our body is in space, and being able to relate one object or body part to another.

Tone: A state of resting muscle activity, which can be influenced by many external factors (e.g. temperature, anxiety, wellness and pain).

Movements start developing before we are born. The order in which they develop is from the middle (the spine and trunk) outwards (to the hands, fingers, feet and toes). Movement develops from gross, big movements to fine, selective movements.

Movements can be Voluntary or Involuntary. ***Voluntary movements*** are all movements of the body that a individual want to do or make their body to do such as walking, running, picking up object etc. These movements are under the control of individuals and could easily be stopped if they want. ***Involuntary movements*** are the movements which are not under the control of subjects. These movements can be jerky, repetitive, slow or quick, rhythmic movements of small & large amplitude, tremors and seizures and can occur in any part of the body.

Movement disorders are a group of disorders where the movement is generally uncontrolled and involuntary and includes athetosis, rigidity, tremor, dystonia, ballismus and choreoathetosis.

2.6 Specific Conditions and Physiotherapy Management – Cerebral Palsy, Spina Bifida, Muscular Dystrophy and Poliomyelitis

2.6.1 Cerebral Palsy:

Cerebral Palsy (CP) is a disorder of movement and posture that appears during infancy or early childhood resulting from the non-progressive interference, lesion, or abnormality of the immature or developing brain during the first 2 years of life.

Prevalence of CP varies from 1-4/1000 babies of a defined age range in different countries. The aetiology of Cerebral Palsy is very diverse and multifactorial. The causes are congenital, genetic, inflammatory, infectious, anoxic, traumatic and metabolic. The injury to the developing brain may be prenatal, natal or postnatal. As much as 75%-80% of the cases are due to prenatal injury with less than 10% being due to significant birth trauma or asphyxia. The most important risk factor seems to be prematurity and low birth weight with risk of Cerebral Palsy increasing with decreasing gestational age and birth weight. The incidence in premature babies is much higher than in term babies. Cerebral Palsy is more common among boys than among girls.

Risk Factors:

There are different risk factors for each stage at which a child might develop Cerebral Palsy. These can be broken down into Prenatal, Perinatal and Postnatal.

- **Prenatal:** Prematurity (Gestational age less than 36 weeks), Low Birth Weight (less than 2500 g), which could be due to poor nutritional status of the mother, Maternal epilepsy, Hyperthyroidism, Infections (TORCH = Toxoplasmosis, Other (Syphilis, Varicella-Zoster, Parvovirus B19,) Rubella, Cytomegalovirus (CMV), Herpes Simplex Virus), Severe Toxemia, Eclampsia, Drug Abuse, Trauma, Multiple Pregnancies, Placental Insufficiency.
- **Perinatal:** Premature Rupture of Membranes, Prolonged and Difficult Labour, Vaginal Bleeding at the time of admission for labour, Bradycardia.
- **Postnatal (0-2 years):** Central Nervous System infection (Encephalitis, Meningitis), Hypoxia, Seizures, Coagulopathies, Neonatal Hyperbilirubinemia, Head Trauma.

There is no way to predict which child's brain will be damaged by one of these factors or to what the extent of the damage will be. None of these factors always results in brain damage and even when brain damage occurs, the damage does not always result in Cerebral Palsy. For example: Some children may have an isolated hearing loss from their meningitis, others will have severe intellectual disability and some will have Cerebral Palsy.

Classification of Cerebral Palsy:

As per Swedish Classification of Cerebral Palsy subtypes employs a topographical descriptive method and describes the type based on muscle tone into: Spastic, Dyskinetic or Choreoathetosis, Ataxic & mixed. And on the basis of number and distribution of the affected limbs: Monoplegia, Hemiplegia, Diplegia, Tetraplegia, and Quadriplegia.

Spastic Cerebral Palsy: are used to distinguish between quadriplegia, diplegia and hemiplegia. Spastic Cerebral Palsy is either bilateral or unilateral.

Dyskinetic Cerebral Palsy and Ataxic Cerebral Palsy: always involve the whole body (bilateral).

Spastic Cerebral Palsy is the most common form of Cerebral Palsy. Approximately 80% to 90% of children with Cerebral Palsy have Spastic Cerebral Palsy. Spastic Cerebral Palsy is characterized by at least two of the following symptoms, which may be unilateral (hemiplegia) or bilateral:

- Abnormal pattern of posture and/or movement
- Increased tone (not necessarily constantly)
- Pathological reflexes (hyper-reflexia or pyramidal signs e.g. Babinski response)

Traditionally Spastic CP is of four types: (Fig. 2.8)

1. Monoplegia
2. Hemiplegia
3. Diplegia
4. Quadriplegia.

Monoplegia

Means only one limb is affected. It is believed this may be a form of hemiplegia/ hemiparesis where one limb is significantly impaired.

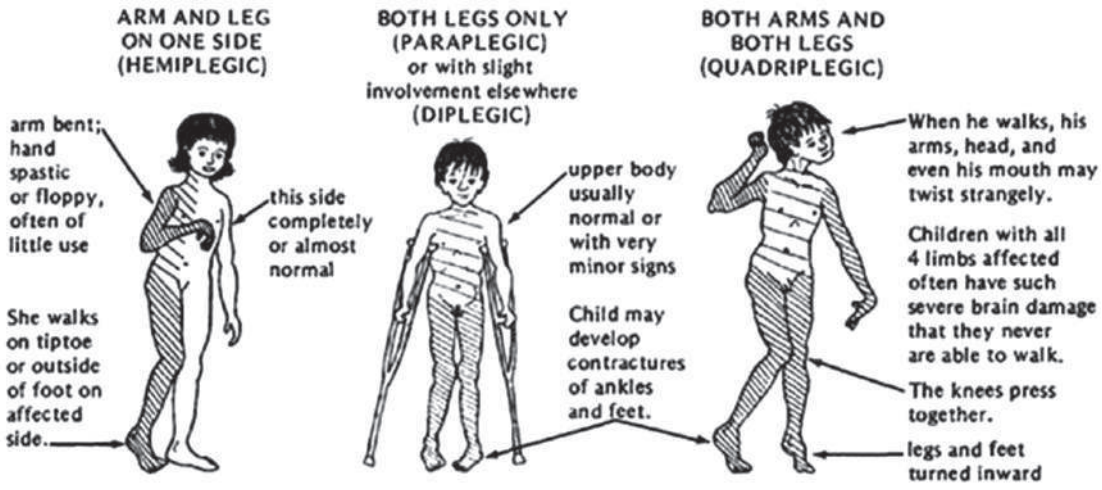


Fig. 2.8: Types of Cerebral Palsy

Hemiplegia (Unilateral)

With hemiplegia, one side of the body is involved with the upper extremity generally more affected than the lower. Seizure disorders, visual field deficits, tactile agnosia, and proprioceptive loss are likely. Twenty percent of children with spastic Cerebral Palsy have hemiplegia.

Diplegia (Bilateral)

With diplegia, the lower extremities are severely involved and the arms are mildly involved. Intelligence usually is normal, and epilepsy is less common. Fifty per cent of children with Spastic Cerebral Palsy have diplegia. A history of prematurity is usual. Diplegia is becoming more common as more low- birth-weight babies survive.

Quadriplegia (Bilateral)

With quadriplegia, all four limbs, the trunk and muscles that control the mouth, tongue and pharynx are involved. Thirty percent of children with Spastic Cerebral Palsy have quadriplegia. More serious involvement of lower extremities is common in premature babies.

Dyskinetic CP

Abnormal movements that occur when the child initiates movement are named Dyskinesias. Dysarthria, Dysphagia and drooling accompany the movement problem. Intellectual development is generally normal, however severe dysarthria makes communication difficult and leads the outsider to think that the child has intellectual impairment. Sensorineural hearing dysfunction also impairs communication. Dyskinetic Cerebral Palsy accounts for approximately 10% to 15 % of all cases of Cerebral Palsy. Dyskinetic Cerebral Palsy is characterised by the following Symptoms:

- Abnormal pattern of posture and/or movement, and
- Involuntary, uncontrolled, recurring, occasionally stereotyped movements of affected body parts

Dyskinetic Cerebral Palsy may be either:

- Dystonic Cerebral Palsy, dominated by both hypokinesia and hypertonia, or
- Choreoathetotic Cerebral Palsy, dominated by both hyperkinesia and hypotonia

Ataxic CP

Ataxia is loss of balance, coordination and fine motor control. Ataxic children cannot coordinate their movements. They are hypotonic during the first 2 years of life. Muscle

tone becomes normal and ataxia becomes apparent toward the age of 2 to 3 years. Children who can walk have a wide-based gait and a mild intention tremor (Dysmetria). Dexterity and fine motor control is poor. Ataxia is associated with cerebellar lesions. Ataxia is often combined with spastic diplegia. Most ataxic children can walk but some need walkers. Ataxic Cerebral Palsy is characterized by the following symptoms:

- Abnormal pattern of posture and/or movement
- Lost of orderly muscular coordination, so that movements are performed with abnormal force, rhythm, and accuracy

Mixed CP

Children with a mixed type of Cerebral Palsy commonly have mild spasticity, dystonia and/or athetoid movements. Ataxia may be a component of the motor dysfunction in children in this group. Ataxia and spasticity often occur together. Spastic Ataxic Diplegia is a common mixed type that often is associated with hydrocephalus.

Problems Regularly Seen with Children with Cerebral Palsy:

This table highlights the problems that children with Cerebral Palsy experience within different areas.

Neurological	Musculoskeletal	Associated Problems
• Muscle Weakness • Abnormal Muscle Tone • Balance Problems • Loss of Selective Control • Pathological Reflexes • Loss of Sensation • Swallowing Difficulty	• Tightness • Contractures • Deformities	• Epilepsy • Visual Problems • Hearing Loss • Speech and Communication • Feeding Difficulty & Failure to Thrive • Respiratory Problems • Incontinence • Intellectual Impairment

Assessment & Physiotherapy Management of Cerebral Palsy:

The Gross Motor Function Classification System (GMFCS) assesses & describes the gross motor function of children and youth with cerebral palsy on the basis of their self-initiated movement with particular emphasis on sitting, walking, and wheeled mobility. The primary criterion has been that the distinctions between levels must be meaningful in daily life. Distinctions between levels are based on functional abilities, the need for assistive technology (including wheeled mobility versus hand-held mobility devices such as walkers, crutches, or canes) and, to a much lesser extent, quality of movement. It has been widely used in both clinical and research settings and proven to be valid, reliable, relatively stable with time and has become the primary tool to describe and communicate a child's gross motor function. The GMFCS has 5 classification levels for 5 different age groups: (Fig. 2.9)

- Before 2 years
- Between 2 and 4 years
- Between 4 and 6 years
- Between 6 and 12 years
- Between 12 and 18 years

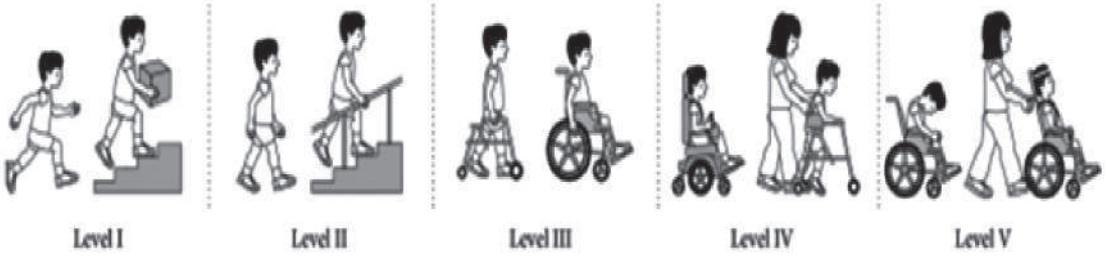


Fig. 2.9: Level of Gross Motor Function Classification System

GMFCS Level	Description
Level I	Walks without limitations indoors or outdoors and climbs stairs without limitations. Speed, balance and co-ordination are reduced
Level II	Walks with limitations indoors or outdoors, climbs stairs holding on to a rail. Experiences limitations walking on uneven surfaces and inclines, in crowds or confined spaces
Level III	Walks indoors or outdoors using a hand held mobility device and climbs stairs holding onto a railing. May require a self-propelled wheelchair when travelling longer distances, outdoors or on uneven terrain
Level IV	Self-mobility with great limitations and may use powered mobility
Level V	Physical impairments restrict voluntary control of movement and have no means of independent mobility. Transported in a manual wheel chair

Physiotherapy Interventions with Cerebral Palsy:

Early physiotherapy interventions have the potential to help a child perform movements and strengthen neural/synaptic connections that would otherwise not be possible due to muscle weakness and poor motor control. In addition, early physiotherapy treatments can help to reduce secondary soft tissue changes such as muscle stiffness and joint contractures. Without such interventions, the child with cerebral palsy may not get the opportunity to practice efficient and effective movements in order to reinforce the neural connections that control these movements. As a result, the child is likely to practice limited, ineffective, energy-consuming movements that may hinder their ability to move and function as they get older and larger. Thus, early physiotherapy intervention may help to prevent a child with cerebral palsy from reinforcing ineffective movement patterns through repetition and improving impairments, minimizing activity limitations and stimulate participation.

The aim and types of interventions are unique for each child with Cerebral Palsy because their needs are all different depending on the level of disability. This table gives an overview of the aims of treatment/interventions for each level of disability.

Mild	Moderate	Severe
Intervention will focus of appearance and integration	Intervention will focus on independence and self-care skill	Intervention will focus on comfort and enhanced care

Goal setting is important as it keeps the focus of rehabilitation patient centred. One common method of goal setting has been derived from SMART (Specific, Measurable, Attainable or Assignable & Realistic) goals**.** Physiotherapy focuses on function, movement, and optimal use of the child's potential and uses physical approaches to promote, maintain and restore physical, psychological and social well-being within all environments of the child including home, school, recreation, and community environments.

Gross motor skills, functional mobility in the management for the motor deficits, positioning, sitting, transition from sitting to standing, walking with or without assistive devices and orthoses, wheelchair use and transfers, are all areas that the physiotherapist works on using a wide range of physiotherapeutic approaches to influence functional ability of the child. The most common physiotherapy and physiotherapy-related approaches utilised in the management of Cerebral Palsy during the past few decades are as follows:

Neuro Developmental Treatment (NDT):

NDT Approach also known as Bobath Approach, was developed in the 1940's by Berta and Karl Bobath, based on their personal observations working with children with cerebral palsy. The basis of this approach is that motor abnormalities seen in children with Cerebral Palsy are due to atypical development in relation to postural control and reflexes because of the underlying dysfunction of the central nervous system. This approach aims to facilitate typical motor development and function and to prevent development of secondary impairments due to muscle contractures, joint and limb deformities.

Sensory Integration (SI) Therapy:

The principles of Sensory Integration therapy is to provide the opportunity to experience a variety of controlled sensory input to encourage the production of an adaptive response that includes motor behaviours, social interactions, or cognitive skills, encouraging the child to utilize intrinsic motivation and promoting purposeful behaviours with meaningful activity. Tactile, proprioceptive, visual, or vestibular sensory deficit impacts systems ability to move and learn new activities. Through sensory stimulation we aim to improve attention and arousal level and enhance sensory perception, selection and discrimination. Techniques used to stimulate sensory system include:

- Light touch
- Slow, repetitive stroking
- Slow vestibular stimulation like rocking, swinging on the gym ball or in hammock
- Rapid vestibular stimulation like spinning on the chair.
- Maintained pressure can be manual
- Neutral warmth like towel wraps, gloves
- Prolonged cooling like cold water bath, ice massage

The intensity of the stimuli needs to be carefully picked to prevent overstimulation and consideration given to the area where the stimuli is applied, as some areas like face, especially around mouth, sole of feet or palm have high receptors concentration and big cortical representation.

Constraint-Induced Movement therapy (CIMT):

Constraint-induced Movement therapy is used predominantly in the individual with Hemiplegic Cerebral Palsy to improve the use of the affected upper limb. The stronger or non-impaired upper limb is immobilized for a variable duration in order to Force Use of the impaired upper limb over time.

Passive Stretching:

It is a manual application for spastic muscles to relieve soft tissue tightness. Manual stretching may increase range of movements, reduce spasticity, or improve walking efficiency in children with spasticity. Passive stretching may be achieved through a

number of methods which include; Manual Stretching, Weight Bearing, Splinting, Serial Casting.

Static Weight- bearing Exercise:

Stimulation of antigravity muscle strength, reduction in spasticity and improvements in bone mineral density, self-confidence and motor function have all been achieved through the use of Static Weigh Bearing exercises such as Tilt-Table and Standing Frame.

Strengthening Exercise:

It aims to increase the power of weak muscles through manually, weight cuff, dumbbells or by using recreational activities and to provide the functional benefits of strengthening in children with CP.

Functional Exercise:

Training related to specific functional activities combining aerobic and anaerobic capacity and strength training in ambulatory children is effective in improving overall physical fitness, the intensity of activities, and quality of life. Training programs on static bicycles or treadmill is beneficial for gait and gross motor development.

Electrical Stimulation:

The goal of the electrical stimulation is to increase muscle strength and motor function. Neuromuscular Electrical Stimulation (NMES) involves application of transcutaneous electrical current that results in muscle contraction resulting in improving strength of muscle. Functional Electrical Stimulation (FES) refers to the application of electrical stimulation during a given task or activity when a specific muscle is expected to be contracting.

2.6.2 Spina Bifida

Spina bifida is a developmental defect in the vertebral column resulting from defective fusion of one or more posterior vertebral arches with resultant protrusion of the contents of the spinal canal. The bony defect may or may not be accompanied by defects of the spinal cord and meninges.

There are two main types of this abnormality

a) Spina bifida occulta

b) Spina bifida cystica (Meningocele & Myelomeningocele)

Fig. 2.10: a) Spina bifida Occulta b) Meningocele c) Myelomeningocele

a) **Spina bifida occulta:** This is the mildest form of the defect. There is defect in the fusion of the laminal arch but may only be evident in radiological findings. There is a band of fibrous tissue between the skin and the bone which results in an indentation in the skin over the vertebrae and sometimes there may be a small tuft of hair over the area. There is rarely any neurological deficit. (Fig. 2.10 a)

b) **Spina bifida cystica:** there is developmental deficiency of laminae, spinous processes, overlying muscles and skin.

Meningocele: The vertebral arch is not fused and a sac protrudes containing meninges and cerebrospinal fluid. The spinal cord lies in the vertebral canal and there is no sign of neurological abnormality. If this defect is closed by early sugery, paralysis is avoidable and rehabilitation is easy.(Fig. 2.10b)

Myelomeningocele: This is the most severe form of spina bifida. The spinal cord is exposed to the surface as a plaque or nervous tissue. It is associated with muscle paralysis, sensory loss, bladder & bowel problem and deformities.(Fig. 2.10c)

Physiotherapy management:

The basic objective of physiotherapy management is:

A. Prevention and management of deformities

B. Improve the muscle power

C. Care of skin & joints

D. Management of bladder

E. Education of ambulation & self care

A. Prevention and management of deformities:

For preventing deformities all measures should be taken. The mother should be taught simple procedures like passive stretching and use of night splints. Mild to moderate deformities may be treated conservatively by passive stretching, range of motion exercise and splinting. Daily sessions for lower extremity passive range of motion exercises should be taught to parents and performed two or three times each day. These exercises are performed gently to prevent unnecessary stress to soft tissue and joint structures. Stretching exercises should be included in case of tightness, contractures & deformity. Parents should be taught for proper handling & carrying of the child.

B. Improve the Muscle Power:

Depending upon level of lesion strengthening exercise should be given. Focus should be given to strengthen upper extremity muscle for crutch walking and transfer training. Lower extremity weight bearing muscles like hip abductors and extensors, knee extensors, ankle dorsi & planter flexors should be strengthened.

C. ***Care of skin & joints:***

In case of anaesthetic skin and insensitivity of the joint position care should be taken to avoid further damage and complications. While using splints and braces and during passive stretching, protection of the skin from pressure and ulcerations is necessary. Parents must be cautious while exposing the child to heat during winters (hot water, heaters or radiators). Keeping babies too close or immersing child in hot water may result into serious burn. Skin should be inspected carefully daily to avoid any ulceration.

D. Management of bladder:

Crede's maneuver (applying manual pressure from umbilicus to pubic symphysis and Valsalva maneuver (by voluntarily contracting abdominal muscle) can be helpful in emptying bladder.

E. Education of ambulation & self care:

Gait training depends upon neurological level of lesion, balance, types of orthotic assistance and walking aid. Children with thoracic level involvement rarely acheive independent ambulation due to lack of muscle power and sensation in both the lower

limbs. They generally depend on wheel chair ambulation and therefore, should be trained in transfer and self care activities.

Children with high lumbar paralysis will require a high level of bracing to stand & walk. Bracing is necessary to stabilize the knees & ankles and to provide medial-lateral control at hips & pelvis. These patient can be made ambulatory by Hip knee ankle foot orthosis with pelvic band or knee ankle foot orthosis, whereas children with lower lumbar paralysis can be made ambulatory with the help of Anlke foot orthosis.

2.6.3 Muscular Dystrophy

Muscular dystrophies (MD) are group of genetic diseases characterized by progressive weakness and degeneration of the skeletal muscles that control movement. Some forms of muscular dystrophies are seen in infancy or childhood, while others may not appear until middle age or later. The disorder differs in terms of the distribution and extent of muscle weakness, age of onset, rate of progression and pattern of inheritance. MD can be X-linked, autosomal recessive or dominant.

Duchenne Muscular Dystrophy (DMD):

DMD is the most common and severe form of MD and primarily affects boys. It is caused by the absence of dystrophin, a protein involved in maintaining the integrity of muscle. Fast muscle fibres are the first to degenerate followed by degeneration of other muscle fibres, until the entire muscle is replaced by fatty and fibrous tissue. Onset is between 3 and 5 years and the disorder progresses rapidly. Most boys are unable to walk by age 12, and later need respirator to breath. Girls in these families have a 50 percent chance of inheriting and passing the defective gene to their children.

Clinical Features:

- Progressive symmetrical muscle weakness with difficulty in walking, climbing stairs, difficulty in getting up from squatting and frequent falls is the initial symptoms and become wheel chair bound by age up to 12 years.
- Children may assume lordotic posture.
- Walk with lordotic and wide base of gait resembles waddling gait.
- Pseudo-hypertrophy of calves and sometimes glutei and deltoid.
- Gower's Sign: Child tries to get from the floor by "climbing up the legs" because of pelvic & lower limb muscle weakness, the child with the support of upper limb on the ground and gradually on the knees and comes to standing posture.

- Pharyngeal weakness may lead to aspiration
- Deformities like Scoliosis begin during the ambulatory stage. Hip & knee flexion deformity, equinus contracture are common as the child loss the ability to walk
- Growth retardation
- Death around 2nd & 3rd decade due to chest infection, respiratory insufficiency, heart failure due to cardiomyopathy.

Physiotherapy Intervention:

Physiotherapists manage patients and their problems not disease. The primary problems encountered by children with DMD include the following:

a) Weakness

b) Decreased Active & passive range of motion

c) Loss of ambulation

d) Decreased functional ability

e) Decreased pulmonary function

f) Progressive scoliosis

g) Pain

Major goals of physiotherapy management common to all children with DMD are as follows:

a) Prevent deformity

b) Maintain muscle power

c) Prolong functional capacity

d) Improve pulmonary function

e) Facilitate the development and assistance of family support

f) Control pain

a) Prevent Deformity:

Active or passive range of motion exercise depending upon condition of patient should be given. Passive stretching 10 repetitions holding for at least 15 seconds should be performed at least once in a day. Splinting and positioning will also help in preventing deformity.

b) Maintain muscle power:

Submaximal endurance training such as swimming or cycling may be beneficial especially in the younger child with DMD.

c) Prolong functional capacity:

Prescription of specific orthotics or adaptive equipment, activity of daily living training, walking aids will help in prolonging functional capacity. Care should be taken to avoid overusing muscles and causing fatigue.

d) ***Improve pulmonary function:***

Deep breathing exercise, incentive spirometry should be taught to child with DMD to maintain good pulmonary health & preventing respiratory complications. Family members should be trained for chest physiotherapy like bronchial drainage, chest percussion and assisted coughing.

e) Facilitate the development and assistance of family support:

Physiotherapist plays an important role in providing support, motivation and training of the patient with DMD and their family members. Family education in regard to the disease process, its implications and emotional support should be given.

f) Control pain:

Most of the pain in DMD is mechanical in nature and caused by limited ability to move in the bed or wheelchair either because of muscle weakness or joint contracture. Appropriate stretching, positioning in wheelchairs, cushions, specialized mattresses may assist in controlling discomfort to children with DMD.

2.6.4 Poliomyelitis:

Poliomyelitis is an endemic and epidemic infectious viral disease, mainly affecting children under the age of five. The disease is under complete control in the western

countries. However it is still one of the most crippling conditions in the developing countries where immunisation has not yet been effectively carried out.

It is transmitted by droplet infection and by oral ingestion. The period of incubation varies from 3 to 30 days. There are three distinct phases of the disease:

(A) Initial Incubation period

(B) Prodormal non paralytic stage

(C) Paralytic Phase

The symptomatic illness following infection is due to the destruction of anterior horn cells of the spinal cord and the brain stem for which the virus has selective affinity which result into flaccid paralysis with normal sensations. The involvement is predominant in the lower limbs, particularly in the extensor group of muscles.

Stages of the disease:

Stage 1: Acute stage:

It begins with fever and headache, followed by neck stiffness and meningitis. Muscles are painful and tender. Paralysis soon follows and reaches its maximum in 2-3 days. Limbs are weak and there may be difficulty with breathing and swallowing. If the patient does not succumb to respiratory failure, pain and pyrexia subsides after 7-10 days and the patient enters the convalescent stage.

Stage 2: Recovery/convalescent stage:

This stage is prolonged. The return of muscle power is most noticeable during the first 6 months, but there may be continuing improvement for up to 1 year.

Stage 3: Residual phase:

Some cases do not progress beyond the early stage of meningeal irritation. In others, however recovery is incomplete and the patient is left with some degree of asymmetric flaccid paralysis or muscle weakness.

Treatment Programme:

1. Acute phase (first 3 to 5 weeks):

Complete physiological rest to the nervous system with maximum possible measures to achieve relaxation of the whole body is the basic aim.

- Avoid forceful exercise and massage as this may increase paralysis.
- Moist hot packs to the affected muscles produce considerable relief from the pain.
- Prevention from contractures: it is a major goal to be achieved during early stage. Proper positioning of the whole body and involved limb is important. Passive range of motion for the joints to avoid contracture formation.
- Muscle power assessment to know the extent of paralysis.
- Respiratory care is important in case of severely affected patient.

2. **Recovery phase (4 weeks to 1 year):**

The treatment program during recovery phase needs to be individualized for the paretic or paralyzed muscle group.

- Sitting up can be encouraged if the paralysis is not severe.
- As soon as the fever drops, exercises should be started to prevent contractures and return strength.
- Passive, active assisted to active resisted/ strengthening exercises, sitting balance training, standing balance training in parallel bars, gait training should be started.
- Crutches, leg braces (orthotic support) and other aids may help the child to move better and may prevent contractures or deformities.
- Hydrotherapy: Exercises in warm water pool are extremely effective.
- Active games, swimming and other activities to keep limb moving as much as they can are important throughout the child's rehabilitation.

3. Residual phase (1 year to 2 years):

At this stage, Chances of neurological recovery are practically not possible. Emphasis should be given on further strengthening the functional needs of the patient. Goals of treatment in this stage are as follows:

- Strengthening of all the innervated muscles.
- Preventing contractures and deformities.

- Making the patient as independent as possible by providing orthotic support, walking aids, adaptive device or wheel chair depending upon the need of the patient.
- Emotional and psychological support.

Each child will have a different combination and severity of paralyzed muscles and will have their own special needs. For some children, normal exercises and play may be all that are needed. Others may require braces or other aids to help them move better. Those who are severely paralyzed may require wheelchair.

2.7 Integrating Physiotherapy into Classroom Context

Physiotherapy plays an important role in meeting the needs of children with a variety of disabilities in various education environments. For appropriate and effective management and education of child in the classroom, communication between the physiotherapist and teacher is essential. The therapist should obtain information from the teacher regarding the child's daily routine at school. Based on information and joint planning can be an effective and efficient educational program for the child.

Physiotherapist should be involved in screening program in schools to detect various disabilities, such as scoliosis or developmental delays as well as preventing and managing musculoskeletal problems. The therapist may provide training to others who will conduct the primary screening and if a child is identified with any problems for which treatment is indicated, physiotherapist may be called to develop an exercise program and to monitor the condition. A physiotherapist might be involved in setting up and conducting developmental screening test for early identification of delays or abnormalities in fine and gross motor development. The therapist may then make recommendations to the classroom teacher and parent for activities to assist the child and early intervention for better improvement. Therapist may provide indirect services to the child by consulting with the teacher. The consultation model reduces the number of individuals who work directly with the child, which provides for grater consistency in care as well as more efficient use of both the child's and professional's time. This method also offers a greater opportunity to integrate educational and therapeutic interventions. It is also believed to be more cost effective system.

The therapist must take ergonomic care of child in classroom and emphasize on correct alignment while child is sitting. Optimal height & type of a chair and desk will

contribute to postural control and thus helpful with desktop activities. Too long sitting position may lead to flexion contracture at hip & knee of the child. During class activity or movement throughout the day, such as standing, walking, or participating in physical activity/education class will help in minimizing the chance of developing contractures. There should be sharing of the responsibility, assistance and supervision required between the classroom staff and the child for quality of movement and safety. The physical education teacher should be informed regarding joint movement goals and specific types or patterns of movement that may be beneficial for the child. Teachers should also be informed regarding purpose & proper use of splints, orthotics and other assistive or adaptive devices. Specific information & suggestion will facilitate learning in child. Therapist should not expect teachers to handle children therapeutically for the purpose of obtaining postural control. A more realistic expectation would be maintenance of correct alignment, relief from sitting, use of adaptive or assistive device and attention to issues regarding safety. The therapist must recognize the teacher as an important ally in the therapeutic arena.

Physiotherapists may assist others in the educational setting by:

4. Identifying architectural barriers and plan for accessibility modification
5. Establishing guideline and child specific modifications for the transport of children with disabilities on school owned vehicles.
6. Promoting acceptance of students with disabilities by both teachers & students
7. Planning recreational areas for accessibility
8. Participating with various prevention activities, including screening programs, development of conditioning program
9. Promoting independence through general environmental modifications.

2.8 Let us sum up

2.9 Unit end exercises

2.10 References:

1. Agre, J., Rodriques, A.A and Sperling, K.B. (1989): symptoms and clinical impressions of patients seen in post polio clinic. Arch. Phys. Med. & Rehabil. 70:367
2. Cerebral palsy & learning disabilities (2017): retrieved from http://www.unitednationalcerebralpalsylawyer.com/education/learning/
3. Durkin MS, Schupf N, Stein ZA, Susser MW. (2007): Public health and preventive medicine. 15th ed. Wallace R, pp. 1173–1184. (Mental Retardation).
4. Emerson E, et al.(2011): People with learning disabilities in England, http://boltonshealthmatters.org/sites/default/files/IHAL2012-4PWLD2011.pdf
5. European Intellectual Disability Research Network (2003): Intellectual disability in Europe. Canterbury: University of Kent; 2003. http://enil.eu/wp-content/uploads/2012/07/Intellectual-Disability-in-Europe.pdf
6. Hocking J., Pearson A. and McNeil J. (2013): Physiotherapy to improve gross motor skills in people with intellectual disability: a systematic review protocol, jbisrir 11(12) 94-108
7. Joshi, J. and Kotwal, P. (1999): Essentials of orthopaedics and applied physiotherapy, 1st edn. B.I. Churchill Livingstone pvt. Ltd.
8. Kisner C. and Colby L.A. (1996): Therapeutic exercise foundation and techniques, 3rd edn. Jaypee brothers
9. LR Levangie PK, Norkin CC (2011): Joint structure and function: a comprehensive analysis. FA Davis
10. Martin J.P., (1977): A short essay on posture and movement. JNNP., 40,25-29
11. O'Sullivan S.B, Schmitz T.J. and Fulk G.D (2016): Physical Rehabilitation, 6th edn. Jaypee brothers
12. Probst M., (2017): Physiotherapy and mental health, Intech open, 179-204
13. Raine S, Meadows L, Ellerington ML. (2009): Bobath Concept: Theory and Clinical Practice in Neurological Rehabilitation, Blackwell Publishing
14. Tecklin J.S. (2008): Pediatric Physical Therapy, 4th edn. Lippincott Williams & wilkins

15. Thomson A., Skinner A. and Piercy J. (1996): Tidy's Physiotherapy, 12th edn. Varghese publishing house

16. Sharrard, W.J. (1955): Muscle recovery in poliomyelitis. J. Bone Jt. Surg. 37-B: 63

17. Sunder, S. (2002): Text book of rehabilitation, 2nd edn. Jaypee brothers

18. Walker W. (2019): Traumatic brain injury retrieved from https://www.physio-pedia.com/index.php?title=Traumatic_Brain_Injury

19. Wolting R.(2019):Cerebral palsy retrieved from https://www.physio-pedia.com/index.php?title=Cerebral_palsy

20. World Confederation for Physical Therapy. WCPT guideline for the development of a system of legislation/regulation/recognition of physical therapists. London, UK: WCPT; 2011. www.wcpt.org/guidelines/regulation-legislationNETAJI SUBHAS OPEN UNIVERSITY

Unit - 3 ❑ Occupational Therapy

Structure

3.1 Introduction

As rehabilitation professional you will be familiar with the term multi disciplinary team. Multidisciplinary teams are groups of professionals from diverse disciplines who come together to provide comprehensive assessment and consultation. One of the important professional disciplines represented in the rehabilitation team for Persons with Intellectual Disabilities and associated developmental disabilities is occupational therapy.

Therapy (in Greek: θεραπεία), or treatment, is the attempted remediation of a health problem, usually following a diagnosis. In the medical field, it is synonymous with the word "treatment". A therapeutic effect is a consequence of a particular treatment which is judged to be desirable and beneficial.

Occupational therapy is a profession concerned with promoting health and well being through occupation. The primary goals of occupational therapy are to promote independent living by improving functional performance, performance components such as sensori motor skills and functional skills. Occupational therapists achieve this outcome by enabling people to do meaningful and purposeful activities that will enhance their ability to participate or by modifying the environment to better support participation.

Occupational Therapist also addresses various sensory issues of children with Autism Spectrum Disorders using different therapeutic approaches. School occupational therapists and occupational therapy assistants also work as key contributors within the education team. They support the student's ability to participate in desired daily school activities or occupations." They help children to fulfill their role as students by supporting their academic achievement and promoting positive behaviors necessary for learning.

In this unit we will discuss the about the nature, definition, objectives, functions,

methods and modalities. We will also discuss about hand functions, sensory integration and ways of integrating occupational therapy in class room settings.

3.2 Objectives

On reading this unit you would be able to

- Define occupational therapy and explain its nature, scope and objectives
- Understand the various modalities used in Occupational Therapy
- Explain hand functions, their types and development
- Understand Sensory integration, its nature, importance and development
- Describe the different methods of integrating occupational therapy in the class room context

3.3 Occupational Therapy – Nature, Definition, Objectives, Scope and Functions

3.3.1 Nature & Philosophy of Occupational Therapy

The discipline of occupational therapy evolved from the recognition many years ago that participation in work and other restorative activities improved the health of persons affected by mental or physical illness. In fact, patients have long been employed in the utility services of psychiatric hospitals. In the 19th century the moral treatment approach proposed the use of daily activities to improve the lives of people who were institutionalized for mental illness. By the early 20th century, experiments were being made in the use of arts and craft activities to occupy persons with serious mental disorders. This practice gave rise to the first occupational therapy workshops and later to schools for the training of occupational therapists.

The goal of early occupational therapy was to improve health through structured activities. World War I emphasized the need for occupational therapy, since the physical rehabilitation of veterans provided them an opportunity to return to productive work. In 1917, coincident with the increase in demand to aid veterans in the United States, the National Society for the Promotion of Occupational Therapy (later the American Occupational Therapy Association) was founded. Subsequent advancements in

occupational therapy included the development of techniques used to analyze activities and the prescription of specific crafts and occupations for patients, particularly for young people and for patients within hospitals. In 1952 the World Federation of Occupational Therapists was formed, and in 1954 the first international congress of occupational therapists was held at Edinburgh.

Philosophy of Occupational Therapy

The Philosophy of occupational therapy has evolved over the history of the profession. The philosophy articulated by the founders that have owed much to the ideals of pragmatism and humanism which are collectively considered the fundamental ideologies of the past century.

Basic principles and assumptions of occupational therapy:

1. People are individuals of worth and inherently different from one another
2. Activity is fundamental to well-being
3. Healthy activity maintains a balance between, existing, thinking and acting thus brings meaning to life, culturally and personally
4. When participation in meaningful activity is interrupted, mind and body deteriorate and occupational performance is interrupted
5. A person can through a medium of activity develop adaptive skills required to restore, maintain and acquire function

3.3.2 Definition and meaning of occupational therapy:

Occupational Therapy (O.T.) is a health and rehabilitation profession that helps individuals achieves independence in their lives despite disabilities. OTs specialize in helping people of all ages to lead productive and satisfying lives. Occupational therapy education includes the study of human growth and development with specific emphasis on the social, emotional and physiological effects of illness and injury. (The American Occupational Therapy Association, 2000)

Occupational Therapy is “therapy based on engagement in meaningful activities of daily life (as self-care skills, education, work or social interaction) especially to enable or encourage participation in such activities despite impairments or limitations in physical or mental functioning.” (Merriam-Webster’s Collegiate Dictionary, 2003)

The practice of Occupational therapy means the therapeutic use of everyday life activities (occupations) with individuals or groups for the purpose of participation in roles and situations in home, school, workplace, community, and other settings. Occupational therapy services are provided for the purpose of promoting health and wellness and to those who have or, are at risk for developing an illness, injury, disease, disorder, condition, impairment, disability, activity limitation, or participation restriction. Occupational therapy addresses the physical, cognitive, psychological, sensory, and other aspects of performance in a variety of contexts to support engagement in everyday life activities that affect health, well-being, and quality of life. (Revised Definition of the Representative Assembly for the OT Association, 2004).

Occupational therapy is a client-centred health profession concerned with promoting health and well being through occupation. The primary goal of occupational therapy is to enable people to participate in the activities of everyday life. Occupational therapists achieve this outcome by working with people and communities to enhance their ability to engage in the occupations they want to, need to, or are expected to do, or by modifying the occupation or the environment to better support their occupational engagement. (WFOT 2012)

3.3.3 Scope and Functions of Occupational Therapy

The role of Occupational Therapy allows OTs to work in many different settings, work with many different populations and acquire many different specialties.

- Pediatrics : Often, children need occupational therapy services for the same reasons an adult needs OT services. However, occupational therapists approach intervention in a different way with children. Common conditions that require OT services include, developmental disorders such as Intellectual disabilities , sensory regulation or sensory processing deficits, fine motor developmental delays or deficits, autism, emotional and behavioral disturbances. Occupational therapists, while dealing with children with developmental disabilities especially intellectual disabilities will work towards improving functional performance (ADL, Work & play activities), performance skills such as sensorimotor, cognitive perceptual and social skills and facilitating conducive & accessible environments for these children.
- Acute care hospitals: Acute care is an inpatient hospital setting for individuals

with serious medical conditions usually due to a traumatic event, such as a traumatic brain injury or spinal cord injury. The primary goal of acute care is to stabilize the patient's medical status and address any threats to his or her life and loss of function. Occupational therapy plays an important role in facilitating early mobilization, restoring function, preventing further decline, and coordinating care, including transition and discharge planning. Furthermore, occupational therapy's role focuses on addressing deficits and barriers that limit the patient's ability to perform activities that they need or want to do. This may be related to independence in self-care, home management, work-related tasks, and participating in leisure and community pursuits.

- Rehabilitation centers: These include centers for following up conditions such as Traumatic Brain Injury (TBI), Stroke Cerebro Vascular Accident(CVA), Spinal Cord Injuries, and Head Injuries
- Home health: Occupational therapists who work in this area of practice generally work with clients in the geriatric population who have one or more of the following diagnoses: Alzheimer's disease, arthritis, depression, CVA, generalized weakness, Chronic Obstructive Pulmonary Disease (COPD), or Parkinson's disease. Occupational therapists working with these clients provide intervention to maximize their independence, cognition, and safety.
- Outpatient clinics: (such as hand therapy, orthopedics') Hand therapy is a specialty practice area of occupational therapy that is mainly concerned with treating orthopedic-based upper extremity conditions to optimize the functional use of the hand and arm. Diagnoses seen by this practice area include: fractures of the hand or arm, lacerations and amputations, burns, and surgical repairs of tendons and nerves. Additionally, hand therapists treat acquired conditions such as tendonitis, rheumatoid arthritis and osteoarthritis, and carpal tunnel syndrome.
- Work hardening: This is essentially a specialized program designed to enable people with physical, psychological, and psychosocial issues inhibiting a person's ability to successfully return to work. Work conditioning is similar to work hardening, except work conditioning purely involves improving physical capacities, whereas work hardening improves physical, psychological, and psychosocial factors.

3.3.4 Objectives of Occupational therapy

Children and youth

Occupational therapists work with infants, toddlers, children, youth, and their families in a variety of settings, including schools, clinics, homes, hospitals, and the community. Assessment of a person's ability to engage in daily, meaningful occupations is the initial step of occupational therapy (OT) intervention and involves evaluating a young person's occupational performance in areas of feeding, playing, socializing, daily living skills, and/or attending school Occupational therapists take into consideration the strengths and weaknesses of a child's underlying skills which may be physical, cognitive, or emotional in nature, as well as the context and environmental demands at play. In planning treatment, occupational therapists work in collaboration with parents, caregivers, teachers, and/or the children and teens themselves in order to develop functional goals within a variety of occupations meaningful to the young client.

Early intervention is an extremely important aspect of the daily functioning of a child between the ages of birth-3 years old. This area of practice sets the tone and/or standard for therapy in the school setting. OT's who practice in early intervention develop a family's ability to care for their child with special needs and promote his or her function and participation in the most natural environment as possible. Each child is required to have an Individualized Family Service Plan (IFSP) that focuses on the family's goals for the child. It's possible for an OT to serve as the family's service coordinator and facilitate the team process for creating an IFSP for each eligible child.

Objectives that an occupational therapist addresses with children and youth may take a variety of forms, which include

- Promoting a wellness program in schools to prevent childhood disabilities
- Providing splinting and caregiver education .
- Facilitating handwriting development through providing intervention to develop fine motor and writing readiness skills in school-aged children.
- Providing individualized treatment for sensory processing difficulties.
- Teaching coping skills to a child with generalized anxiety disorder
- Consulting with teachers, counselors, social workers, parents/ caregivers, or any person that works with children regarding modifications, accommodations and

supports in a variety of areas, such as sensory processing, motor planning, visual processing, sequencing, transitions between schools, etc. Instructing caregivers in regard to mealtime intervention for children with autism who have feeding difficulties.

- Modification of the school environment to allow physical access for children with disabilities
- Provide assistive technology to support student success
- Helping to plan instructional activities for implementation in the classroom
- Support the needs of students with significant challenges such as helping to determine methods for alternate assessment of learning
- Helping students develop the skills necessary to transition to post-high school employment, independent living and/or further education (AOTA).

Other settings, such as homes, hospitals, and the community are important environments where occupational therapists work with children and teens to promote their independence in meaningful, daily activities. Also Occupational therapists undertake a growing OT intervention referred to as "Sensory Integration Treatment". This therapy, provided by experienced and knowledgeable pediatric occupational therapists, was originally developed by A. Jean Ayres, an occupational therapist. Sensory integration therapy is an evidence-based practice which enables children to better process and integrate sensory input from the child's body and from the environment, thus improving his or her emotional regulation, ability to learn, behavior, and functional participation in meaningful daily activities.

Recognition of occupational therapy programs and services for children and youth is increasing worldwide. Occupational therapy for both children and adults is now recognized by the United Nations as a human right which is linked to the social determinants of health.

Health and wellness

According to the American Occupational Therapy Association's (AOTA) Occupational Therapy Practice Framework, 3rd Edition, the domain of occupational therapy is described as "Achieving health, well-being, and participation in life through

engagement in occupation". Occupational therapy practitioners have a distinct value in their ability to utilize daily occupations to achieve optimal health and well-being. By examining an individual's roles, routines, environment, and occupations, occupational therapists can identify the barriers in achieving overall health, well-being and participation.

Occupational therapy practitioners can intervene at primary, secondary and tertiary levels of intervention to promote health and wellness. It can be addressed in all practice settings to prevent disease and injuries, and adapt healthy lifestyle practices for those with chronic diseases

Mental health

The occupational therapy profession believes that the health of an individual is fostered through active engagement in one's occupations (AOTA, 2014). When a person is experiencing any mental health need, his or her ability to actively participate in occupations may be hindered. For example, if a person has depression and/or anxiety, he or she may experience interruptions in sleep, difficulty completing self-care tasks, decreased motivation to participate in leisure activities, decreased concentration for school or job related work, and avoidance of social interactions. Occupational therapy practitioners possess the educational knowledge base in mental health and can contribute to the efforts in mental health promotion, prevention, and intervention. Occupational therapy practitioners can provide services that focus on social emotional well-being, prevention of negative behaviors, early detection through screenings, and intensive intervention (Bazyk & Downing, 2017)

Assistive technology

Occupational therapy practitioners, or occupational therapists (OTs), are uniquely poised to educate, recommend, and promote the use of assistive technology to improve the quality of life for their clients. OTs are able to understand the unique needs of the individual in regards to occupational performance and have a strong background in activity analysis to focus on helping clients achieve goals. Thus, the use of varied and diverse assistive technology is strongly supported within occupational therapy practice models.

3.4 Modalities of Occupational Therapy for Persons with Intellectual Disabilties and Associated Disabilities

3.4.1 Occupational Therapy Practice

Occupational therapists and occupational therapy assistants are experts at analyzing the performance skills and patterns necessary for people to engage in their everyday activities in the context in which those activities and occupations occur. (AOTA, 2004b).

The practice of occupational therapy includes

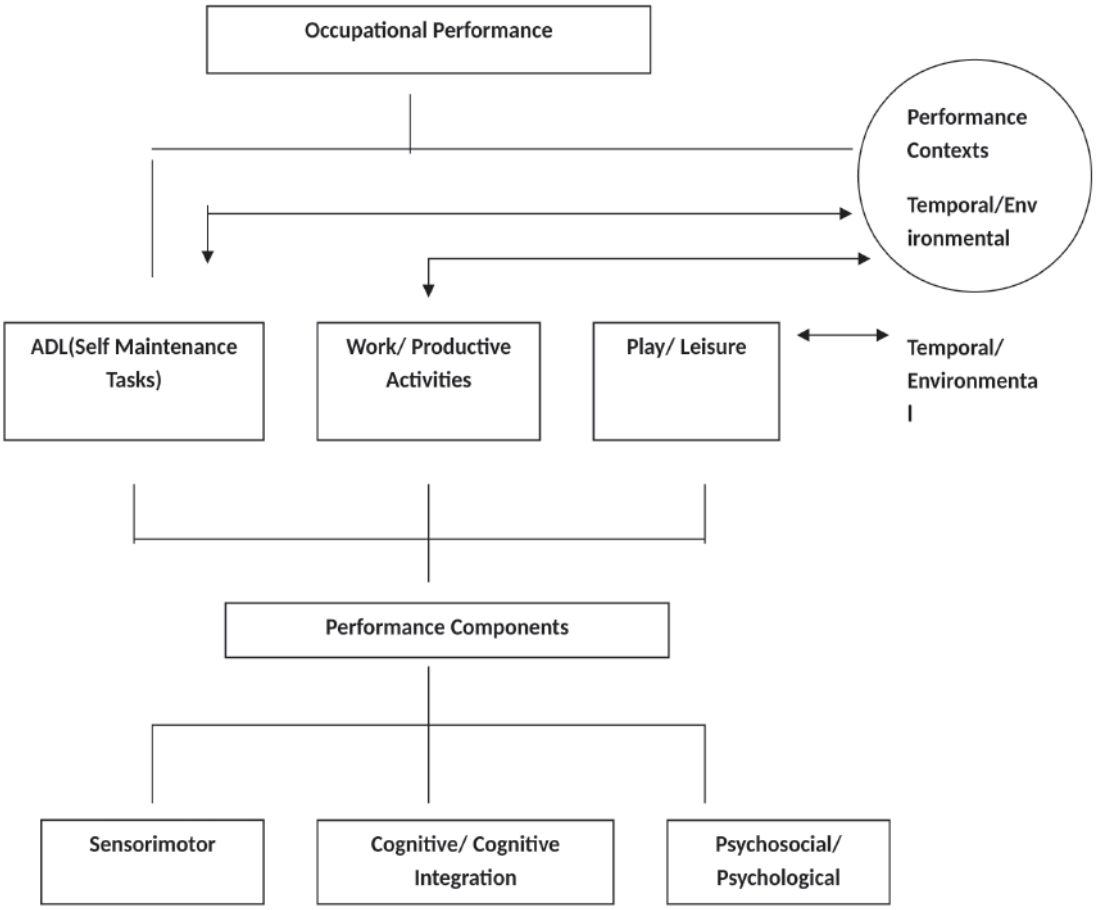
1. Therapeutic use of occupations, exercises, and activities.
2. Training in self-care, self-management, home management, and community/work reintegration.
3. Development, remediation, or compensation of physical, cognitive, neuromuscular, sensory functions, and behavioral skills.
4. Therapeutic use of self, including one's personality, insights, perceptions, and judgments, as part of the therapeutic process.
5. Education and training of individuals, including family members, caregivers, and others.
6. Care coordination, case management, and transition services.
7. Consultative services to groups, programs, organizations, or communities.
8. Modification of environments (home, work, school, or community) and adaptation of processes, including the application of ergonomic principles. Scope of Practice American Occupational Therapy Association
9. Assessment, design, fabrication, application, fitting, and training in assistive technology, adaptive devices, and orthotic devices, and training in the use of prosthetic devices.
10. Assessment, recommendation, and training in techniques to enhance functional mobility, including wheelchair management.
11. Driver rehabilitation and community mobility.
12. Management of feeding, eating, and swallowing to enable eating and feeding performance.

13. Application of physical agent modalities, and use of a range of specific therapeutic procedures (e.g., wound care management; techniques to enhance sensory, perceptual, and cognitive processing; manual therapy techniques) to enhance performance skills. (AOTA, 2004a)

3.4.2 Domains of Occupational Therapy

Occupational Performance

Central to the philosophy and the main domain of concern for occupational therapy process for children with mental retardation is occupational performance. Occupational performance refers to the ability of an individual to perform and be satisfied with their performance in purposeful daily activities within their environment, developmental stage and societal roles. The elements of occupational performance are the performance areas, performance components and performance context.



Performance Areas

The performance areas are activities of daily living (ADL), work and productive activities and play and leisure. ADLs include self maintenance tasks of feeding and eating, grooming, hygiene and functional mobility.

Performance Components

Performance components are the learned developmental patterns of behavior which are the substructure and foundation of the individual's performance.

Performance components include sensory motor component, cognitive integration and cognitive components and the psychosocial skills & psychological components.

Sensori motor components:

Sensori motor components include sensory and perceptual processing, neuromuscular abilities and motor skills.

Sensory and perceptual processing refers to the ability of the child/person to take in, assimilate and interpret sensory information.

Neuromuscular components like reflexes, muscle tone, strength, endurance, postural alignment and control and soft tissue integrity are the foundation for development of motor skills. Motor components refer to gross, fine and oral motor skills.

Motor skills evolve as a direct response to sensory input from the environment. They reflect the child's ability to adapt to the environment; higher level motor skills support and influence cognitive and social development.

Cognitive components

Cognitive components underlie the child's ability to perceive, attend to and learn form the environment. Cognitive ability is required to learn skills in all performance areas-self care, play and school/work. Children with intellectual disabilities have cognitive deficits such as poor concentration, & memory, deficits in concept formation, poor reasoning and judgment, orientation difficulties and poor problem solving skills. They also lack the ability to apply the learning in one situation to other similar situations (Poor transfer of learning and generalization). This creates situation wherein the child has to learn every activity as a new activity, leading to excessive time, effort and frustration which in turn leads to poor learning. The memory deficits further compounds the problems by creating difficulties in retention of learning.

Psycho social components:

Psycho social skills refer to the child's underlying abilities to interact with others, to cope with new or difficult situation and to manage his or her behaviors in socially appropriate ways. Psycho social skills influence the child's ability to establish friendships and other social relationships. Effectively coping with challenging situations and exhibiting socially appropriate actions are aspects of psycho social skills. As psychosocial components of performance mature the child develops values, interests and a self identity.

Children with intellectual disabilities exhibit difficulty in initiating & sustaining conversation, interacting with their peer groups and elders. They do have poor self confidence, low frustration tolerance and poor motivation. These deficits can be attributed to their cognitive, motor and communication difficulties. The motor, cognitive, communication and psycho social development are so closely interlinked that deficit in one areas will automatically affect the other areas.

In this scenario, occupational therapy can help the child with intellectual and developmental disabilities to overcome their sensorimotor, cognitive and psychosocial difficulties through a systematic designed remediation programme planned with due consideration to the performance context.

Performance Context

The environment defines a set of extrinsic factors that support the child's functional performance. Physical, social and cultural dimensions of the environment have great impact on the child's performance.

The social environment refers to family members, peers and other significant adults with whom the child interacts. The physical environment refers to the non human aspects of the environment, space, objects and building structures that constitute the child's immediate environment. Culture refers to the values, beliefs, customs and behaviors of the child's family and of others in his or her community.

3.4.3 Intervention Methods and Modalities of Occupational Therapy

Occupational therapy services may use several different treatment approaches to meet the complex, individual needs of a child or teenager with Intellectual and Developmental Disabilities. Different treatment approaches should not be mixed without reflection on their underlying assumptions. The discussion that follows reflects

suggestions regarding when a specific treatment approach might be used. The ideas should not be viewed as formulas but as options. Decision regarding which approach to follow should be based on each child's strengths and needs, on family priorities, on associated handicapping conditions, on the therapist's specialty skills, treatment objectives and on other services.

Remedial approaches

This approach mainly concentrates on the underlying skill and performance component deficit and attempts to correct it with a notion that this remediation will in turn enhance the performance. Various approaches under remedial approach are developmental approach, sensorimotor approaches like neuro developmental therapy, Rood's approach and sensory stimulation approach.

Educational approach

This approach involves task breakage and simplification, using teaching techniques such as clear and specific instructions, modeling (demos) and physical and verbal promptings.

Compensatory approach

Assisting the persons with Intellectual and Developmental Disabilities to function at maximum level is an important part of occupational therapy services. Assistive devices can help persons to participate in activities such as communication, mobility, self care and play. Planning compensation begins by considering the child's relative needs and the social and the physical environment where the person will function.

This approach involves task method modification, environmental modifications and aids and appliances to promote function in daily living skills, school and leisure activities. eg. built up pencils, padded spoons, reachers, button hooks, writing aids, wheel chair and class room seating modifications.Also devices such as orthosis such as wrist drop splint, aero plane splint, gutter splint, wrist cock up splint, gaiters etc and prosthetic devices like Above & below Elbow prosthesis will be prescribed according to the requirement of the clients.

3.4.4 Intervention Modalities used in Occupational Therapy

Occupational therapists use a variety of modalities to help with treatment. A modality is the employment of therapeutic activities and agents such as whirlpools, hot packs,

cold packs, paraffin, and fluidotherapy. The therapeutic agents either produce heat or cold and are used for a variety of reasons.

Therapeutic activities:

Therapeutic activity is the systematic performance or execution of planned activities intended to enable the patient or client to remediate or prevent impairments of body functions and structures, enhance activities and participation, reduce risk, optimize overall health, and enhance fitness and well-being.

Physical Agent Modalities:

The use of physical agent modalities was controversial in the profession of occupational therapy for many years. But, as professional roles and licensure acts were passed, the use of these modalities by OTs was clarified and approved by the American Occupational Therapy Association (AOTA).In 2008, AOTA published a position paper on the use of physical agent modalities that every occupational therapist should review prior to using modalities. It emphasizes that PAMs are used by OTs as treatments to prepare an area for other treatment techniques, such as functional activity.

PAMs may also be used concurrently with therapeutic activity or exercise. The use of PAMs without applying their effects to occupational performance is not considered occupational therapy. OTs should always use PAMs with the ultimate goal of improving their patients' functional abilities. Some PAMs may be useful in certain situations, while others may be contraindicated. The purposes of these PAMs also vary, and several PAMs are discussed in the next section.

Superficial Thermal Agents

Superficial thermal agents cause a change in temperature within a few millimeters of the surface of the skin. This temperature change promotes blood flow, which brings oxygen to the area and promotes healing. The change in temperature also activates enzymes that enhance healing.

- Hot packs are made from a variety of materials and can even be homemade. They are designed to carry heat between 1 to 8 hours and this temperature decreases over time. These packs increase blood flow and promote healing. They decrease tissue tightness and pain as well.
- Whirlpool is a hydrotherapy, or water therapy, intervention that involves warm

water. This heat promotes healing and increases blood flow to an affected area. Whirlpool is also used in wound care to debride, or clean up, wounds by removing dead tissue.

- Cold packs can be used in acute injuries to decrease blood flow to an area of the body. They do so by decreasing the diameter of blood vessels. This causes pain relief and a decrease in swelling.
- Paraffin is a wax that can be used to treat pain and/or stiffness in smaller areas like the hands or feet. It is contained in a container that keeps it warm. It is used in conjunction with mitts to contain the heat during treatment. This is often done prior to other OT interventions after the tissue is more pliable.
- Infrared lamps transmit electromagnetic radiation that penetrates the tissue in an area of pain. There are several forms of infrared treatment units including lasers. Infrared decreases pain and tissue tightness.
- Fluidotherapy is a dry heating PAM that uses convection to transfer heat. This is also ideal for smaller body parts like hands and feet, which are inserted into openings in the unit. The treated body part is warmed by circulating corn meal that acts similarly to a fluid and transfers heat. Like other heating agents, this prepares the tissue to be stretched, decreases pain, and increases mobility.
- Contrast Bath

A contrast bath is a specific thermal agent technique where the hand or arm is alternately immersed in warm water and cold water or ice. The technique is primarily used to reduce edema and increase blood flow.

Deep Thermal Agents

Heating agents cause oxygen to be released into the tissue more rapidly, which increases healing. Acute injuries, which happened within 48 to 72 hours, should be treated by deep heat agents with caution because the area is already inflamed. Edema, or swelling, is enhanced by heat, and swollen areas should be treated by heat with precaution.

- Diathermy is used for many therapeutic purposes, including reducing swelling and pain and increasing range of motion and flexibility. This treatment transmits high frequency electromagnetic energy into tissue, where tissue resistance to the energy generates heat.

- ❖ Ultrasound uses a high-frequency sound wave that can generate thermal or nonthermal effects. Nonthermal effects include tissue repair, in which cells in an affected area divide to replace damaged tissue. It can effectively heat tissues that contain a great deal of collagen, like tendons and ligaments. This promotes healing and can increase the available range of motion in a treated joint. Certain ultrasound settings can also decrease swelling.
- ❖ Phonophoresis is a treatment to an area with ultrasound and topical medication to deliver drugs into the affected area. In addition to the effects of ultrasound, phonophoresis can also decrease inflammation and/or break down tissue depending on Electrotherapeutic agents use various forms of electric current to provide treatment to an area. Depending on the type of current used, these modalities can help relieve pain, reduce edema and inflammation, promote tissue healing, and facilitate muscle function and strength.

Electrotherapeutic agents are more easily incorporated into occupational therapy treatment than other modalities because they lend themselves well to use during functional activities. Most electrical stimulation units include settings for all of the various electrotherapy types.

The following is a list of the more commonly used electrotherapeutic agents.

Transcutaneous Electrical Nerve Stimulation (TENS)

TENS uses electrical currents to stimulate the nerve endings at frequencies that reduce pain. Electrodes are placed surrounding the painful area to provide specific types of electrical current to block pain receptor signals from being sent to the brain.

Neuromuscular Electrical Stimulation (NMES)

Neuromuscular electrical stimulation uses electrical currents to facilitate muscle contraction. Electrodes are placed on specific points of the muscles to elicit contraction with adjustable current intensities.

NMES is often used to help strengthen weak muscles and promote normal muscle movement patterns when used in conjunction with functional activities.

Functional Electrical Stimulation (FES)

Functional electrical stimulation uses the same types of electrical currents as NMES but uses shorter pulse frequencies. It is often used to help a patient initiate a muscle movement when more active movement is present in the muscle.

Iontophoresis

This electro modality uses a mild electrical current to push medication through the skin to underlying tissues. Medication is contained in a water-based medium that is usually prepackaged into an electrode. The electrodes are placed on the affected area and the iontophoresis unit is used to deliver the medication, which is usually lidocaine or hydrocortisone.

Iontophoresis is used to reduce pain, inflammation and edema in an affected area and is often used as an alternative to cortisone injections.

3.5 Hand Functions

3.5.1 Motor Skills :

A motor skill is a learned ability to cause a predetermined movement outcome with maximum certainty. The goal of motor skills is to optimize the ability to perform the skill at the rate of success, precision, and to reduce the energy consumption required for performance. Motor skills are movements and actions of the muscles. Typically, they are categorized into two groups:

Gross motor skills – require the use of large muscle groups to perform tasks like walking, balancing, and crawling. The skill required is not extensive and therefore are usually associated with continuous tasks. Much of the development of these skills occurs during early childhood. The performance level of gross motor skill remains unchanged after periods of non-use. Gross motor skills can be further divided into two subgroups: locomotor skills, such as running, jumping, sliding, and swimming; and object-control skills such as throwing, catching and kicking.

Fine motor skills – requires the use of smaller muscle groups to perform smaller movements with the wrists, hands, fingers, and the feet and toes..These tasks that are precise in nature, like playing the piano, writing carefully, and blinking. Generally, there is a retention loss of fine motor skills over a period of non-use. Discrete tasks usually require more fine motor skill than gross motor skills. Fine motor skills can become impaired.

Some reasons for impairment of motor skills could be injury, congenital deformities, cerebral palsy, and developmental disabilities

3.5.2 Hand Functions

Fine motor activities which are performed using wrist, hands and fingers are otherwise known as Hand functions. Hand function is an important part of the human movement repertoire, and is essential in many activities that demand well-coordinated hand and arm movements. The hand can be used to communicate through gestures and sign language, and can be used to show love. In daily activities like cooking, driving, or combing one's hair, the hand enables us to manipulate different objects and use tools. At work, the hand function is essential, from the grip strength that builders need to the extremely fine coordination required for microsurgery. Nor can we forget the role of the hand in art like painting and playing music. The way of functioning of hand works in healthy persons is not fully understood in detail, and it is an exciting challenge to understand how the nervous system can control such a complex system.

Motor control of the human hand

Adequate motor control of the hand is crucial for different reasons, as exemplified in the beginning of the introduction. Motor control can be defined as the ability to regulate or direct the mechanisms essential to movement. The hand is indeed a highly specialized part of the human body. It consists of 27 bones and 29 muscles (38 when subdivisions are counted) that control the hand. Voluntary movements require contraction and relaxation of muscles, recruitment of appropriate muscles, appropriate timing, and sequencing of muscle contraction and relaxation. When moving the hand, these aspects of this complex anatomical system need to be controlled, including all muscles and joints with more than 20 degrees of freedom.

Experimental evidence indicates that the simultaneous motion and force of the fingers is characterized by coordination patterns that reduce the number of independent degrees of freedom to be controlled. The motor and sensory innervations of the hand are provided by the radial, median and ulnar nerves. The areas of the cerebral cortex that contribute directly to the control of hand movements include the primary motor cortex, the supplementary motor area, the presupplementary motor area, and the premotor cortex.

The motor cortical areas receive inputs from subcortical motor areas such as the basal ganglia and the cerebellum. Finger movements are controlled by a highly distributed network in the brain rather than by functionally and spatially discrete groups of neurons controlling each finger. A structure of particular interest is the cerebellum, which contains 10% of the total volume of the brain, but more than half of its neurons . Forty times

more axons project into the cerebellum than exit from it. The cerebellum is involved with planning and executing movement, regulation of postural control, and serving in a comparator and corrector role. Its unique construction and connections allow it to upgrade and integrate information about the outside world continuously with information about body position, movement, and signaling along central motor pathways. In relation to control of the hand, the contribution of cerebellar regions to appropriate scaling and timing of the grip force profile is poorly understood.

Recent studies indicate that, in addition to exerting a unilateral control, the cerebellum also controls contralateral movements.

Grip and grasp

As verbs the difference between grip and grasp that grip is to take hold of , particularly with the hand while grasp is to grip : to take hold particularly with the hand

Types of grasp/grips:

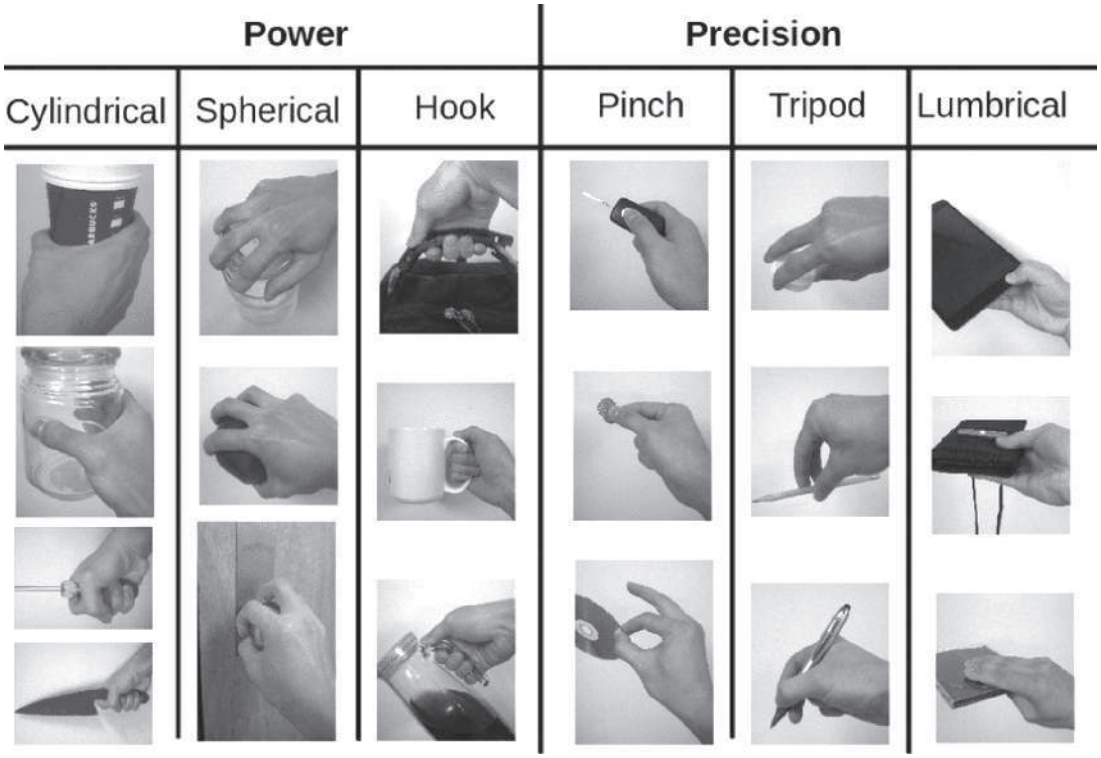
The number of ways that objects of varying sizes and shapes can be grasped is nearly infinite; however, a broad classification system for grasp has evolved that makes it easier to observe. Prehension refers to those activities in which the hand reaches to grasp an object. Prehension can be categorized as either power grip or precision handling .There are three varieties of power hand grip: cylindrical, spherical, and hook grip. There are also varieties of pinch grips: key pinch (also named lateral pinch), tip pinch (also named two-point pinch), and three point pinch (also named three-jaw chuck pinch or tripod pinch.

3.5.3 Development of hand function in children

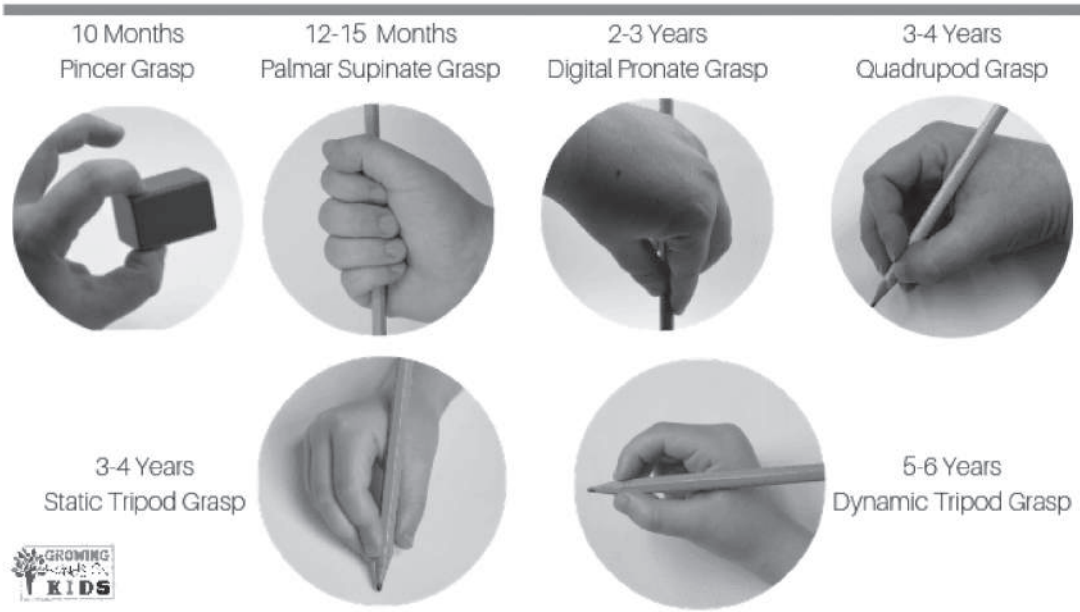
Different theories of motor development have evolved over time, but current thinking suggests that development is a complex outcome of the maturation of multiple physiological systems in combination with the demands placed on children by the environment and by task-related experience.

Motor skills develop in different parts of a body along three principles:

- Cephalocaudal – development from head to foot. The head develops earlier than the hand. Similarly, hand coordination develops before the coordination of the legs and feet. For example, an infant is able to follow something with their eyes before they can touch or grab it.



TYPICAL PENCIL GRASP DEVELOPMENT FOR HANDWRITING



- ❖ Proximodistal – movement of limbs that are closer to the body develop before the parts that are further away, such as a baby learns to control the upper arm before the hands or fingers. Fine movements of the fingers are the last to develop in the body.
- ❖ Gross to specific – a pattern in which larger muscle movements develop before finer movements. For example, a child only being able to pick up large objects, to then picking up an object that is small between the thumb and fingers. The earlier movements involve larger groups of muscles, but as the child grows finer movements become possible and specific things can be achieved.

Developmental stages :

Through each developmental stage of a child's life and throughout our lifetime motor skills gradually develop. They are first seen during a child's development stages: infancy, toddler-hood, preschool and school age. "Basic" fine motor skills gradually develop and are typically mastered between the ages of 6-12 in children. These skills will keep developing with age, practice and the increased use of muscles while playing sports, playing an instrument, using the computer, and writing.

Infancy

The first motor skills, beginning from birth, are initially characterised by involuntary reflexes. The most notable involuntary reflex is the Darwinian reflex, a primitive reflex displayed in various newborn primates species. These involuntary muscle movements are temporary and often disappear after the first two months. After eight weeks, the infant will begin to voluntarily use their fingers to touch. However, their ability to grab objects is still undeveloped at this point.

At two to five months the infant will begin to develop hand-eye coordination, and they will start reaching for and grasping objects. In this way, they improve their overall grasping skills.

The next developmental milestone is between seven and twelve months, when a series of fine motor skills begins to develop. These include, but are not limited to, increase in grip, enhancement of vision, pointing with the index finger, smoothly transferring objects from one hand to the other, as well as using the pincer grip (with the thumb and index fingers) to pick up tiny objects with precision. A lot of factors change in grasping when the infant becomes seven months. The infant will have better chance

of grasping due to the fact that the infant can sit up on their own. Therefore, the infant will not fall over. The infant grasping also changes. The infant starts to hold objects more properly when age increases.

Toddler-hood

By the time a child is one year old, their fine motor skills have developed to allow the manipulation of objects with greater intent. As children manipulate objects with purpose, they gain experience identifying objects based on their shape, size, and weight. By engaging in hands-on play the child learns that some objects are heavy, requiring more force to move them; that some are small, easily slipping through the fingers; and that other objects come apart and can possibly be put back together again. This type of play is essential for the development of not only the child's fine motor skills, but also for learning how the world works. It is during this stage in the development of fine motor skills that a toddler will show hand dominance.

Preschool

Children typically attend preschool between the ages of 2 and 5. At this time, the child is capable of grasping objects using the static tripod grasp, which is the combined use of the index, thumb, and middle finger. A preschooler's motor skills are moderate, allowing the child to cut shapes out of paper, draw or trace over vertical lines with crayons, button their clothes, and pick up objects. A preferred hand dominates the majority of their activities. They also develop sensory awareness and interpret their environment by using their senses and coordinate movements based on that.

After the static tripod grasp, the next form is the dynamic tripod grasp. These are shown in a series through Schneck and Henderson's Grip Form chart. Based on the accuracy and form of hold the child will be ranked either from 1-10 or 1-5 of how well they are able to complete the dynamic tripod grasp while properly writing. In conjunction with accuracy and precision the child will be able to properly position a writing utensil in terms of implement diameter as well as form and grip strength. Proper handwriting and drawing fall deeper into a category of graphomotor skills.

The National Center of Teaching and Learning illustrates the abilities that preschoolers should have improved through their fine motor skills in several domains. Children use their motor skills by sorting and manipulating geometric shapes, making patterns, and

using measurement tools to build their math skills. By using writing tools and reading books, they build their language and literacy. Arts and crafts activities like cutting and gluing paper, finger painting, and dressing up develops their creativity. Parents can support this development by intervening when the child does not perform the fine motor activity correctly, making use of several senses in a learning activity, and offer activities that the child will be successful with. Developmental disabilities may render a child incapable of performing certain motor activities, such as drawing or building blocks.

School age

During the ages between 5 and 7 the fine motor skills will have developed to a much higher degree, and are now being refined. As the child interacts with objects the movements of the elbows and shoulders should be less apparent, as should the movements of wrist and fingers. From the ages of 3–5 years old, girls advance their fine motor skills more than boys. Girls develop physically at an earlier age than boys; this is what allows them to advance their motor skills at a faster rate during prepubescent ages. Boys advance in gross motor skills later on at around age 5 and up. Girls are more advanced in balance and motor dexterity.

Children should be able to make precise cuts with scissors, for example, cutting out squares and holding them in a more common and mature manner. The child's movements should become fluid as the arms and hands become more in sync with each other. The child should also be able to write more precisely on lines, and print letters and numbers with greater clarity. In terms of motor development and athletic performance, pediatric boys tend to be much more physically active than pediatric girls by nature and have a harder time staying still for long periods of time. This is due to the early development of motor skills that occurs in boys faster than it does in girls. During the first 2–3 years of elementary school, gross motor skills are similar among girls and boys with basic skills such as being able to run, jump, and toss a ball. However, boys start to develop more gross motor skills that give them an advantage in activities where girls may still be working on the basics. Boys' high energy and choice to be a part of large groups comes from their gross motor skills being developed. In general, pediatric girls tend to fall behind pediatric boys in terms of advancement of gross motor skills toward the end of elementary school.

FINE MOTOR SKILLS CHART

FINE MOTOR SKILLS CHART	
Age	Skill
One to three months	Reflexively grasps finger or toy placed in hand.
Three months	Grasping reflex gone. Briefly holds small toy voluntarily when it is placed in the hand.
Four months	Holds and shakes rattle. Brings hands together to play with them. Reaches for objects but frequently misses them.
Five months	Grasps objects deliberately. Splashes water. Crumples paper.
Six months	Holds bottle. Grasps at own feet. May bring toes to mouth.
Seven months	Transfers toy from hand to hand. Bangs objects on table. Puts everything into the mouth. Loves playing with paper.
Nine months	Able to grasp small objects between thumb and forefinger.
Ten months	Points at objects with index finger. Lets go of objects deliberately.
Eleven months	Places object into another's hand when requested, but does not release.
Twelve months	Places and releases object into another's hand when requested. Rolls ball on floor. Starts to hold crayon and mark paper with it.
Fifteen months	Builds tower of two blocks. Repeatedly throws objects on floor. Starts to be able to take off clothing, starting with shoes.
Eighteen months	Builds tower of three blocks. Starts to feed self well with spoon. Turns book pages two or three at a time. Scribbles on paper.
Two years	Builds tower of six or seven blocks. Turns book pages one at a time. Turns door knobs and unscrews jar lids. Washes and dries hands. Uses spoon and fork well.
Two and a half years	Builds tower of eight blocks. Holds pencil between fingers instead of grasping with fist.
Three years	Builds tower of nine or ten blocks. Puts on shoes and socks. Can button and unbutton. Carries containers with little spilling or dropping.
Four years	Dresses self except for tying. Cuts with scissors, but not well. Washes and dries face.
Five years	Dresses without help. Ties shoes. Prints simple letters.
www.NCLEXQuiz.com	

https://courses.lumenlearning.com/educationalpsychology/chapter/gender-differences-inthe-classroom/

3.5.3 Eye Hand Coordination :

Eye–hand coordination (also known as hand–eye coordination) is the coordinated control of eye movement with hand movement and the processing of visual input to guide reaching and grasping along with the use of proprioception of the hands to guide the eyes. Eye–hand coordination has been studied in activities as diverse as the movement of solid objects such as wooden blocks, archery, sporting performance, music reading, computer gaming, copy-typing, and even tea-making. It is part of the mechanisms of performing everyday tasks; in its absence, most people would be unable to carry out even the simplest of actions such as picking up a book from a table or playing a video game.

Neural Mechanism :

The neural control of eye–hand coordination is complex because it involves every part of the central nervous system involved in vision: eye movements, touch, and hand control. This includes the eyes themselves, the cerebral cortex, subcortical structures (such as the cerebellum, basal ganglia, and brain stem), the spinal cord, and the peripheral nervous system. Other areas involved in eye–hand coordination that have been studied most intensely are the frontal and parietal cortex areas for the control of eye saccades and hand-reach. Both of these areas are believed to play a key role in eye–hand coordination and the planning of movements during tasks.

A more specific area, the parieto occipital junction, is believed to be involved in the transformation of peripheral visual input for reaching with the hands, as found via fMRI. This region in particular has subdivisions for reach, grasp, and saccades. In addition to the parieto–occipital junction, the posterior parietal cortex is believed to play an important role in relating proprioception and the transformation of motor sensory input to plan and control movement with regard to visual input.

Many of these areas, in addition to controlling saccades or reach, also show eye position signals that are required for transforming visual signals into motor commands. In addition, some of the areas involved in reach, like the medial intraparietal cortex, show a gaze-centered remapping of responses during eye movements in both monkeys and humans. However, when single neurons are recorded in these areas, the reach areas often show some saccade-related responses and the saccade areas often show some reach related responses. This may aid in eye–hand coordination or hint at the ability of cells to wire together as they're used more frequently.

Numerous disorders, diseases, and impairments have been found to result in disruption to eye–hand coordination, owing to damage to the brain itself, degeneration of the brain due to disease or aging, or an apparent inability to coordinate senses completely

Importance of Eye Hand Coordination :

Good eye-hand coordination can help the child in so many different areas of life. Here are just a few:

Sports: Hand eye coordination can help your child to catch a ball and hit a ball with a bat, and then graduate to more intense sporting demands.

Handwriting: Visual-motor integration, which is a vital base for handwriting, grows out of this coordination skill. The eyes need to guide the hand in forming the letters and making sure they stay within the lines.

Reading: Eye tracking skills, which are vital for reading, can be developed through games and activities used for hand eye coordination.

Play and Life Skills: Young children use this skill in learning to stack towers, build with lego etc. We also need our eyes to guide our hands when we tie shoelaces and frost cakes!

3.5.4 Activities for improving hand function

Certain types of activities work on fine motor skills in ways that strengthen fingers, works on hand eye coordination and helps with their precision

1. Pom Poms in general are small, needing small movements to grasp them, pick them up, and move them. They are fantastic material to work on hand eye coordination.
2. Buttons are also small items that work great in developing fine motor skills. Picking them up works those small muscles, But the true fine motor skills comes in the act of buttoning something up, that takes some amazing finger strength and hand eye coordination.
3. Paper Clips are great for finger movements and manipulation. Being able to slide the clip onto a piece of paper takes a lot of concentration for kids in preschool and kindergarten.

4. Clothespins are a fantastic material for building finger strength. We use them a lot in our learning activities that the kids absolutely love.
5. Rubber Bands also work on finger strength, but in the opposite way that most materials do. These are a fantastic addition to any fine motor activity!
6. Tweezers take a lot of hand eye coordination to be able to operate successfully and move an item from one place to another. Try it!
7. Straws can be used as beads, to thread onto something! But they also work great with play dough too.
8. Play Dough is fantastic for building those small muscles! Kneading, pushing and rolling the dough really helps! Find out how to make homemade playdough.
9. Knobs and Screws (or Nuts and Bolts), any real tool from Dad's toolbox is a hit for my kids! These also take incredible hand eye coordination and concentration to be able to tighten and loosen.
10. Stickers are amazing! Have your child try to peel the stickers off the sticker sheet! If it's tricky, you can remove the non-sticker part of the sheet and it's still an amazing fine motor activity. And then placing the sticker on a paper also takes hand control.

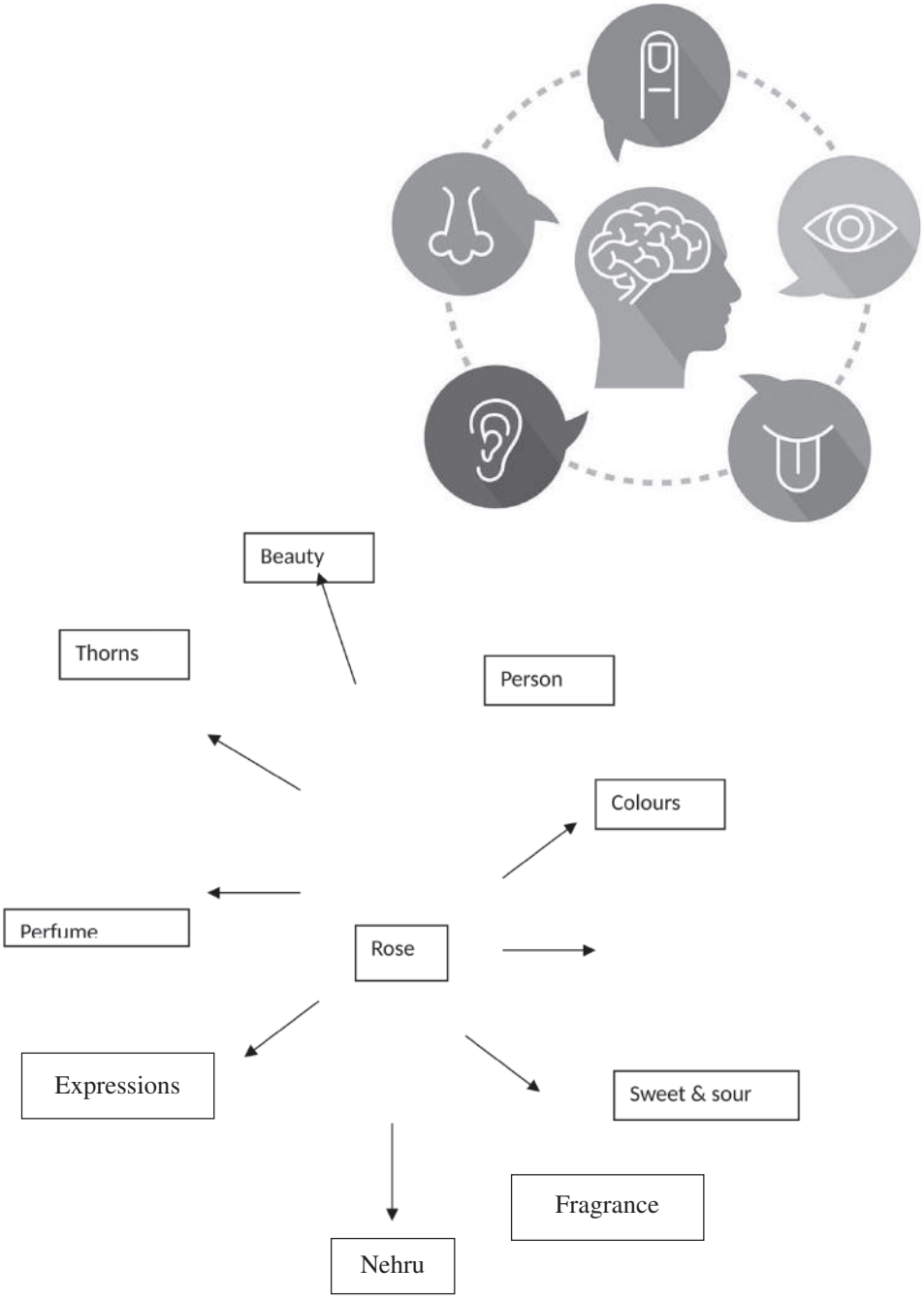
3.6 Sensory Integration

3.6.1 Sensory Integraton:

Sensory integration theory was proposed and developed in 1960s, by Jean Ayres, an occupational therapist and psychologist. Grounding her theoretical constructs on neuro physiology and psychology, she intended to explain the relationship between behavior and neural functioning especially sensory processing. During the initial periods of its evolution, this theory is commonly identified with learning disabled, however recently extended to include other forms of neuro behavioral problems including Intellectual disabilities, autism, related pervasive developmental disorders and behavioral problems

"Sensory integration is the neurological process that organizes the spatial and temporal aspects of sensory inputs from one's own body and the surrounding environment and makes it possible to use the body effectively" Jean Ayres (1989)

As the name indicates, Sensory Integration stands for assimilation of information from various senses and planning an appropriate response. This is a complex process, which involves four basic steps -input, orientation, habituation, and modulation.



The brain can be considered a prisoner in the solitary confinement of the skull and it has to rely entirely on the information provided by the senses. The brain perceives objects as what the senses say rather than what the object is. Perception is largely subjective rather than objective.

As we had seen, the Rose can be recognized by its different characters and it is our senses which gives us a complete picture of the flower.

Eg.	Fragrance/perfume	smell
	Beauty, colour	vision
	Thorns	vision, touch, etc.
	Sweet and sour	taste

We need more than one sense to understand anything and without integration of the relevant senses, one can imagine the difficulty one would have in understanding the world.

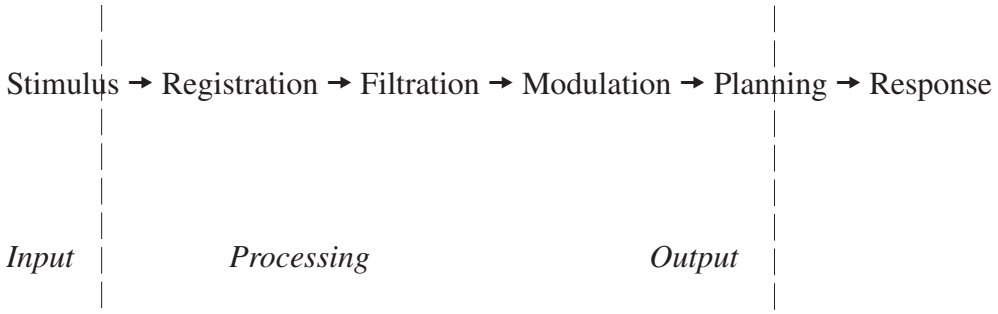
3.6.2 Importance of Sensory Integration :

Sensory Processing/Sensory Integration is when our different sensory systems work together to process different sensations from our body and/or environment. When this occurs, we are able to identify and give meaning to the different sensations we experience to accomplish daily activities and move in a coordinated manner. Adversely, Sensory Processing Disorder is the inability to receive and efficiently use sensory information. Difficulty in processing sensory information interferes in our daily activities and impacts our functional ability to perform different tasks.

Our sensory systems tell us what is going on around us or in the environment. Our bodies absorb different sensory inputs, which our brain then interprets and translates. We have 8 different sensory systems that we must know: proprioception, vestibular, tactile, auditory, olfactory, oral and visual.

3.6.3 Process Of Sensory Integration

Have you ever imagined what happens in our brain when we perform any activity or when we react to information from the environment. What happens when a mosquito bites and why do you scratch immediately or why do you close your ears when you hear a loud sound such as that produced by slamming of the door.



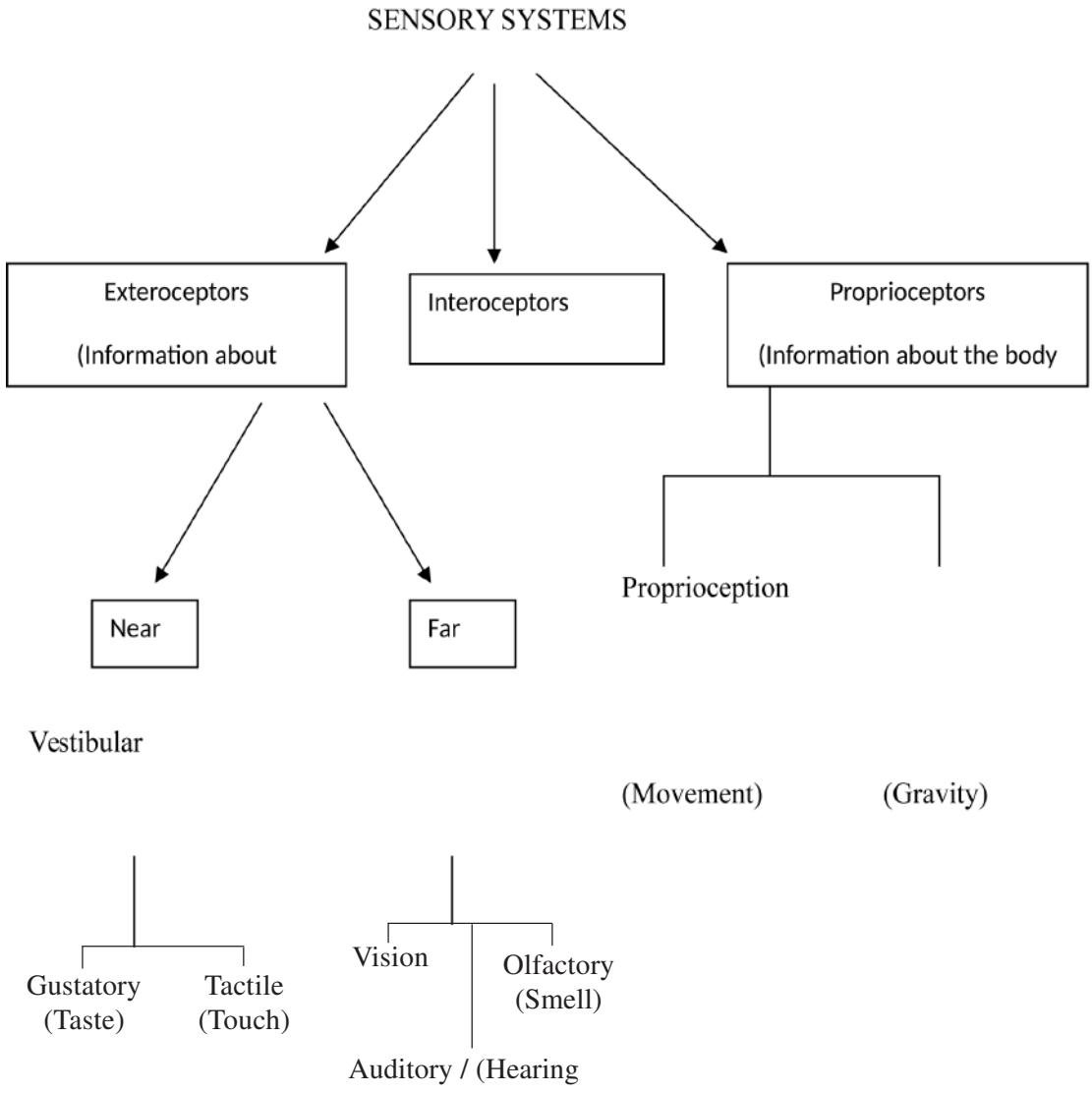
You are going in a two-wheeler in an arterial road of a city with heavy traffic, you see a lot of things, the vehicles, people, traffic signals, shops on the roadside, advertisement hoardings, etc. but you do not attend to each one of them. Rather, you filter out all irrelevant information and attend to your priorities i.e., the person /vehicle ahead and the traffic signal. You then modulate (adjust your sensitivity) to the particular stimulus and then plan accordingly. It could be slowing down or halting at the signal. When you execute this, it is called a response.

Adaptive Response

Adaptive Response is the ability to successfully meet the demands of the challenging environment in an appropriate manner. Eg. When you have to cross a closed railway gate, you bend and go. An adaptive response indicates that integration of senses has occurred. An adaptive response could be motor (movement), autonomic (sweating) or emotional (happiness).

Nature of Sensory Integration :

Sensory processing and integration requires optimal functioning of the eight sensory systems



DESCRIPTION OF THE EIGHT SENSORY SYSTEMS

1. Visual - The visual system is responsible for seeing
2. Olfactory - The olfactory system is responsible for processing smell.

3. Auditory - The auditory system is responsible for hearing
4. Gustatory - The Gustatory system is responsible for the sense of taste
5. Tactile sensory system - The tactile system is responsible for processing touch information from the body
6. Proprioceptive system (Sensations from muscles and joints of the body)

The proprioceptive system (sometimes abbreviated as "prop" by therapists when they talk about it) senses the position, location, orientation, and movement of the body muscles and joints. Proprioception provides us with the sense of the relative position of neighboring parts of the body and effort used to move body parts.

7. Vestibular system (Sense of head movement in space) The vestibular system contributes to balance and orientation in space. It is the leading system informing us about movement and position of head relative to gravity
8. Introception

The eighth, often neglected, but frequently problematic sensory system in SPD is the Interoceptive System. Interoception refers to sensations related to the physiological/ physical condition of the body. Interoceptors are internal sensors that provide a sense of what our internal organs are feeling. Hunger and thirst are examples of interoception.

Interoception detects responses that guide regulation, including hunger, heart rate, respiration and elimination. The Interoceptive stimulation is detected through nerve endings lining the respiratory and digestive mucous membranes. Interoception works the vestibular and proprioceptive senses to determine how an individual perceives their own body. Wellmodulated interoception helps the individual detect proprioceptive and vestibular sensation normally. For example, if a person feels his/her heart pounding, while it is not comfortable, trauma from the stimulation is not likely; nor will the stimulation be craved. The same is true for hunger and thirst, as well as the feeling of the need to urinate or have a bowel movement.

3.6.4 Management of Sensory Integration Issues

For many people small adjustments to their environment or to the way they are allowed to move at school or at work can make a huge difference to how they manage their day to day life. We offer a range of courses for parents, teachers and other

professionals to help you understand more about sensory integration difficulties and think about changes you can make to your environment or the way you manage work, play or school that will make these activities more accessible to people with sensory integration difficulties.

Ayres' Sensory Integration intervention (or ASI) is a term used to describe intervention developed by Ayres to improve or develop sensory integration for children and adults with sensory integration difficulties. Therapists need specific training to understand the complex reasoning underpinning this therapy.

3.7 Inegrating Occupational Therapy In Class Room

3.7.1 School Based Occupatitonal Therapy

School occupational therapists and occupational therapy assistants are key contributors within the education team. They support a student's ability to participate in desired daily school activities or "occupations." They help children to fulfill their role as students by supporting their academic achievement and promoting positive behaviors necessary for learning. School occupational therapists (and occupational therapy assistants, under the supervision of the occupational therapist) support academic and non-academic outcomes, including social skills, math, reading and writing (i.e., literacy), behavior management, recess, participation in sports, self-help skills, prevocational/ vocational participation, transportation, and more. Because of their expertise in activity and environmental analysis, practitioners are particularly skilled in facilitating student access to curricular and extracurricular activities. They focus on the students' strengths, and can design and implement programming to improve inclusion and accessibility, such as Universal Design for Learning. Additionally, they play a critical role in educating parents, educators, administrators and other staff members. They offer services along a continuum of prevention, promotion, and interventions and serve individual students, groups of students, whole classrooms, and whole school initiatives. They collaborate within the education team to support student success. In this way, occupational therapy practitioners can contribute within both general and special education.

Occupational therapy practitioners have specific knowledge and expertise to increase participation in school routines throughout the day. Interventions include:

- Conducting activity and environmental analysis and making recommendations to improve the fit for greater access, progress, and participation
- Reducing barriers that limit student participation within the school environment
- Providing assistive technology to support student success
- Supporting the needs of students with significant challenges, such as by helping to determine methods for alternate educational assessment and learning
- Helping to identify long-term goals for appropriate post-school outcomes
- Helping to plan relevant instructional activities for ongoing implementation in the classroom
- Preparing students for successfully transitioning into appropriate post–high school employment, independent living, and/or further education

Occupational therapy practitioners are key contributors within the educational team. They help to address both mental and physical health. They collaborate with a variety of partners, such as:

- Students, to help them to develop self-advocacy and self-determination skills in order to plan for their future and transition to college, career/employment, and community living; improve their performance in learning environments throughout the school (e.g., playgrounds, classrooms, lunchrooms, bathrooms); and optimize their performance through specific adaptations and accommodations Occupational Therapy in School Settings.

Occupational therapy enables people of all ages live life to its fullest by helping them to promote health, make lifestyle or environmental changes, and prevent or live better with injury, illness, or disability. By looking at the whole picture a client's psychological, physical, emotional, and social make-up—occupational therapy assists people to achieve their goals, function at the highest possible level, maintain or rebuild their independence, and participate in the everyday activities of life.

- Parents, to support their engagement with school activities such as attendance in individualized education program (IEP) meetings with cultural sensitivity, or to assist in homework management issues by monitoring stress levels and volume of work

- Educators and other school support staff, to offer curricular modifications to support diverse learning abilities and to meet state learning standards
- Paraeducators, to support child success and promote safety within the school environment such as reducing autism wandering on playgrounds (e.g., physical and behavioral assistance needs)
- Administrators, to provide training for students, staff, and parents, such as offering recess promotion strategies or contributing to anti-bullying initiatives, as well as to recommend equipment for schools and ways to modify existing buildings and curriculum to allow access for all.

Occupational therapy services for students with special needs are determined through the IEP process. School-based occupational therapy is available for students who are eligible for special education. Occupational therapists complete evaluations and assessments, and work with other members of the school-based team to help determine what is needed for a student to receive a free, appropriate public education in the least restrictive environment. They collaborate with the team to identify a student's annual goals and determine the services, supports, modifications, and accommodations that are required for the student to achieve them, including addressing transition needs no later than 16 years of age. When the IEP team determines that occupational therapy is needed in order for a student to meet his or her annual goals, then occupational therapy should be included in the student's IEP. In some instances, students whose disability affects their participation in school but who do not qualify under the Individuals with Disabilities Education Act (IDEA), may be eligible to receive occupational therapy under other federal laws such as Section 504 of the Rehabilitation Act and the Americans with Disabilities Act.

Occupational therapy practitioners help to promote healthy school climates that are conducive to learning. They offer other valuable services to meet broader student behavioral and learning needs, along with systemic needs, by addressing students' mental health and participating in other school-wide initiatives such as positive behavior supports, response to intervention (RtI), and Early Intervening activities. In addition, occupational therapy practitioners are active participants in developing curriculums and programs; addressing school health and safety; identifying assessment accommodations and modifications; and developing violence prevention, anti-bullying, and other types of programs. In this capacity, occupational therapy practitioners support

the needs of all students, including those without disabilities. For example, many schools use the occupational therapist's knowledge and expertise to assist in curriculum development for handwriting and social skills, or to recommend modifications to or design of classroom environments or assignments that help all students access and participate in school (i.e., implementing universal design for learning).

3.7.2 Strategies For Class Room Management

Collaboration with Occupational Therapists

The strategies that follow in this chapter should be applied with the child's individual differences in mind. Not all will work for all children, and it is imperative that interventions are focused on the child's unique developmental profile. This includes identifying areas of challenge and intentionally addressing those. Teachers must also learn the child's strengths and motivations in order to best engage the child and elicit progress. Often, the child's therapist will be the most knowledgeable source of strategies that work for that particular child.

Barnett and O'Shaughnessy (2015) claim that it is essential for OTs and teachers to collaborate in order to ensure maximum benefit for the shared student. Indeed, supportive, mutually respectful relationships between OTs and teachers can improve results for students. If the child has sensory processing difficulties, the OT should be able to identify that child's specific needs and can assist the teacher in understanding them. OTs can also identify environmental variables that support or interfere with the child's ability to benefit from classroom activities and can recommend strategies to enhance engagement (Barnett & O'Shaughnessy, 2015).

Therapists can also benefit from gaining information on how the child behaves in the classroom, in order to further the child's progress during their sessions. As Judy Wilner explains: "Teachers are able to spend much more time with their students. Generally, therapists only see students 2-3 half hours a week. Therefore, an exchange of ideas is crucial. Therapists need to hear about the child's issues in the classroom, which is more relevant than how the child performs in a structured 1:1 setting" (personal communication, November 3, 2017).

According to Barnett and O'Shaughnessy (2015), teachers and therapists can communicate effectively through active listening, and by posing thoughtful questions. In addition, it can help to paraphrase and summarize the conversation, in order to check

for understanding, and to seek clarification when necessary. Another essential factor to successful collaboration is mutual respect. Mutual respect is fostered when both teachers and therapists are open to new ideas and value the expertise of the other professional.

In many settings, conversations between therapists and teachers happen in passing, perhaps in a hallway, or in the classroom while children are present. This does not facilitate successful collaboration, as both therapists and teachers cannot be fully present in these moments. Barnett and O'Shaughnessy (2015) suggest putting in place regularly scheduled meetings to allow for co-planning, and opportunities to discuss the students, their goals, and how they can be supported most effectively. In addition, OTs should be allotted periods of observation in the classroom. This will allow them to evaluate which strategies may benefit the child, as well as how these might benefit the other children in the classroom. In addition, this will enable the OT to develop an understanding of classroom set-up and activities. As a result, the OT can offer general suggestions to the teacher, as well as specific strategies for students, based on what was observed (Barnett & O'Shaughnessy, 2015).

2. Meeting Children Where They Are

In the Developmental Interaction Approach, learning is based in the teacher's awareness of the child's development, with the assumption that development unfolds at different times and ages for different children. This approach prioritizes "meeting" children where they are, and on their own terms (Nager & Shapiro, 2000). For this reason, therapy, and learning, are often successful when it is child-directed. In Occupational Therapy, using a Sensory Integration Approach (OT/SI) therapists honor children's preferences when creating activities for that child and aim to meet children where they are by providing a challenge that the child can achieve (Schaaf & Miller, 2005). OT/SI incorporates four principles that are inherent in the therapists' work with children:

-The Just Right Challenge: therapist offers playful activities with achievable challenges (there is a challenge in activities but the child is always successful)

-The Adaptive Response: In response to the above, the child adapts their behavior to include new and useful strategies, furthering development.

- Active Participation: Therapist creates challenging, playful, sensory rich environments that entice the child to play (therapist uses observation skills to understand

child's behaviors and interests and create a playful environment). The methods of play incorporate new and advanced abilities that increase the child's repertoire of skills and processing.

- Child-Direction: The therapist observes and interprets the child's behavior constantly to follow child's lead and suggestions, and uses the child's cues to provide enticing, sensory-rich activities (Schaaf & Miller, 2005).

These principles can be informative for teachers working with children with sensory integration difficulties. For example, keen observation of the child's behaviors and preferences can help the teacher understand the child's behavior from a sensory perspective. This, in turn, can help teachers create an environment that is therapeutic, motivating, and also challenging, to help the child become more functional in daily life activities.

Kranowitz (1998) suggests that children learn best when they investigate subjects that are interesting and relevant. Therefore, it can be productive to find out a child's interests, and lead him to explore these subjects through his preferred sensory path. For example, a child interested in buildings, who is also a tactile learner, might benefit from building models with Lego. Pediatric OT Judy Wilner combines the child's preferences with activities that she knows will be supportive for that particular child: "I try to pair preferred activities with non preferred activities. I like to give the child some choices but also encourage them to try my choice" (personal communication, November 3, 2017).

A practical illustration of how teachers can develop the principles of OT/SI into curriculum is the "Look-Move-Build-Sketch" approach. This approach to curriculum is guided by the idea that "successful sensory integration therapy is correlated with 13 children's motivation in selecting activities that will be beneficial to them" (Miller, 2007). Each word of the name "Look-Move-Build-Sketch" (Miller, 2007) stands for a variety of experiences and activities that create meaningful learning for children.

- "Look" refers to the child's act of taking in information and exploring through sensory experiences. Outdoor experiences are especially meaningful, and provide children with the opportunity to "see" in many ways.

- "Move" involves purposeful movement that provides a deeper and more holistic understanding of objects and concepts. For example, teachers can encourage children

to move their bodies like the objects they are studying or observing, in order to internalize their learning about the objects. This provides outlets for kinesthetic children that need to be physically active, and promotes body awareness. Movement also allows for non-verbal communication of knowledge.

- "Build" incorporates tactile learning, by allowing children to physically manipulate materials, three dimensionally. This allows children to develop a deeper understanding of the objects, and promotes abstract thinking skills, because they are representing the objects internally.

- "Sketch" is a vehicle for communicating what children have already internalized and refers to the child's expression of their knowledge. This involves creating representational and interpretive expressions that communicate their knowledge, which can be done in many ways.

Miller (2007) emphasizes that these do not have to happen in any particular order: "it provides an organizing structure for activities, yet is flexible enough to allow individual children to experience just the right amount of challenge". In addition, this approach is practical in that it can be used at any time of day, both in the classroom and outside. The sensory focus of this model provides children with multiple languages through which to communicate their knowledge, recognizing the diverse ways in which young children receive, process, and respond to sensory stimuli. As a result, this allows for the success of all children.

3. Environment

In order to enable and promote participation in the classroom environment, it is crucial for educators to design their classrooms around the needs of children with 14 disabilities, and specifically to the needs of the children in that particular classroom. Occupational therapists use the environment intentionally, which might mean modifying it to remove barriers to the child's success (Luborsky, 2017). According to Rodger and Ziviani (2006), "occupational therapists view the environment as a facilitator of occupational performance, as well as a feature that can present barriers or excessive demands, which hinder performance" . Enabling the child's "optimal occupational performance" often involves physical modifications to the environment. When children in your classroom have sensory processing disorders, learning disorders, or attention difficulties, the following environment-based intervention strategies can help. In fact, all children can benefit from a safe, calm, and distraction-free environment (Kranowitz,

1998). Reducing sensory overload is a first step towards helping children feel safe and calm in the classroom environment (Kranowitz, 1998).

Teachers need to consider all of the senses that might distract children with sensory processing disorders. To begin with, tactile distractions can divert the child's attention, such as the proximity of classmates. Help the child find a spot to feel safe, such as the head of the table or the edge of a rug, to lessen contact with other children. Provide the space the child needs. In addition, it is important to limit visual distractions: remove clutter on bulletin boards and secure pictures to walls so they don't flutter. Put a solid colored sheet over open shelves with materials that might distract the child. Remove swaying mobiles and adjust blinds to prevent sunlight from flickering through. If the movement of other children is distracting, have the child sit near the teacher at the front of the room with her back to her classmates, and surround her with children who sit quietly and pay attention (Kranowitz, 1998).

Moreover, auditory distractions may make the room seem like an echo chamber for the child with auditory processing problems. Cover hard surfaces with carpet or cloth (to avoid them reflecting sound). In addition, be aware of background noise like a ticking clock or an air conditioner. Don't sit the child near a window or by humming fish tanks. Furthermore, playing classical music during quiet work time might soften auditory environment. Finally, even smells can be distracting for some children (Kranowitz, 1998). Teachers should limit olfactory distractions by keeping animals and other aromatic materials away from the child with sensory processing difficulties.

Providing comfortable and appropriate furniture is another environmental adjustment that can be made to support children receiving OT (Kranowitz, 1998). Some children frequently fall off chairs because of inefficient body awareness. If the furniture is an appropriate fit, these children may be able to align their bodies and maintain a stable posture. Find a chair that does not tip: the height of the chair should allow the child to place his feet flat on the floor. In addition, if a preschool child is fidgety at circle time, a ball to sit on may help focus her attention. The ball's diameter should equal the distance between her buttocks and the floor when her knees are bent at a right angle and her feet are flat on the floor (Kranowitz, 1998).

Furthermore, it can be organizing and regulating for children when there are "sensory spaces" in the classroom (Saunders, 2005). These sensory spaces can include a work space, in which toys and materials are easily accessible. A quiet space should include

pillows, and quiet activities, such as books. In addition, a movement or "heavy work" space with therapy putty and small weights, for example, can be beneficial to some children. Teachers should also incorporate opportunities for "heavy work" into the daily 16 schedule.

Finally, Saunders (2005) recommends sticking to a monochromatic color scheme in the classroom, and allowing for a blank or neutral space. Hues of blue, violet and green are generally calming and should be used for areas that provide calming opportunities. Bright colors such as red and orange are alerting, and should be used sparingly to draw attention to important details or areas of information, such as around the daily schedule board.

4. Consistency & Organization

In addition to controlling the physical environment, educators should be aware of the way the classroom is managed throughout the day. As pediatric OT Judy Wilner explains, "everything can be distracting and disorganizing for some children, especially in classrooms in which transitions are abrupt, and the routine is unpredictable" (personal communication, November 3, 2017). For this reason, teachers can help children participate and feel confident by managing the classroom in a consistent and organized way. All children, particularly those with occupational therapy needs and sensory integration challenges, can benefit from a consistent classroom routine, carefully planned transitions, and movement breaks throughout the day. In addition, teachers can help these children become better organized, through giving children the time they need to process information and simplifying instructions.

Kranowitz (1998) suggests that children with sensory difficulties might have trouble getting organized, and need support to overcome a feeling of chaos externally and internally. She suggests that these children are most comfortable when things are "exactly as they were yesterday and will be tomorrow". 17 Kranowitz (1998) offers several valuable strategies for managing the classroom and helping children become organized. These include developing a consistent routine: pictures of routines should be posted in the classroom where children can see them, and teachers should adhere to the schedule. In addition, the room should be arranged in a predictable way every day. Moreover, Kranowitz (1998) encourages teachers to "plan transitions as carefully as lessons". Teachers can incorporate movement and rhythm into transitions. They might clap, or

beat a drum to signify what is going to happen next. Transition fillers such as poems, or songs accompanied by motions, can "turn empty time into teachable moments" (Kranowitz, 1998). Students should always be notified about impending transitions, and should be given plenty of warning when something out of the ordinary is going to occur. Sequential information regarding transitions or other anxiety provoking events can be shared through Social Stories. Social stories are a social learning tool developed for people with autism. For children, these often appear as short, simple, illustrated stories that describe everyday events that children might find difficult or confusing, to relieve anxiety around those events or topics. They are used to teach communal skills and relieve anxiety for some children, through the clear presentation of precise and sequential information (Special Learning Inc., 2018).

Teachers should also plan movement breaks between and during activities. Some children need to fidget in order to regulate, so it is essential for teachers to provide acceptable ways for these children to move during the routine. Encourage them to stand and stretch, or march to a drumbeat, for example. In addition, opportunities for activities like Simon Says (where nobody loses), follow the leader, jumping jacks, and relay races, should be incorporated into the structure of the day.

Kranowitz (1998) also recommends that teachers make eye contact when giving children instructions. These instructions should be concise and specific, and only one or two directions should be given at a time, depending on the readiness of the child. Instructions should be repeated in this way. In addition, some children need more time than others to process directions, and answer questions. Teachers should allow children this time, and also let them know in advance if they will be called upon.

Teachers can also anticipate problems and help find alternatives for children. For example, Kranowitz (1998) suggests, "For the preschooler, going through an obstacle course at his own pace, after everyone else has completed it, is one possibility. If he resists a particular obstacle such as the balance beam or tunnel, let him be! Praise him for conquering the obstacles he can manage" .

Finally, if a child distracted by too many choices, he might not be able to choose any: help him find an activity that he can do while socializing with just one or two other children. If in doubt, it can always be helpful to consult with an OT about activities and techniques to address the child's specific needs.

5. Active Sensory Motor Experiences

When occupational therapists work with young children, many of the activities they engage in involve sensory input and movement. Indeed, exercise stimulates the proprioceptive system, which relates to body awareness, and impacts levels of serotonin, a brain chemical that helps to regulate levels of arousal and alertness. In addition, movement can have alerting or calming effects on children based on the types of movement involved: fast movement is alerting, while slow rhythmic movement is calming (Saunders, 2005). Children with autism, attentional challenges, learning disabilities (LDs), and Sensory Processing Disorders, can benefit from the regulatory effects of movement and exercise, as well as from opportunities to engage in multisensory activities (Luborsky, 2017).

a. Movement Activities Newman & Kranowitz (2012) suggest that children should spend equal or more time actively moving than in sedentary activities. They write, "when children experience the three-dimensional world by moving within it, they can build a solid foundation for developing skills in all domains"

These suggestions for movement activities that can be beneficial for all young children, not just those with OT needs.

Newman and Kranowitz (2012) recommend introducing novel ways of moving throughout the day. Children can be encouraged to jump, slide or gallop to their cubbies. They could creep on their hands and knees during clean up time. These novel movements can help strengthen the child's muscle tone, and prepare the child for smaller distinct movements, like using scissors.

In addition, children can really benefit from spending time outside, and will often be motivated to move. Allow them to walk barefoot on the grass or sand, step in puddles, jump in leaf piles, and snow mounds. Messy activities like these promote neurological growth (Newman & Kranowitz, 2012).

Some movements give children confidence to handle life's challenges successfully. Provide a large cardboard box for children to maneuver through or around. This will help them feel in charge of their bodies as they navigate a small space on their own. Moreover, teachers can help children become aware of the space around them. Activities that promote spatial awareness include clapping bubbles between hands, tracking a flashlight beam with fingers, noses, and feet, and catching falling leaves or feathers on

elbows. Any activity that involves watching a slow moving object trains the eye to move smoothly, a precursor to reading (Newman & Kranowitz, 2012).

b. Multi-Sensory Activities In the theory of Sensory Integration, meaningful sensorymotor activity is a powerful mediator of neural plasticity and brain development. Multi sensory activities help children with attentional, behavioral, and sensory issues meet their needs in a socially acceptable, and safe way (Miller, 2007). The brain of a child with sensory integration disorder does not process sensory information in the same way as typically developing children. Children with sensory integration disorders might have defenses or cravings for certain sensory stimuli: a call for tactile, vestibular, or proprioceptive input. Children who are hypersensitive to some sensory input might become easily overaroused and take action to try to keep this from happening. On the other hand, some children seek sensory input, and this might show through fidgeting behaviors and difficulty attending or staying put (Saunders, 2005). Educators need to provide appropriate activities to meet the child's sensory needs. Pediatric OT Judy Wilner suggests paying attention to material and activity selection: "Think about whether the activity/material is excitatory or inhibitory and how that relates to the child's needs" (personal communication, November 3, 2017). For some children, OTs and teachers collaborate to create a sensory diet designed to help a child achieve and maintain optimal sensory processing (Aldrich & Shelly, 2006). This is a plan developed to provide the optimal combination of sensations, at the right 21 intensities and times for a given child, to elicit appropriate responses to the environment. Strategies and activities to provide varied sensory input are designed to target and regulate various sensory systems, based on the specific needs of the child.

For example, activities done against resistance can be self-regulating, these include aerobic exercises, chores like carrying groceries, rough housing, tug of war, moving desks, carrying books, chewy snacks, and chair pushups. These activities provide proprioceptive input, which involves body awareness (Saunders, 2005).

The vestibular system, which involves balance, is also involved in self-regulation. Activities that stimulate the vestibular system include jumping games, bouncing on a therapy ball, rocking in a rocking chair, swinging, and trampoline jumping. These activities can be calming or alerting based on the type of movement they involve: slow rhythmic movement is calming, whereas fast movement is alerting (Saunders, 2005).

Finally, for many children, tactile input such as pressure touch is calming and enhances dopamine to reduce stress (Saunders, 2005). This can be achieved by providing back rubs, pressing a child between two mats or beanbags, rolling a therapy ball back and forth over the child with downward pressure, and giving hand hugs, or self-hugs.

6. Adapting One's Own Behavior Teachers can learn from therapists in intentionally adapting the ways they behave with and around young children. Many successful teachers already engage in the following behaviors, but it is an important reminder that all children, particularly those with disabilities, need to feel understood, respected, supported, and included in order to fully participate and benefit from the learning environment. 22 Teachers should emphasize the positive and praise children for their accomplishments. Give each child, in words of Carl R. Rogers, "unconditional, positive regard" (Kranowitz, 1998). Reward children for what they accomplish: "The outof-sync child needs constant assurance that her efforts are appreciated and worthwhile. She may not feel competent, even when she is!" (Kranowitz, 1998). Teachers should also keep their voices low. Hearing high-pitched or loud voices can be uncomfortable for children with sensitive auditory systems. In addition, providing physical feedback to children can help them focus and feel connected. Teachers should get close and look the child in the eye. It can be helpful to press on a child's shoulders firmly while speaking to them (Kranowitz, 1998). Finally, keep your expectations realistic. Teachers need to let children know that it is okay if a child doesn't complete a task or does it differently from the other children. As Kranowitz (1998) writes, "remember what is most important in learning: process rather than product, and participation rather than perfection" .

7. Curriculum Approaches

Through intentional and meaningful adjustments to the environment, curriculum, and interactions with children, early childhood educators can extend the work of occupational therapists and support the needs of their young learners. Furthermore, occupational therapy offers a unique perspective on how young children learn and the optimal conditions in which they can fully participate and engage in the classroom environment. These strategies and activities, which were designed to help children with various developmental variations in a therapeutic setting, can actually help every child to learn and develop cognitive, physical, sensory, and motor skills, and enhance self-esteem and sense of accomplishment. In the words of Carol Kranowitz (1998):

"Every child benefits from a safe, calm, and distraction-free environment. Every child requires occasional breaks from work to move and stretch. Every child needs to know that someone is paying attention to his strengths and weaknesses, likes and dislikes, ups and downs. Every child needs assurance that it's okay to have differing abilities, that he can be successful, that his ideas have merit, that his personhood is valued".

The Universal Design for Learning (UDL) approach emphasizes access to learning for all students, and involves flexibility, simplicity, perceptibility, and efficiency in the multiple ways information is presented, and expressed. This approach involves the design of activities, assessments, and materials that aim to meet the needs of children with a wide variety of backgrounds and abilities. As a result, UDL allows students to participate in learning through drawing on their own unique strengths, weaknesses, and preferences (American Occupational Therapy Association, 2015). Occupational Therapists often play an important role in supporting the implementation of UDL and can recommend and adapt activities to facilitate learning for all students. Incorporating strategies that are universally designed makes learning accessible to all children and therefore not only provides needed support to students with varying needs, but also provides all the other students in the classroom with meaningful learning opportunities.

There is sometimes conflict between classroom teachers and occupational therapists when teachers are concerned about changing their classroom structure or schedule to accommodate and integrate OT practices that just one or two children need (Barnett & O'Shaughnessy, 2015). However, these strategies can be beneficial to all children, particularly if applied intentionally in the context of an informed curriculum. All children benefit from hands-on, active learning experiences that stimulate their senses 24 (Miller, 2007). Through the Universal Design for Learning approach, teachers can make learning accessible to all children.

3.8. Let us sum up

Occupational therapy is a profession concerned with promoting health and well being through occupation. Occupational therapists, working with children with intellectual and developmental disabilities will be focused on improving functional performance (ADL, Work and play activities), performance skills such as sensorimotor, cognitive perceptual and social skills and facilitating conducive & accessible environments for these children. Motor skills can be classified as fine motor (hand functions) and gross

motor skills. Occupational therapist may use different treatment approaches such as remedial, educational, behavioral and compensatory approach to meet the complex, individual needs of a child or teenager with intellectual disability. They may use different treatment approaches such as remedial, educational, behavioral and compensatory approach to meet the complex, individual needs of a child or teenager with mental retardation.. Occupational therapists use a variety of modalities to help with intervention .Therapeutic activities are the primary medium used in the practice of Occupational therapy. Occupational therapists also use a wide variety of physical agent modalities (PAMs) in a wide variety of settings as a preparatory activity to functional intervention. Occupational Therapist also addresses various sensory issues of children with Autism Spectrum Disorders using Sensory integration approach. School occupational therapists and occupational therapy assistants are key contributors within the education team. They support a student's ability to participate in desired daily school activities or "occupations." They help children to fulfill their role as students by supporting their academic achievement and promoting positive behaviors necessary for learning.

3.9. Unit end exercises

ACTIVITY 1:

a) Define Occupational therapy

b) What is the nature of occupational therapy

c) What are the principles of occupational therapy

d) Describe the scope of Occupational therapy

e) What are the objectives and functions of Occupational therapy

ACTIVITY 2:

a) Describe the various domains of occupational therapy practice

b) What are the various approaches used in occupational therapy intervention

c) What are the various intervention modalities used in occupational therapy

d) Define Therapeutic activity

e) Describe PAM

ACTIVITY 3:

a) Describe hand functions

b) Explain the various types of grasps with examples

c) Describe the development of hand functions in children

d) Define eye hand coordination?

e) Enumerate few activities for improving eye hand coordination.

ACTIVITY 4:

a) Define sensory integration?

b) Enumerate various sensations involved in Sensory Integration

c) Define adaptive behavior

c) Describe the process of sensory integration

f) What is the importance of sensory integration in day to day life

ACTIVITY 5:

a) What is School based Occupational therapy

b) What is the role of occupational therapy in class room management?

c) What are strategies used for integrating occupational therapy in class room

d) Define Just Right Challenges

3.10 References

1. American Occupational Therapy Association, American Physical Therapy Association, & American Speech-Language-Hearing Association. (2014). Workload approach: A paradigm shift for positive impact on student outcomes. Retrieved from http://www.aota.org/-/media/Corporate/Files/Practice/Children/APTA-ASHA-AOTA-Joint-Doc-Workload-Approach-Schools-2014.pdf
2. AOTA http://www.aota.org

3. Catherrine A trombley (1995) , Occupational therapy for physical Dysfunction,4th Edition
4. Cohn, E. S., & Lew, C. (2010). Occupational therapy's perspective on the use of environments and contexts to support health and participation in occupations. American Journal of Occupational Therapy, 64(Suppl.), S57–S69. http://dx.doi.org/10.5014/ajot.2010.64S57
5. ***Elizabeth Blesedell Crepeau PhD OTR FAOTA, Ellen S. Cohn ScD OTR FAOTA, etal. | Mar 28, 2008 Willard and Spackman's Occupational Therapy***
6. Foster, M. (2002) "Theoretical Frameworks", In: Occupational Therapy and Physical Dysfunction, Eds. Turner, Foster & Johnson.
7. Frolek Clark, G., & Chandler, B. (2014). Best practices for occupational therapy in schools. Bethesda, MD: AOTA Press
8. **Heidi Mchugh Pendleton (Author), Winifred Schultz-krohn Pedretti's Occupational Therapy: Practice Skills for Physical Dysfunction 8th Edition**
9. http://www.nclexquiz.com/fine-motor-skills-overview-age/
10. https://handsonaswegrow.com/fine-motor-skills-activities/
11. https://www.sensoryintegration.org.uk
12. Mosey, A.C. (1985) *Psychosocial Components of Occupational Therapy*. New York: Raven Press.
13. Nelson, D. (1996) Therapeutic Occupation: A Definition. *American Journal of Occupational Therapy,* 50(10), pp.775-782.
14. Pedritti (2001) *Occupational therapy practice skills for physical dysfunction*,
15. Punwar, A.J. (1994). *Philosophy of Occupational Therapy in Occupational Therapy, Principles and practice.* 2nd Ed. Williams and Wilkins, Baltimore, 7-20.
16. Taylor, E. and Manguno, J. (1990) Use of Treatment Activities in Occupational Therapy.

18. Tubbs, C. and Drake, M. (2007) *Crafts and Creative Media in Therapy*. 3rd ed. Thorofare: Slack Incorporated.

19. Turner, A. (2002). History and Philosophy of Occupational Therapy in Turner, A., Foster, M. and Johnson, S. (Eds) Occupational Therapy and Physical Dysfunction, Principles, Skills and Practice. 5th Edition. Edinburgh, Churchill Livingstone, 3-24

20. Willard & Spackman (1993) Occupational therapy

21. Winter 1-5-2019 Supporting Therapy in the Classroom : Strategies for Occupational, Speech/Language, and Physical Therapy Laure Elise Recoder Bank Street College of Education, lrecoder@bankstreet.ed

Unit 4 ❑ Behaviour Modification

Structure

4.1 Introduction

Behaviour is an aspect of an organisms functioning, including overt behaviour, thought, emotion and physiological activity. These functions may or may not be directly observable. Behaviour in broader sense has the influence of both the heredity and the environmental aspects. But a behavioural scientist who is engaged in the task of modifying or restructuring the behaviour of another person basically deals with the environmental factors influencing behaviour. Thus to him, behaviour is that portion of the organism interaction with its environment that is characterized by detectable

displacement in space through time of same part of organism, and that results in measureable change in at least one aspect of the environment That means , the behaviour, in this context, is the relation between an organism and its environment. In the case a human being, the society in which he lives plays a major role in his behaviour as any society has its own criteria and principles. he society in turn had its roots in the individual, his/her home and his family. Thus the behaviour of a person is a complex process, where in interaction between him and his family or society, at large takes place.

4.2 Objective

After studying this unit the trainee will be able to :

Understand the concept of behaviour, behaviour management, behaviour analysis and principles of behaviour management.

Recognize the reasons for the behaviour

Carry out functional analysis of the behaviour

Enumerate and apply principles of behaviour management and

Understand and use the behavioural techniques in managing problem behaviour.

4.3 Aims, scope, and importance of behaviour modification

4.3.1 Behaviour

The term ‘ Behaviour ‘ is taken its totality, connoting a wide & comprehensive meaning. “Any manifestation of life is activity and behaviour is a collective name for these activities.

Behavior modification is a therapeutic approach designed to change a particular undesirable negative behavior.Behaviour Modification is changing human behaviour by the application of conditioning or learning techniques. Behaviour Modification plays a major role in meeting the challenges of all skill training / desirable behaviour and in controlling the problematic / undesirable behaviour in mentally challenged individuals.

Criteria of problem behaviours

1. When behaviours are dangerous to self or others
2. When behaviours are age inappropriate
3. When behaviours interfere in learning

4. When behaviours causes stress to others
5. When behaviours are socially deviant
6. If the behaviours occur too frequently
7. If it occurs for a long duration
8. If it is too severe

4.3.2 Origin of the Theory

Behavior modification relies on the concept of conditioning. Conditioning is a form of learning. There are two major types of conditioning; classical conditioning and operant conditioning.

Classical conditioning relies on a particular stimulus or signal. An example of this would be if a family member came to the kitchen every time you baked cookies because of the delicious smell. The second type is known as operant conditioning, which involves using a system of rewards and/or punishments. Dog trainers use this technique all the time when they reward a dog with a special treat after they obey a command.

Behavior modification was developed from these theories because they supported the idea that just as behaviors can be learned, they also can be unlearned. As a result, many different techniques were developed to either assist in eliciting a behavior or stopping it. This is how behavior modification was formed.

4.3.3 Aims of behaviour modification

The behaviour modification which based on the basic learning principles, make two major achievements in this process. They are a)increasing a desirable behaviour in a person and b) decreasing an undesirable behaviour in a person .Behaviour modification is an approach which focuses on observable and measureable voluntary behaviour .it is concerned with method of changing overt behaviour rather than on understanding subjective, unconscious processes or motivation.

4.3.4 Scope of behaviour modification

Research studies have established the efficacy of behaviour modification techniques for maintaining a stable general mental health. It is used as a supporting therapeutic technique. In the treatment of many mental illness (both psychoses and neuroses) with mentally retarded individuals, behaviour modification plays a major role in meeting the

challenges of all skill training behaviour and in controlling the problematic or undesirable behaviour. The role of behaviour modification is also important in the training and rehabilitation of any disabled condition.

4.3.5 Importance of behavior Modification

It is important to manage problem behaviours in children because

1. Problem behaviours reduce the social acceptability of the child
2. Problem behaviour may harm the child
3. It may harm others
4. It may interfere in the child is learning process at school or home
5. It may interfere in the learning process of other children at school or home
6. It may be socially unacceptable or inappropriate for the child's age
7. It may interfere in the performance of certain other behaviours already learnt by the child

Principles of BM

- Behaviour problems are skills which are learnt
- They are functional
- They can not be understood in isolation of entire person and environment in which problems occurs
- No magic cure
- No simple solutions
- No readymade packages
- Long term undertaking

4.4 Types of behaviour: Adaptive and Mat-Adaptive

Behaviour can be classified in two categories:

Adaptive Behaviour

Maladaptive behaviour

4.4.1 Adaptive Behaviour

When we perform our daily living skills, cognitive skills, domestic activities, we show some specific behaviour like eating, dressing, reading, writing etc. Most special needs children show deficit in these skill areas.

This means that they perform poorly on certain tasks which normal children of their own age can do easily. What a given mentally handicapped child can do or cannot do depends on various factors such as severity of mental retardation, opportunity provided for training, associated conditions, etc. For the convenience of easy understanding, the various skill behaviours can be broadly classified into the following categories or domains:

i) Motor:

Examples: Runs, skips, jumps, walks up and down stairs, rides a bicycle, unscrews a bottle lid, pours liquid from one container to another without spilling, etc.

ii) Activities of daily living: This includes,

a) Eating:

Examples: Drinks from cup or glass, eats with own hands, mixes rice on own, etc.

b) Toiletting:

Examples: Indicates toilet needs, washes self after toilet use, etc.

c) Brushing:

Examples: Brushes teeth, spits paste, rinses mouth, etc.

d) Bathing:

Examples: Pours water on self, washes face with soap, applies soap on body, etc.

e) Dressing:

Examples: Undresses on own, puts on shirt, buttons, unbut- tons, etc.

f) Grooming:

Examples: Applies powder, combs hair, clips nails, etc.

iii) Language: This includes, a) Receptive language:

Examples: Points to pictures in a book, arranges pictures after listening to a story. etc.

b) Expressive language:

Examples: Uses two word phrases, names common objects in use, etc.

iv) Reading and Writing:

Examples: Reads sight words, reads own name, scribbles with pencil or chalk, writes own name, writes address, etc.

v) Number and Time:

Examples: Rote counts till five, counts five objects meaningfully, adds single digit numbers, names or identifies numbers on the clock; names, identifies day, date and months of year, etc.

vi) Domestic and Social:

Examples: Washes utensils, dries clothes, greets guests with a 'namaste', or 'adaab', says 'please' or 'thank you', etc.

vii) Prevocational and Money

Examples: Docs simple embroidery work, uses screw- driver, recognises values of coins, adds or transacts money, etc

4.4.2 Mal adaptive behaviour

Often children with normal intelligence also show problem behaviours to some extent; exhibition of problem behaviour is a normal developmental phenomenon. But with the advancement with the age children with normal intelligence learned to behave appropriately in the given situation.

Many times, children with mental handicap show behav- iours that are considered as problematic because of the harm or inconvenience they cause others, or to the child himself. The presence of problem behaviours in children puts great strain on teachers. Besides, they may interfere with learning in the school/classroom settings. These problem behaviours could be due to a number of reasons. From a behavioural point of view, it may be due to lack of communication skills, cognitive skills or problem solving skills, etc. it may also be due to wrong handling by people in the environment of the child.

For the convenience of easy understanding, the various problem behaviours can be broadly classified into the following categories or domains:

i) Violent and destructive behaviours: Examples: Tears books, breaks things, throws objects, etc.

ii) Temper tantrums:

Examples: Rolls on the floor, screams, cries excessively, etc.

iii) Misbehaviour with others:

Examples: Pulls objects from others, spits on others, etc.

iv) Self injurious behaviours:

Examples: Bangs head, scratches self, pulls own hair, bites self, peels skin/ wounds, etc.

v) Repetitive behaviours: Examples: Rocks body, nods head, shakes parts of the body repeatedly, etc.

vi) Odd behaviours: Examples: Smiles, laughs or talks to self without reason, col1ects rubbish, etc.

vii) Hyperactivity: Examples: Does not sit at one place for required time, does not complete task at hand, etc.

viii) Rebellious behaviours: Examples: Refuses to obey commands, does opposite of what is requested, etc.

ix) Antisocial behaviours: Examples: Steals, cheats in games, lies or twists the truth, blames others, etc.

x) Fears: Examples: Fear of places, persons, animals or objects, etc.

4.5 Identification Of Problem

Any programme of behaviour management in children must begin wit the identification of specific problem behaviours posed by each child. There are many ways of identifying problem behaviours in children, such as, by means of directly observing the child, interviewing parents/ caretakers of the child using a checklist, etc. Many times a child may present just one problem, or more than one problem behaviour. Before a functional behaviour assessment can be implemented.it is necessary to pinpoint the behaviour causing learning or discipline problems and to define that behaviour in concreate terms that are easy to communicate and simple measure and record. If description of behaviour are vague,it is difficult to determine appropriate interventions. Identifying problem behaviours is the first step towards managing them.

4.5.1 Steps in identification of mal adaptive behavior

The behavior modification techniques for decreasing the undesideable behavior involves a detailed assessment of the child in tune with the principle of IEP

The following steps are involved in this process

Identification of problem behavior : Once problem behavior is brought to the notice of the teacher, it is his /her duty ti identify it appropriately by applying the guidelines given in this regard.

1. Behavioral description of problem behavior :In behavior modification ,symbolic terms of the behavior has no value .Only behavior terms are used for describing a behavior .For example ,the problem behavior anger can be viewed as ,abusing somebody, shouting at others, beating others or self bitting,throwing thing at others .Hence ,by using the term anger it is essential that the behavior is described in an objective manner which could be observed and measured.
2. Selection of problem behaviour:A child may posswss more than one problematic behaviour.But only one or two proiblem at a time is selectedfor management.Since selection of more problems would pose difficulty in controlling the environmental factors which has influence on behaviour.This selection or the priritisation of the problem behaviour is done by applying the following criteria
   a) choosing the problem behaviour which are easy to manage .
   b) choosing problem behaviours which are dangerous in nature for self or to others.

3. Baseline assessment

There are many ways of recording problem behaviours. Before begining to record, decide on the method to be used for recording specific behaviours.

Event recording

Teachers can record the number of times a specific problem behaviour occurs in a given child. This is called event recording.

A typical format for recording the frequency or number of events of a given problem behaviour in child.

B DURATION RECORDING

There are some problem behaviours which occur very few number oftimes. But, if they occur even once, they may continue for a long time. In such cases, it is best to use duration recording techniques.

INTERVAL RECORDING

When problem behaviours occur for specific number of times, you can use event recording techniques. When they occur over a specific period of time, you can use duration recording techniques.

However, in actual classroom situations, it may be difficult for teachers to continuously observe and record the total frequency Or duration of a given problem behaviour. Under such circumstances, set apart specific intervals of time in a period or day to record whether the specific problem behaviour has occured or not. If the problem behaviour has oecured many times oreven once within that specified interval of time, it is recorded as one occurence.

TIME SAMPLING

Another way of recording specific problem behaviours is to observe the child and record at specific points of time whether the said behaviour has occured or not. This is one of the most widely used and economical technique of

recording which can be easily used by the teacher in the group or classroom setting.

FUNCTiONAL ANALYSIS OF PROBLEM BEHAVIOURS

ProbJem behaviours in children do not occur in a vaccum. All behaviours both, skill behaviours and problem behav- iours occur because they serve a purpose for the individual. This is true for every human being. Even, when two children show the same problem behaviour, the factors contributing to the problem behaviour may be different for each of the child. The management of problem behaviours for each child must then be individualised and based upon the understanding of the factors controlling the problem behaviours.If problem behaviours are tried to be managed using adhoc methods without an understanding of the factors controlling the problem behaviours, there is a great risk of mismanagement. Stich factors may only lead to an increase rather than decrease in the problem behaviours.

There are a number of models available for analysing behaviour problems. One of the most simple model known as A-B-C model is presented below, Teachers need to use this model to analyse and understand the problem behaviours in terms of three major components:

A. What happens immediately BEFORE! th•!behaviour?

This is called as ANTECEDENT factors.

B. What happens DURING the behaviour?

This is called as BEHA VIOUR.

C. What happens immediately AfTER the behaviour?

This is called as CONSEQUENCE factors. Understanding 'Before' (antecedent) factors.

Analysis of antecedents controlling a problem behaviour include answering the following questions

1. When does the problem behaviour generally occur?
2. Are there particular times of the day when the problem behaviour tends to occur more? Example, during morning hours, or meal times, etc.
3. With whom does the problem behaviour occur? Ex- ample, does it occur more in the presence of specific persons/teacher, etc.
4. Where does the problem behaviour occur? Are there specific places or situations when the problem behaviour occurs more? Example, in the school play ground, or classroom, or at home, or when the child is sitting alone, etc.
5. Why did the problem behaviour occur? This includes finding out what factors immediately led to the problem behaviour. Example, was the child told to do something, or was the child refused something before the occurence of the problem behaviour, etc.
6. The teacher must reassess what is being taught to a given child showing behaviour problem. Sometimes a child may show a problem behaviour even because of factors related to leaching or [he leaching situation. For example, if the task being taught to the child istoo difficult for him to understand or acheive or is beyond the difficulty level managable by the child, etc. Therefore, assess the target

behaviours, rearrange them at appropriate difficulty levels, organise the teaching place to make it optimally suitable for the child's learning to take place. Also check if the materials used for teaching are appropriate and interesting to the child. All these 'before' factors influence optimal learning.

If errors occur in any of these factors, the chances for the occurence of problem behaviours increase. Hence, errors in teaching have to be analysed as an important variable in the management of problem behaviours ill children with mental handicap.

Understanding 'During' (behaviour) factors

Analysis of 'during' factors include use of recording tech- niques to answer the following questions:

1. How many times does the problem behaviour occur?

or

2. For how long does the problem behaviour occur?

Understanding 'After' (consequence) factors.

Analysis of 'after' factors include answering the following questions.

1. What do people present in the enviroment exactly do to stop the specific problem behaviour?
2. What effect does the problem behaviour have on the given child or others?
3. How is the child benefitting by indulging in the problem behaviour?

The analysis of consequences or after factors show that every behaviour of the child is linked with benefits. If there were no benefits the behaviour would cease to occur. Let us examine some of the factors or benefits which children seem to get when they indulge in problem behav- iours. Analysis of these factors will helps us to understand and manage several probJem behaviours.

1. Attention seeking factors

Children are generally great attention seekers. For that matter, all of us love to get attention from others. For example, a child makes faces at other children only to get their attention. Attention factors include providing any physical or verba] contact with the child. Sometimes verbal reprimands or commands of the teacher may work as attention factors for a given problem behaviour in a child. Other attention seeking

behaviours include receiving a pat, hug, or smile, or sometimes even being able to get the eye contact with the teacher. Teachers must find out whether a particular problem behaviour is occuring to get attention. If the problem behaviour tends to occur more when youare not paying attenuon to tne cmld, and stops when you attend to the child it means that it is an attention seeking behaviour.

2. Self stimulation factors

Some times children learn to indulge in repetetive behaviours, such as, body rocking finger flicking, etc, This is especially true of severely and profoundl y retarded children. Usually self stimulatory behaviours increase when these children are left alone, unstirnulated or understimulated or at times overstimulated in their environments. When such children are engaged in a useful activity, these self-stimulatory behaviours tend to reduce.

3 Skill deficit factors

Some problem behaviours in children occur due to skill deficits. When a child has not learnt to behave or respond in appropriate ways, his problem behaviour may be an indirect expression of this underlying skill deficit. For example, a child with poor communication skills, and who does not know how to say "give me the ball" learns to get the ball from other child by snatching it. Similarly another child, who does not want to complete a given task in the class and cannot say so, may learn to get away from that task by throwing the teaching materials. In such cases, teaching and build- ing up appropriate skill behaviours become an important task to replace such problem behaviours. Hence the teacher's task is to increase appropriate behaviours and also to replace problem behaviours by helping the child unlearn or decrease the inappropriate behaviours he has acquired.

4. Escape

Many times children may indulge in problem behav- iours in order to escape a difficult situation. It may be to get away from specific persons or activities they dislike. For example, whenever the teacher gives a task to a child to perform, he may start crying after which the teacher may withdraw that activity. Hence, the child will gradually learn to cry in order to get away from the activity. If the child's problem behaviour increases in the presence of demands and stops when the demands are removed, it suggests that the child is indulging in the problem behaviour to escape certain demands or situations.

5. Tangible factors

Some problem behaviours in children may be actually fetching them tangiable/ material rewards. For example, if a teacher gives a toy to a crying child so as to make him stop crying, the child may temporarily stop crying. But in the long run, and indirectly, the teacher may have actually taught him to cry more as that would easily fetch him a tangible reward. If the problem behaviour .. stops when a tangible reward is presented the function of that problem behaviour could be tan- gible.

For instance, a child may cry in order to escape the burden of completing an assignment as also to receive specific material rewards. Although, generally there may be one antecedent or consequence factor for any specific problem behaviour, a more detailed analysis will often show that there are actually more than one BEFORE and/or AFTER factors for any or all problem behaviours. Also, it is important to remember that the function/s maintaining problem behaviours can change over a period of time. Hence, functional analysis only ends with the end of the treatmen.

Examples of problem behaviours with possible antecedents, consequences and its functions are given below:

BEFORE (ANTECEDENTS)

During lunch time, while Mary is siuing alone in a corner.

DURING (BERA VIOUR)

Mary rocks her body back and forth.

AFTER (CONSEQUENCES)

No one bothers her and Mary continues to rock.

FUNCTION

Self-stimulation.

Sashi is refused a toy by Sashi bangs her The school ayah gives Tangible the teacher head her the toy and Sashi.

4.6 Development And Implementation of Behaviour Management Programme

Based on a thorough understanding of antecedent and consequence factors controlling specific problem behaviours in children, the teacher must decide about the package programme consisting of various techniques to be used for managing problem behaviours.

If you discover that "BEFORE" factors are more important in determining a specific problem behaviour, you must use techniques that can gain control over these situational factors triggering the problem behaviour.

And if you discover that" AFTER" factors determine specific problem behaviours, you may have to use techniques that help in eliminating the rewards following that problem behaviour. Chapter Nine explains the various techniques for management of problem behaviours in children with mental handicap.

Behavioural Techniques In Managing Problem Behaviours

Various behavioural techniques have been used successfully by teachers to manage behaviour problems of children individually on one to one basis and in the classroom/ setting.

General considerations for using behavioural techniques in managing problem behaviours

The following points are to be kept in mind before using any technique of managing problem behaviours

1. A single child may show a number of problem behaviours. The teacher must select the appropriate technique for managing each of these problem behaviours, Thinking that the same technique will help manage all the problem behaviours may hot be true.
2. Two or more children with mental handicap may show the same problem behaviour.Yet, they may need different techniques to manage the same problem Behaviour. This hi~ybe because the factors controlling the problem behaviour may be different in each child even though the problem behaviour may be the same.
3. There ate it feady made packages or recipies to manage behaviour problems in children. The behavioural techniques to manage specific problem behaviours in a given child is based upon an understanding of the unique combination of "BEFORE'; and "AFTER" factors controlling that particular problem behaviour in an individual child. Teachers need to individualise and identify specific techniques to manage each problem behaviour.

4. Behaviour management programme is a long term undertaking. On the one hand, it involves decrease of inappropriate-behaviours; and, on the other hand, it necessitates teaching more appropriate behaviours to children

1. Changing the Antecedents
2. Extinction/ Ignoring
3. Time Out
4. Physical Restraint
5. Response Cost
6. Overcorrection
7. Conveying Displeasure
8. Gradual Exposure for Fears
9. Differential Rewards

1. CHANGING THE ANtECEDENTS (Before factors)

antecedent (before) factors, in the presence of which, behaviour problems may tend to occur more. These factors may include particular settings, situations, places, persons, times, specific demands placed on the child, task difficulty levels, methods of instructions used by the teacher, sudden change in routine, etc. If the teacher can identify links between any of these factors and the occurrence of problem behaviours then a simple avoidance, alteration or change of such factors may be sufficient to manage problem behaviours. Let us consider these points in more detail with suitable examples. Problem behaviours can be managed by controlling or changing the antecedents. For example, when the child is not engaged in any activity he tends to rock his body. Similarly if repeated instructions given to eat leads to the problem of throwing food on another child or if allowing a child to sit next to the window leads to the problem of inattention to tasks, then suitable changes in the environment could alone prevent the problem. If lack of interest in a task is because the task is not at the level of the child (i.e., either too easy or too difficult) then resetting the behavioural objectives could help. If the child does not obey instructions given by the teacher due to lack of comprehesion, then providing the instructions in simple language could help the child to carry out the instructions.

II EXTINCTION/IGNORING

Extinction means removal of attention rewards permanently following a problem behaviour. This includes actions like not looking at the child, not talking to the child, having no physical contact with the child

III TIME-OUT:

Some problem behaviours in children are so serious or harmful to themselves or others that you cannot simply ignore them. For example, pulls others hair, kicks others, breaks things, snatches books, throws articles, etc.

Time out can be effective in dealing with aggressive and destructive behaviours. Example, throwing things, breakings things, hitting others, etc

What is Time Out?

Time out method includes removing the child from the reward or the reward from the child for a particular period of time following a problem behaviour. Ensure that re- wards or a rewarding situation is removed following the problem behaviour. If a child is removed from a situation which he does not like then it may act as a reward and may only lead to an increase in the problem behaviour. For example, Rekha does not like to sit in the class and learn functional academics. During the class she hits other children, if the teacher sends out Rekha from the class because she is hitting other children, this consequence may be actually workingasa reward for the child to escape the trouble of si tting in the class and doing classwork andhence, lead to an increase in the problem behaviour.

Types of Time Out

Following the occurence of a problem behaviour in a child there are many ways for using the technique of time out in the school or classroom settings

1. Place the child outside the sphere of learning activity for a specified period of time in the class. The child should be placed in a position, where he can see or hear the activity, but cannot participate in it.
2. Insist the child to place his head on the desk in a head down position for a specified period of time.
3. Remove the rewarding activity materials from the child for a specified period of time.

4. Remove the child to an area in the class wherein he or she can neither see nor participate in the activities of other children for a specified period of time. For example, in the comer of the classroom, facing the wall.
5. Seclude the child to an isolated room (usually called Time Out Room) wherein he can neither see, hear nor participate in the activities of other children for a specified period of time. This is also called as seclusion time out.

IV PHYSICAL RESTRAINT

Physical restraint involves restricting the physical movements of the child for sometime following a problem behaviour.

While indulging in some types of problem behaviours, a few children may completely loose control of themselves. They may even harm themselves by banging head, biting self, etc. Sometimes, they may harm others by hitting, slapping, etc. At such times, it becomes necessary to physically stop the child from indulging in such problem behaviours. You may have to hold the child is arms tightly down his sides for a short period, or hold his hands or tie his hands with a soft cotton cloth at the back for few seconds, or hold him in between your knees etc. For example, when a child shakes his head continuously from side to side, you can physically restrain him by holding his head firmly in between your palms for a few seconds to stop his head movements.

V RESPONSE COST

Another way of decreasing problem behaviours in children is to take away the rewards that the child has earned by performing specific good behaviours. In other words, this technique involves the child to pay a fine or the cost for indulging in a problem behaviour by giving away some thing or event he has earned from showing desirable behaviours.

There are many ways in which response cost techniques can be applied in the school or classroom settings.

If a child refuses to work on assignments during class time, he will loose the privilege of free time after school. A child, who has earned a badge following desirable behaviour will loose it when he indulges in a problem behaviour. Thus he pays a cost for his undesirable behaviour.

VI RESTITUTION (OVER CORRECTION)

The use of this technique will not only decrease problem behaviours in children, but also teach appropriate ways of behaving. When this technique is implemented, after the occurence of a problem behaviour, the child is required to restore the disturbed situation to a state that is much better than what it was before the occurence of the problem behaviour. The child may be also required to practice right ways of behaving.

For example, if a child passes urine in the class, he would be required to not only clean the dirty area but also mop the entire/larger area of the floor in the class. Similarly, if a child throws his play materials in the classroom, he is required to pick up any or aH other toys/things lying in the classroom and put them in appropriate places.

VIII GRADUATED EXPOSURE FOR FEARS

Graduated exposure techniques are especially used to decrease fears in children, either in the school or home setting. The procedure of graduated exposure involves a step by step gradual exposing of the child to a feared person, place, object or a situation. Many children show fears of specific persons, animals, situations. For example, fear of sitting on the potty, fear of taking a swing or slide, fear of loud noises, etc.

For example, if the child has fear of dog, initially let him pass by the dog from a long distance while you hold his hand and while he is eating a chocolate or whatever he likes. Then, bring him closer to the dog while he gets an opportunity to observe a model with the dog. Eventually, take him closer to the dog, and if the dog is friendl y , get him to touch it with his hands.

Differential reward of low rate behaviour

When it is the intention of the teacher only to reduce the intensity of a misbehaviour and not to eliminate that behaviour completely, this technique is useful. For example, if a child speaks too loudly he is rewarded only when he speaks slowly. If a child asks permission to go to the toilet more frequently, then reward him if he goes to toilet only once in three hours.

4 Differential reward of alternate behaviours

In this method, the teacher identifies other desirable behaviours that the child is required to perform and rewards such behaviours immediately. This technique is used along with other techniques for decreasing problem behaviours.

4.7 Integrating behaviour modification in classroom context

Unique and individual intervention are more important than any prescribe behaviour programme.Some example of useful interventions include building relationships, adapting the envionment,managing sensory stimulation, changing communication strategies, providing prompts and cues,using a teach,review,and retech process,and developing social skill. The classroom teacher needs to ensure acceptence foe all students in the classroom. Teachers 'actions that can promote acceptance include

- Choosing learning materials to represent all groups of students
- ensuring that all students can participate in extra activities
- Valuing,respecting and talking about differences
- Celebrating cultural and ethnic differences
- Ensuring that all students are protected from name calling or other fors of abusive language
- make the student aware of his or her time table
- post timetables to show daily routine
- prepare students for transition or changes
- make special arrangements for recess and lunch time if necessary
- repharse instruction, breaking them down into small steps
- using visual cues
- using picture to illustrate steps in a process
- using sign prompts

Effective feedback should be immediate and follow the demonstration of an appropriate behaviour, the use of a routine /or the successful completion of teacher instruction.Research has shown that positive reinforcement can lead to improved behaviour.Agood general rule is that positive feedback should occur three times as

frequently as negative feedback.The positive feedback does not always have to be verbal-it can also include praise,hugs,smiles,handshakes.nodsandeyecontact.

4.8 Let us sum up

Behaviour modification refers to the techniques used to try and decrease or increase a particular type of behaviour or reaction .This might sound very technical, but its used very frequently by all of us.Parents use this to teach their children right from wrong.Therapist use it to promote healthy behaviours in their patients.Animal trainers use it to develop obedience between a pet and its owner.We even use it in our relationships with friends and significant others.Our responses to the them teach them what we like and what we don't.

The purpose behind behaviour modification is not to understand why or how a particular behaviour started.Instead it only focuses on changing the behaviour,and there are various different methods used to accomplish it .This incluse

- Positive reinforcement
- Negetive reinforcement
- Punishment
- Flooding
- Systematic desentization
- Aversive therapy
- Extinction

3. Positive reinforcement is pairing a positive stimulus to a behaviour .A good exemple of this is when teachers reward their students for getting a good grade with stickers.Positive reinforcement is also often used in training dogs.
4. Negetive reinforcement is the opposite and is the pairing of behaviour to the removal of a negative stimulus. A child that throws a tantrums because he or she does not want to eat vegetables and has his or her vegetables taken away would be a good example.

5. Punishment is design to weaken behaviours bu pairing an unpleasant stimulus to a behaviourRecieving a detention for bad behaviour is a good example of a punisjhment.
6. In behaviour modification ,extinction eliminates the incentives for unwanted behaviour by with hold the expected responses.Awidespresd parenting technique based on extinction is the time out,in which a child is separed from the groupwhenhe or she mis behaves . This technique removes the expected reward of parental attention.

4.9 Unit end exercise

1. What is mal adaptive behaviour
2. Explain the different behaviour modification techniques?
3. Discuss about ABCmodel
4. Discuss about the classroom management for children with mal adaptive behaviour.
5. Prepare a short note on behaviour modification techniques.
6. Define the Behaviour,behaviour modification and functional analysis.

4.10 References

Kaplan Joseph, S. (1995).Beyond Behaviour Modification. A cognitive-Behavioural Approach to Behaviour Management in the school.(Third Edition pro.ed 8700 Shoal Creek Boulevard Austin, Texas 787576897.

Madhuban .T ,Manjula K. et al. Mental Retadation A manual for Psychologist National institute for the mentally handicapped Secunderabad 500009.

Marzano What Works in Schools: Translating Research into Action (Alexandria, VA: Association for Supervision and Curriculum Development, 2003).

Missouri Schoolwide Positive Behavior Support (MSPBS) Missouri Schoolwide Positive Behavior Support Team Workbook (2012) [online] http://pbismissouri.org/wp-content/uploads/2015/05/Tier-1_4-23-2015.pdf

National Dissemination Center for Children with disabilities "Social Skills and Academic Achievement" Evidence for Education (2008), Vol. 3, No. 2, pp. 1-8.

Nelson, J. R., Martella, R. M. and Marchand-Martella, N. "Maximizing student learning: The effects of a comprehensive school-based program for preventing problem behaviors" Journal of Emotional and Behavioral Disorders (2002), Vol. 10, No. 3, pp. 136-48.

Morgan, P. L., Farkas, G., Tufis, P. S., and Sperling, R. S. "Are reading and behavioral problems risk factors for each other?" Journal of Learning Disabilities (2008), Vol. 41, pp. 417-436.

Simonsen, B., Fairbanks, S., Briesh, A., Myers, D. and Sugai, G. "Evidence-based practices in classroom management: Considerations for research to practice" Education and treatment of children (2008), Vol. 31, No. 3, pp. 351-380.

Vannest, K. J. & Harrison, J. Evidence based practices for learning and behavior problems across levels of prevention and intervention (Boston, MA, American Psychological Association, 2008).

Unit - 5 ❑ Assistive Devices

Structure

5.1. Introduction

Persons with disabilities are among the most stigmatized and excluded groups of individuals around the world. They are likely to have poorer health, less education, less economic opportunity and are more likely to live in poverty and deal with greater inequalities than their age matched population without disabilities. However, when they are given opportunities to flourish as any other individual, they have the potential to lead fulfilling lives and to contribute to the social, cultural and economic vitality of their communities. For many persons with disability, assistive technology represents the difference between enjoying their rights or being deprived of them. However, in many low-income countries very small sections of those who need assistive technology are able to obtain it. There is thus an urgent need to address this situation.

In this unit we will discuss the various aspects of Assistive Devices available for different form of disabilities across the globe.

5.2 Objectives

- Define Assistive Device.
- To gain an understanding about assistive device and technology.
- To know about various assistive devices/ technologies available for Intellectual Disability, Hearing Impairment, Visual Impairment, & Locomotor Disability.
- To understand the various acts under Ministry of Social Justice and Empowerment.

5.3 Definition, Importance And Types Of Assistive Devices For Independent Living

5.3.1 Definition of Assistive Devices.

"Assistive devices and technologies are those whose primary purpose is to maintain or improve an individual's functioning and independence to facilitate participation and to enhance overall well-being" (World Health Organization, 2016). They can also help prevent impairments and secondary health conditions. Examples of assistive devices and technologies include wheelchairs, prostheses, hearings aids, visual aids, and specialized computer software and hardware that increase mobility, hearing, vision, or communication capacities.

Assistive technology (AT) actually refers to devices and services, although most commonly people associate the term assistive technology with the tools or devices. An assistive technology device refers to "any item, piece of equipment, or product system, whether acquired commercially off the shelf, modified, or customized, that is used to increase, maintain, or improve the functional capabilities of a child with a disability" (Individuals with Disabilities Education Improvement Act of 2004). The term does not include a medical device that is surgically implanted, or the replacement of that device.

5.3.2 Importance of Assistive Devices

Aids and assistive devices are the supporting devices used by persons with disabilities in improving their quality of life in terms of mobility, communication and for performing their daily activities. There is a wide range of assistive devices available to meet the needs of person with disabilities. By use of these aids and assistive devices, people with disabilities will become independent and their participation in the society increases.

Across the globe, over one billion people, need one or more assistive devices (WHO, 2016). The number in need of assistive devices is estimated to increase to beyond two billion by 2050 as a result of rise in non-communicable diseases and the aging global population (WHO, 2017). However evidence indicates that an estimated 90% of people who would benefit from assistive technologies do not have access to them among which 5-15% includes children with disability (UNICEF, no date; Borg et al, 2015). Lack of access to assistive devices is due to a number of factors including high costs, limited availability and lack of governance, inadequate financing in many settings, as well as a widespread lack of awareness and suitably trained professionals (WHO, 2016; Borg, Ekman, & Östergren, 2017).

5.3.3 Types of Assistive Devices

Assistive Technology, by its definition in IDEA 2004, is vague and ambiguous. Broken down, assistive technology essentially is anything or can come from anywhere, as long as it helps or just maintains an individual's skills. Because assistive technology can be anything, it can be instructional technology (for example, computer-based concept mapping and calculators), it can be everyday technology that is repurposed (for example, cell phones and iPads), and it can be specifically designed tools and devices (such as text-to-speech, speech-to-text, and AAC) (Bouck, Shurr et al., 2012; Edyburn, 2004).

A better way to understand AT is through the different categorization schemes. AT can be thus categorized as per (a) Level of technology, and (b) as per purpose of use.

5.3.3.1 Classification as per Level of Technology:

While typically AT is categorized as low-tech (minimum technology) or high-tech (sophisticated technology), other classification also exists, including no-tech, low-tech, mid-tech, or high-tech as well as low-tech, moderate-tech (or mid-tech), or high-tech (Blackhurst, 1997; Edyburn, 2005a; Johnson, Beard, & Carpenter 2007). Table 1 depicts the examples of assistive technology devices by technology.

- No-tech assistive technology most commonly refers to when no tool or device is actually used, but perhaps a teaching strategy is implemented, such as mnemonic (Behrmann & Jerome, 2002).
- Low-tech assistive technologies are generally tools or devices that are low in cost, require less training, and are typically not sophisticated, such as pencil grips (Behrmann & Schaff, 2001).
- Moderate-or mid-tech assistive technologies are the typical tools or devices that are battery operated, is more sophisticated, may require more training, and has a higher cost than low-tech assistive technology, such as a calculator.
- High –tech assistive technologies are sophisticated devices and tools and are commonly associated with computer-based technology. These are considered to have a higher cost and require more training, such as text-to-speech (Edyburn, 2005a).

Table 1: Examples of various Assistive Technology Devices classified as per level of Technology

No-Tech	**Low-Tech**	**Mid-Tech**	**High-Tech**
• Mnemonics (HOMES for remembering the names of the Great Lakes) • Graphic Organizers	• Pencil Grips • Raised lined paper • Highlighter strips • Braille playing cards	• Calculators • Audio recorders • Switches	• Speech-to-text • iPad • Word prediction

5.3.3.2 Classification as per Purpose:

Another way AT can be classified is by purpose (Table 2 depicts the examples of assistive technology devices by purpose). Bryant and Bryant (2003) suggested seven purposes for assistive technology: positioning, mobility, augmentative and alternative communication, computer access, adaptive toys and games, adaptive environments, and instructional aids. Similarly, Wisconsin Assistive Technology Initiative; WATI suggested fourteen categories for assistive technology: seating, positioning and mobility, communication, computer access, recreation and leisure, activities of daily living, motor aspects of writing, composition of written material, reading, mathematics, organization, vision, hearing, and multiple challenges (Gierach & Stindt, 2009).

Table 2: Examples of various Assistive Technology Devices classified as per purpose.

Bryant & Bryant (2003) Purpose	Wisconsin Assistive Technology Initiative (WATI) Categories	Examples
Seating, positioning, and mobility	Positioning Mobility Seating	• Adjustable-height desks • Custom wedges • Wheelchair • Gait trainer
Augmentative and alternative communication	Communication	• Picture Exchange Communication System • Proloquo2Go for iPod, iPad
Computer access	Computer access	• Alternative keyboard • Speech/voice recognition
Adaptive toys and games	Recreation and leisure	• Switch – operated battery toys • Larger or Braille playing cards
Adaptive environments	Activities of daily living	• Adapted utencils, bowls, and cups • Motor-controlled lights
Instructional Aids	Motor aspects of writing	• Speech-to-text • Pencil Grips
	Composition of written material	• Word prediction • Portable spell checker
	Reading	• Reading pen

	Mathematics	• E-text or supported e text • Concrete or virtual manipulatives • Calculator
	Organization	• Watch Minder • Picture Schedule
	Vision	• Text-to-speech • Screen magnification
	Hearing	• FM system • Hearing Aid

Source: AssistiveWare© www.assistiveware.com; E. Bouck and S. Flanagan, "Assistive Technology and Mathematics: What is There and Where Can We Go", Journal of Special Education Technology, 24(2), 2009, pp. 17-30; D. Bryant and B. Bryant, *Assistive Technology for People with Disabilities* (Boston, MA: Allyn & Bacon, 2003); J. Gierach, Assessing Students Needs for Assistive Technology, 5th ed. (Milton: Wisconsin Assistive Technology Initiative, 2009); L. Johnson, L Beard, and L. Carpenter, *Assistive Technology: Access for All Students (Upper Saddle River, NJ: Pearson Education, 2007).*

Note that the National Trust has established a National Resource Centre for display of available assistive devices called "Sambhav" (a registered organization of the National Trust), New Delhi. To view the detailed list of the aids and assistive devices along with the cost as provided by AADI (Action for Ability Development and Inclusion), please visit thenationaltrust.gov.in/content/assesstive_device.php

5.4 Different Types Of Assistive Devices For Id, Hi, Vi & Locomotor Disability

Assistive devices aren't new. In fact, it has been a part of the human experience since ancient times. It is believed that eyeglasses were invented in Italy between 1268 and 1289; and, the first recorded use of a wheelchair dates back to 5th Century China. It may not surprise you to learn that AT may fit into more than one category depending upon the person's needs as well as how and where the person uses the AT. Throughout this section, we will be discussing the various AT solution's available for intellectual disability, hearing impairment, visual impairment and locomotor disability.

5.4.1. Types of Assistive Devices for Intellectual Disability (ID):

According to American Association of Intellectual and Developmental Disabilities (AAIDD) "ID is a neurodevelopment disorder that begins in childhood and is characterized by limitations in both intelligence and adaptive skills, affecting at least one of three adaptive domains (conceptual, social, and practical), with varying severity". The extent of adaptive impairment is key to defining ID and its severity. The term ID replaces the older term of "mental retardation".

Since individuals with ID often have difficulties in multiple domains, so intervention are tailored to the individual & is designed to treat motor, psychosocial, speech-language and other problems that may occur simultaneously with mental retardation. Depending upon the type of disability present as a co morbidity (such as hearing loss, motor problems etc), appropriate assistive device can be selected (mentioned in section 5.2.2, 5.2.3, and 5.2.4). In this section, we will specifically discuss AT based on age range of individuals with ID, and the communication needs.

5.4.1.1 Assistive Devices available for Persons with Intellectual Disability (PWID) based on their age range:

Based on age range of PWID, Government of India distributes the following assistive devices under Assistance to Disabled persons for purchasing/fitting of Aids/appliances (ADIP) Scheme:

- **Kit 1 (a) Age Group 0-3 years (Early Intervention Group),** which includes materials like rattles, teethers, ADL Kits, Palm Grip, Drum, sensory footsteps, crib toys, squeaking toys, pyramid rings, soft ball, wooden blocks, pull toy, sensory mat, stimulation toys, nesting cups, musical books, squeaky shoes, NIMH Book - RAPID, and kit bag.

(b) **TLM Kit**, which includes resonance board, water play set, different texture gloves and socks, Pre-Braille Book (shape), visual stimulation kit, auditory stimulation kit, olfactory stimulation kit, and Pre-cane.

- **Kit 2: Age Group 3-6 years (Pre Primary Group):** Number picture tray, building blocks, abacus slates, Fine motor skill mat, peg board, dolls, beads, raised shape tray, picture sets (everyday objects), blowing toys, coloring books with crayons, puzzles, count and match, sensory books, LKG Books, Hand Puppet, magic slate,

word cubes, lacing shoes, nesting cups, face puzzle, and NIMH Book-Towards Independence series.

- **Kit 3: Age Group 7-11 years (Primary Group):** Picture puzzle, slate and abacus, picture and word cards, assembling kit, number cards, adapted daily living items, pound toys, jigsaw puzzle, telling time kit, count and match, puzzle-body parts, alphabet worm, functional literacy workbook, functional numerical workbook, UKG level books, Class 1 books, magic slate, coloring books with crayon, beads and NIMH Publications (Teaching functional academics for students with mental retardation, functional literacy flip charts, functional literacy workbooks, functional numeracy workbook, etc)
- **Kit 4: Age Group 12-15 years & 16-18 years (Secondary & Pre vocational Groups):** Community helpers, wooden block of alphabets, needle work kit, duplicate currency, general knowledge flashcards, alphabets-words wooden cubes, fitting and assembling cubes, number tiles, On India puzzle, measuring sets, story books, India General (Picture cards, word cards), mobile phone, calculator, digital watch, number cubes, multiplications tactile board, pocket multiplier, worksheet, pen and duster, class 2 & class 3 books, and NIMH publications (teaching functional academics for students with mental retardation, functional literacy workbooks, functional numeric workbooks, play fun n learn).

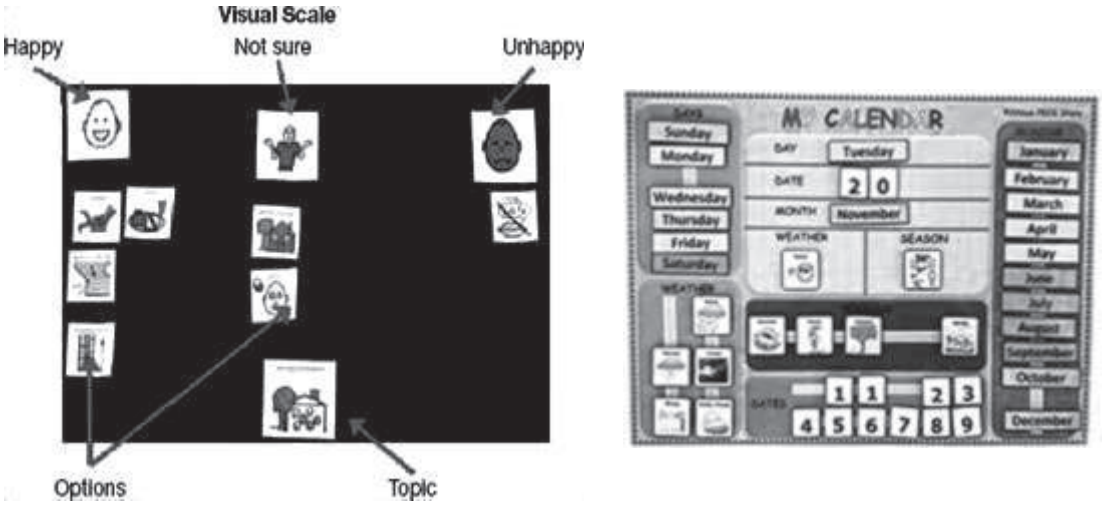
5.4.1.2. Assistive Devices available for PWID based on Communication Needs:

Communication impairments interfere with a PWID's ability to understand or process information or express one's self in an auditory manner. Communication impairments can significantly affect the clarity and content of one's speech. They can also be related to a comprehension deficit that results in ineffective verbal communication. For people with ID having communication impairments, there are various AT solutions ranging from low tech to high tech. The ideal device (low to high tech) for each PWID to use is often determined by the level of physical or cognitive impairment as well as affordability.

- Low Tech/ No Tech:

Low tech and no tech solutions for people with communication impairments are typically items readily available to everyone. Examples of no tech solution can be use of strategies as simple as using a pen and paper or a dry erase board to communicate, symbol-based communication that consists of using symbols on a communication board

or in a communication book to indicate a desired word or phrase, or talking mats whereby a person with disability can use pictures to replace verbal vocabulary (Figure 1). The user can indicate the desired symbols through a direct point, an eye gaze, or a series of yes/no questions.



(A) (B)

Figure 1: Examples of Low Tech Communication Aid (A) Talking Mat, and (B) Picture Exchange Communication Board

The low tech options are easy to obtain and cost effective. However, these options do not provide an audio output, thus they do not provide the user a "voice", thus making it difficult for the user to initiate a conversation. Also, symbols can cause confusion for conversation partners.

- **Mid Tech Communication Options**

Mid tech devices are defined as such because they are slightly more expensive than low tech devices, they run on a power supply typically batteries, and using them effectively requires some level of training. These solutions consist of some sort of recordable device with a static display and a limited number of options for storing recordings (Figure 2). In a mid tech communication device, each recorded word, phrase, or message is associated with one of the static selection options. When that option is selected, the corresponding message is played. Most mid tech communication devices also provide switch scanning options to allow access to people with various levels of physical impairments.

Benefits of these devices include the provision of a "voice" for the user via an audio output and the relatively inexpensive cost of the device. Due to their limited communication options, mid tech devices are also simple to use, especially for people with cognitive impairments. The presence of an audio output also makes conversation initiation possible. One downside of these devices is that the static nature of the displays and necessity to record messages limits speech options for the user. Limited speech options make unplanned conversations difficult. Another issue is that the batteries that power these devices can run out fairly quickly leaving users without a communication option until the batteries can be changed.

(A) (B)

Figure 2: Examples of Mid Tech Device (A) The Cheap Talk 8, where each of the eight squares acts as a button that when pressed, plays a recorded message. Symbols have been placed over each square to represent that square's recorded message, and (B) Little step by step communicator, a single-button communication aid with levels which is ideal for pre-recording sequential messages to be used at specific times of the day, or for recording and storing sequential messages that are used on a regular basis.

- **High Tech**

High tech communication devices, also referred to as Augmentative and Alternative Communication (AAC) devices, consist of a computer-based, touch screen system with a dynamic display that utilizes a combination of recorded voice and synthesized voice to convey messages for people with communication impairments. To use these types of devices one can either directly type words or phrases to be spoken or activate a symbol

that has been programmed to link to a word, phrase, or sentence. These devices (Figure 3) are produced by many manufacturers (Prentke Romich, Assistive Technology, Inc., Words+, Dynavox, Avaz etc.) and made in various sizes, making them easily portable. To access these AAC devices, one can either use direct touch or switch scanning. The number of options and the complexity of scanning make these AAC devices difficult for people with severe cognitive impairments to use effectively.

(A) (B)

Figure 3: Examples of High Tech Device. (A) Dynavox, a touch screen based AAC device. The screen shows symbols that either play a message or change the dynamic display to display the symbols with messages to expand conversation options, and (B) Screen of Avaz AAC App

High tech AAC devices are portable and usable across many different environments. The biggest drawback to these devices is their cost. These types of devices also require a significant initial training and programming due to their complexity. To provide a user with numerous communication options, someone has to program each option into the device. Also, much like mid tech devices, many high tech devices are battery operated and have the potential to run out, leaving the user without a means of communication, if the user does not pay attention to low battery warnings.

5.4.2. Types of Assistive Devices for Hearing Impairment

Hearing impairment is defined by the WHO (WHO 2015b) as the inability to hear as well as someone with normal hearing. Hard of hearing (HOH) refers to people with

hearing loss ranging from moderate to severe. Deafness is currently defined by the WHO (WHO 2015b) as a condition in which an individual has very little or no hearing. Hearing Loss can affect one ear or both ears and can be due to various medical causes. From an anatomic physiological point of view, it can originate from a dysfunction of the external or middle ear (conductive hearing loss), deterioration of the cochlea (sensory hearing loss), neurological conditions affecting either the auditory nerve, or nuclei, or the cortex (neurologic hearing loss).

The auditory cortex tends to become atrophic when under-stimulated. As a consequence, uncorrected hearing losses of sensory nature (i.e. due to the organ of hearing) sooner or later also tend to cause a deterioration of the auditory cortex (i.e. lead to neurosensory hearing loss). This is particularly relevant because when a hearing loss becomes neurosensory, hearing aids become less effective. They may indeed improve the sensory function but they cannot substantially improve neurological atrophy.

Existing AT for deaf and hearing impaired people include three broad classes of devices: 1) hearing technology, 2) alerting devices and 3) communication technology.

5.4.2.1. Hearing Technology

Hearing technology includes devices used to improve the level of sound available to a listener. This technology includes devices like hearing aids (air conduction and bone conduction hearing aids), assistive listening devices, personal sound amplification products (PSAPs) and implantable device (BAHA, Middle Ear Implant, Cochlear Implant and Auditory Brainstem Implant).

- Hearing Aids: Hearing aids are sound-amplifying devices intended to compensate for impaired hearing (EHIMA 2015). Hearing aids may be thought of as miniature, personalized public-address systems. Sounds that strike the microphone (input transducer) are amplified, transmitted electrically to a miniature loudspeaker (output transducer), and then into the patient's external ear canal. Some hearing aids utilize a bone-conduction vibrator for the output transducer, and others are partially or fully implanted.

Hearing aids have a long history. Early hearing aids used analogue signals which processed sound in a linear fashion; today they are very rarely used. Current hearing aids use digital signals which allow them to be programmed at different frequencies. Digitalisation also provides special processing capabilities that help improve speech

recognition, noise reduction and overall performance. Hearing aids come in a variety of shapes, sizes, colours, and types. Among the hearing aids available today are the body-type, eyeglass, behind-the-ear (also available in open fit model), in-the-ear, in-the-canal, and completely in-the canal instruments (Figure 4). Fully digital circuitry is available in even the smallest size hearing instruments.

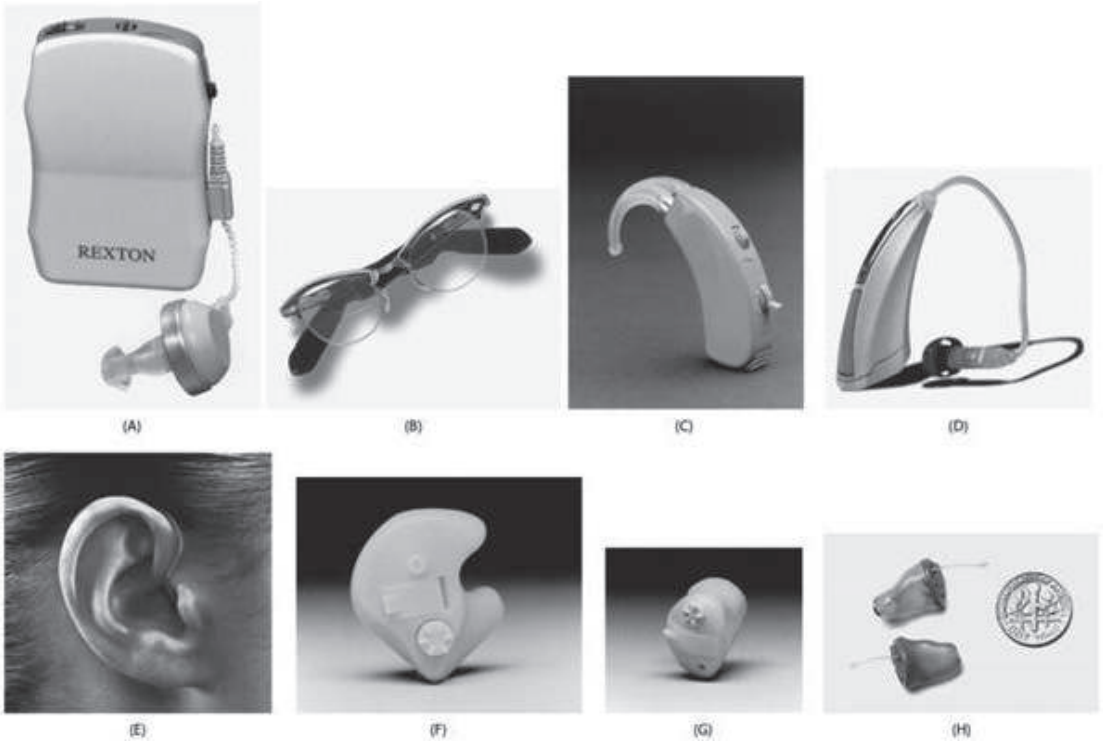


Figure 4: Types of air-conduction hearing aids: (A and B) the rarely seen body-type aid and eyeglass hearing aid with electronics housed in the paddle of the temple of the glass; (C) behind-the-ear (BTE) aid; (D and E) Open-fit receiver in the canal hearing aid and the same hearing aid on the ear revealing its high cosmetic advantage; (F) in-the-ear (ITE) aid, and (G) in-the-canal (ITC) aid; and (H) completely in –the-canal (CIC) aid. (A, C, G, and H courtesy of Rexton, Inc; B and D courtesy of Starkey Laboratories; E and F courtesy of GN ReSound).

Another type of hearing aid is Bone-conduction hearing aids, which are selected for those patients with conductive hearing loss and otological conditions that preclude the use of air-conduction amplification (Figure 5). These conditions may include persistent or recurrent ear drainage or hearing loss resulting from congenital ear canal anomalies.

The transducer is a vibrating receiver that is pressed firmly against the mastoid process. The transducer may be built within an eyeglass hearing aid or a post auricular instrument worn with a headband, or coupled to a body-style hearing instrument. As vibration of the skull stimulates both cochleas from a single bone-conduction instrument, true binaural hearing, arising from timing and intensity differences of sounds reaching the two ears, is not attainable.

Figure 5: The vibrating receiver of a bone-conduction hearing aid sends sound waves to the cochlea through the bone-conduction auditory pathways of the skull. (Courtesy of Starkey Laboratories).

- Assistive listening devices (ALD) can be used by individuals or large groups of people. They amplify the sounds and are particularly helpful when there is a significant background noise (NAD 2016). By using different types of energy, ALDs transmit signals to a miniature wireless receiver (tele-coil, also known as t-coil), which turns back signals into sounds. Originally, ALD receivers were headsets; today, t-coils are often installed inside hearing aids or a cochlear implant. There are several types of ALDs: some are designed for large environments, such as conference halls, airports, theatres etc., others are to be used in small settings and for one-on-one conversations. They could use different technologies, including *hearing loop systems* (which create electromagnetic fields to amplify sounds), *frequency-modulated (FM) systems* (which use radio signals) and *infrared systems* (which use infrared light). See Figure 6 for examples of different ALD's.

A **B** C

D

Figure 6: Examples of a few hearing assistance technologies for use by individuals with hearing impairment: (A) an infrared system for transmission and reception of auditory signals through invisible light frequencies, useful for the TV and in many live theaters and cinemas; (B) amplified cordless phone with caller ID; (C) FM system with microphones in both the transmitter and receiver for increased auditory signals, shown with earphones but also available with a neckloop that interfaces with hearing aid telecoils; (D) amplified neckloop that picks up Bluetooth signal from a cell phone and creates an induction signal for the hearing aid telecoil. (Courtesy of beyondhearingaids.com)

- Personal sound amplification products (PSAPs) are devices that increase sound levels and reduce background noise. They include a vast array of items, such as amplification systems, stethoscopes, TV/telephone amplification (Figure 7) etc. Usually, they use earphones or headphones or have a neck loop for hearing aid users to listen through their hearing aids. They can also have directional microphones that can be angled towards sound sources (NAD 2016).

Figure 7: A "personal communicator" amplifier to enhance communication in the absence of custom hearing amplification. The device may be plugged directly into the television set or other audio-output jacks to provide direct sound to the user's ear thereby improving the signal-to-noise ratio. With a plug-in microphone, such devices can also be invaluable in helping to maintain more private conversations between healthcare providers and their patients in compliance with privacy legislation. (Courtesy of Williams Sound Corporation)

- Implantable device, also considered as hearing prosthesis are categorised under four varieties BAHA, Middle Ear Implant, Cochlear Implant and Auditory Brainstem Implant.

Bone Anchored Hearing Aids (BAHA), also referred to as an "osseointegrated auditory prosthesis," or an "osseointegrated cochlear stimulator," is a device that is surgically implanted under the skin in the mastoid area (Figure 8). A screw hole is prepared following a surgical incision in the mastoid, which is closed after the BAHA is firmly screwed into place. After the incision heals (about eight weeks), the patient is fitted with the induction device (which fits directly over the implant) and either an at-the-ear or body-worn battery-powered processor.

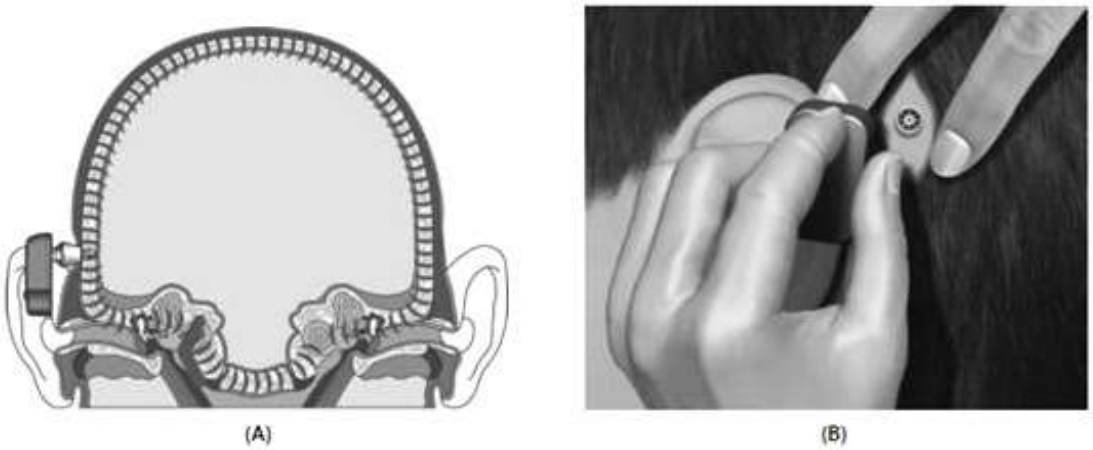


Figure 8: The Cochlear™ BAHA©, an osseointegrated auditory implant (Cochlear ™ BAHA BP 100 Bone Conduction System): (A) Bilateral routing of bone – conducted sound. (B) The BAHA attaches to an abutment connected to a titanium screw threaded directly into the mastoid bone allowing transmission of sound directly via the titanium screw (BAHA provided courtesy of Cochlear Americans, 2010 Cochlear Americas).

For fitting of BAHA, patients must have significant air-bone gaps and reasonably good bone-conduction thresholds in at least one ear. BAHA is often used successfully with bone-conduction pure-tone averages as poor as 45 dB. FDA has approved the use of BAHA for children as young as 5 years of age, for bilateral implantation, and for unilateral hearing loss (Spitzer, Ghossaini, & Wazen, 2002). In the case of congenital or sudden-onset unilateral deafness following autoimmune inner-ear disease or acoustic neuroma removal, a bone anchored hearing implant can be placed on the deaf side, where it can receive sound and deliver it through the bones of the scull (Transcranial Routing of Signal [TROS]) to the opposite ear's normal-functioning cochlea (Wazen et al., 2003).

Middle Ear Implants are designed primarily for moderate to severe sensory/neural hearing loss. However, these devices are increasingly being now used with mixed hearing loss as well. The rationale behind the use of middle-ear implants has been improved fidelity by driving the ossicles and/or cochlea directly without occlusion of the outer ear and reduction of acoustic feedback, because the energy is not transduced back to an acoustic signal. The device consists of three components: (1) an external audio processor that transmits sound across the skin to (2) an implanted receiver, which in turn transmits the converted electrical signal to (3) a transducer mounted onto the ossicular chain (Figure 9 A & B).

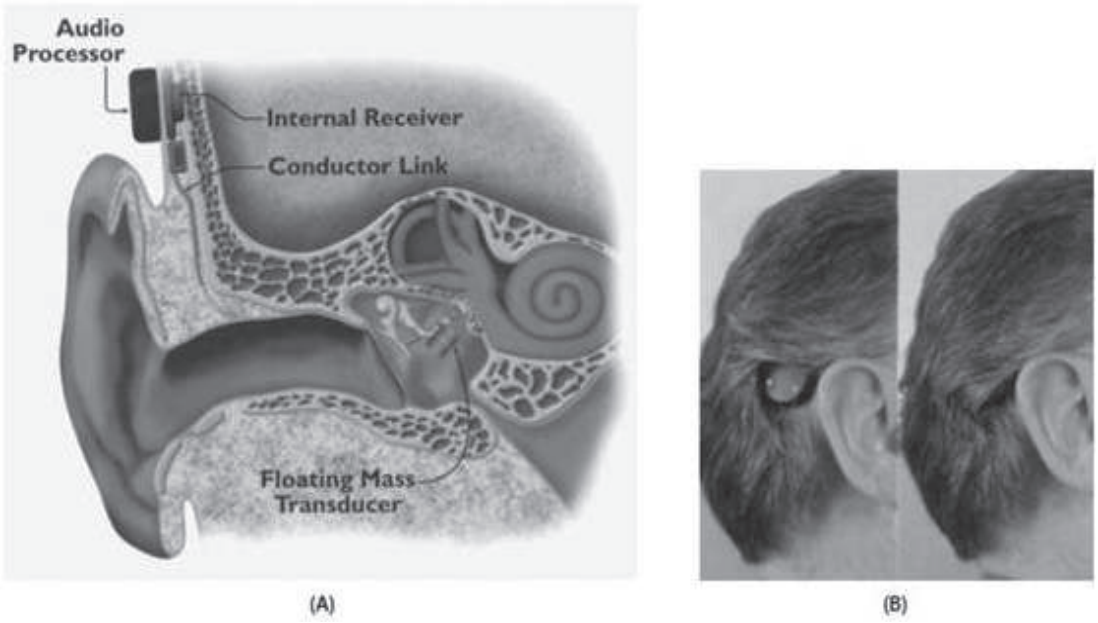


Figure 9: Middle –ear implant showing (A) anatomical cross-sectional view of device components and (B) physical appearance of the audio processor as worn (Courtesy of Med-El Corporation)

Cochlear Implant (CI) is a surgically-implanted sensor that converts sound inputs into electrical outputs that can be transmitted through the auditory nerve. It could be considered as an artificial cochlea, "the cochlear implant does not result in "restored" or "cured" hearing. It does, however, allow for the perception of the sensation of sound" (American Speech Language-Hearing Association 2016). The cochlear implant, which

remains controversial, is suggested for adults who have recently lost their hearing (in any case, after having learned speech and language) and for children older than 1 year and younger than 5 years who have profound hearing loss in both ears (American Speech-Language-Hearing Association 2016). The technology – although still in development – cannot be considered any longer experimental (unlike bionic eyes).

In the absence of viable hair-cell function, the cochlear implant (House, 1982) allows for direct stimulation of the auditory nerves (Figure 10). The internal receiver, which is implanted under the skin behind the pinna, consists of wire electrodes and a tiny coil. Up to 22 active electrodes are placed 22 to 24 mm into the scala tympani within the cochlea (Figure 11A). Ground electrodes are placed outside the bony labyrinth, often in the temporalis muscle. A small microphone attached to an ear hook feeds electrical impulses to a speech processor housed in a behind-the-ear casing, as in Figure 11B, or a body-worn unit similar to a body-style hearing aid. The processor codes the speech information, which is subsequently delivered to a transmitter, which converts it to magnetic impulses that are transmitted to the electrode array (Figure 10). An electrical signal is induced from the magnetic field in the cochlea and flows on to stimulate the auditory nerve.

Figure 10: Example of an ear-level cochlear implant device showing its internal components (Cochlear Nucleus® CP512 cochlear implant) and external components (CP810 Sound Processor and CR110 Remote Assistant). Nucleus® 5 photo provided courtesy of Cochlear™ Americas, © 2010 Cochlear Americas. TM).

Figure 11: (A) Implantation of a multielectrode array of a cochlear implant device (Courtesy of Cochlear Americas) (B) Physical appearance of the cochlear Implant processor as worn.

Auditory Brainstem Implant (ABI), the most recent form of prosthesis available in Hearing Industry are used for patient's, (e.g.,neurofibromatosis type 2, 90% of whom exhibit bilateral acoustic neuromas, bilateral temporal bone fractures or bilateral agenesis of the cochlea), cochlear implantation provides no benefit., and thus the cochlea and first-order neurons are by passed, permitting direct stimulation of the cochlear nuclei. As with cochlear implantation, the implanted electrode is coupled through a transcutaneous magnetic connector to an external sound processor. While ABI creates an enhanced auditory awareness and improved speech reading performance, communication improvement is not as great as that obtained for cochlear implant recipients, regardless of the extent of auditory rehabilitation received following implantation.

5.4.2.2. Alarm and Alerting Systems

Alerting or alarm systems are devices that are suited also for deaf people, because they do not usually require any residual hearing capacity (Lucker and Hersh 2003). They use light or vibrations or a combination of them to alert users that a particular event is occurring. They include 1) clocks and wake-up alarm systems, 2) household device alerts (Figure 12) and 3) doorbell and telephone alerts. They may use remote

receivers placed around the house or portable pagers. There are also devices designed for baby monitoring, which are able to recognise different types of baby cries and alert the disabled parent accordingly.

Figure 12: Smoke detector system that activates a bed vibrator for vibrotactile alerting (Courtesy of beyondhearingaids.com).

5.4.2.3 Communication Support Technology

Communication support technology, also known as augmentative and alternative communication (AAC), includes various tools that overall aim at improving communication skills of the disabled person. They are usually classified under two main headings: 1) telecommunication services and 2) person-to-person interactions (NSW Government 2016). Telecommunication services (Figure 13) include mainly standard technologies, such as physical and virtual keyboards, touch screens, video calling, captioning for phone calls (Figure 14) , text messaging and other social media and text-based technology (e.g. Whats App, FB Messenger, Snapchat etc.). There are also systems that use voice recognition software and are able to translate spoken words into sign language or text. AAC for person-to-person interactions includes picture boards, keyboards, touch screens, display panels, speech-generating devices and software. Some of these technologies address also born-deaf people and deaf people who run the risk of losing their speaking ability as well as deaf-blind people.

Figure 13: video Relay Service to communicate with a hearing person via a video language interpreter (source Wikimedia Commons)

Figure 14.: Captioned telephone with text display used with the relay service (Courtesyof beyondhearingaids.com).

5.4.3. Types of Assistive Devices for Visual Impairment

Visual impairment is defined by the WHO (2015a) as the condition of moderate or severe visual impairment (low vision), even after treatment and/or refractive correction. Interestingly enough, the WHO (2015a) proposed to include in the definition of blindness and visual impairment also people with correctable conditions (e.g. by standard glasses, contact lenses, medicine or surgery) but who do not have actual access to corrective measures because of environmental (e.g. disadvantaged economic conditions, social norms and practices) or personal (e.g. psychological conditions, attitudes of immediate family members) factors.

Existing ATs for blindness and visual impairment could be roughly divided as follows: 1) haptic aids, 2) travelling aids, 3) AT for accessible information and communication, 4) AT for daily living (Hersh2008). A fifth – emerging – category should be also mentioned: 5) phone and tablet applications for blind and visually impaired people.

5.4.3.1 Haptic Aids

Haptics means “pertaining to the sense of touch”, “tactile”, which is a complex sensorial modality, actually including many subcategories. Another term for haptic aids is *active touch*. The term “haptic” is today preferred to “tactile”. It covers systems that also use kinaesthetic information, generated by sensors in muscles, tendons and

joints. Blind and visually impaired people have always used tactile sensations as a substitute for vision, and they have probably always used canes to avoid obstacles. However, the two most well-known and widely used tactile aids – the Braille writing system and the white cane – have been introduced fairly recently, with the Braille system (Roth and Fee 2011) dating back to the Napoleonic wars and the white cane (Lions Clubs International 2016) to the early 1900s. The following are the different types of Haptic Aids.

- Haptic low-tech aids include the white cane, the traditional Braille system and embossed pictures (including tactile maps).
- Technologically advanced applications include 1) advanced Braille applications, 2) advanced canes, 3) haptic aids for computer usage and 4) matrices of point stimuli.
- Advanced Braille applications are technological applications aimed at simplifying the use of Braille. They include 1) software for Braille training, 2) Braille embossers (also known as Braille printers) which transfer computer-generated text into embossed Braille output, 3) Braille translation programs, which convert text scanned in or generated via standard word processing programs into Braille, 4) Braille computer interfaces, such as Braille monitors and keyboards (Figure 15).

Figure 15: Braille Notetaker (Source: Florida School for the Deaf and the Blind in St. Augustine, Florida-Video Library)

- Advanced canes (also known as technology canes or smart canes) have been developed over the last decades. Cane technology has chiefly focused on improving lightness and length of canes, consequently most progress has been made in relation to the material used (e.g. graphite-reinforced plastic, fibrereinforced plastic etc.). However, technologists today also explore the possibility to create electronic canes that better detect and identify obstacles (Ong, Zhang and Nee 2013). This technology is ultimately based on traditional cane principles coupled with additional technology to detect obstacles and transmit information to the cane bearer (Hersh and Johnson 2008d). Technologies explored to detect obstacles include laser and ultrasounds (also known as Batcane). Technologies to transmit information including both audio and tactile interfaces as well as a combination of the two. The tactile interface is usually made of vibrating buttons or pins. The audio interface usually comprises tones of different pitch conveyed through a single earphone. Information includes basic details on obstacles, but can also become very sophisticated, using a combination of haptic and auditory signals to suggest a spatial map of the surroundings (Hoyle and Waters 2008).
- Haptic aids for computer use include 1) tactile computer mouse and touchpad, 2) haptic graphical user interface, 3) haptic display.

Matrices of point stimuli is a major enabling technology for new haptic applications. Haptic applications typically convey their signals to the user's body surface. By using several static and/or vibrating pins, it is possible to create a matrix of point stimuli. By dynamically activating some of these pins, it is then possible to form different patterns which may provide details that are usually only captured by sighted people, such as written texts, tactile pictures (including diagrams and maps) and so on. Devices provided with a matrix of point stimuli can be fed, for instance, by a wearable camera, becoming tactile-visual substitution systems (Jansson 2008).

5.4.3.2 Travelling Aids

One of the main challenges that blind and visually impaired people face is travelling through different environments, including unknown environments. Travelling challenges include 1) mobility, 2) navigation and 3) environmental access. Mobility concerns the identification of a safe path avoiding and negotiating obstacles and hazards. Navigation concerns way finding, that is to say, knowing the current location and establishing how

to get from the current location to a destination. Environmental access concerns good design of the physical environment in order to minimise hazards for blind and visually impaired people and to provide them with contextual information.

The various assistive devices available for the visual impairment as travelling aids are listed below.

- Primary aids: devices that are mainly used in near space. All primary aids share some features. They must be easy to carry, small, lightweight and, ideally, consist of a single unit. Moreover, given that they can be used outdoor and in many different situations, it is paramount that they are robust, able to withstand all weather conditions as well as knocks and falls. Low- tech primary aids include low-tech haptic aids, such as the white cane. High-tech primary aids include various obstacles and object location detectors, which scan the environment (Figure 16). They include devices such as hand-held ultrasonic torch, laser technologies and devices based on infrared and cameras (Karungaru, Terada and Fukumi 2011).

Figure 16: Project Tacit: Sonar for the Blind (Source: Grathio Labs).

- Secondary aids: devices that are mainly used in far space for orientation and navigation (Bradley and Dunlop 2008). These devices usually provide two types of information. First, they provide geo-location information and assist in how to reach a given destination and find the best route to be followed. Once the user starts travelling, the integrated Global Positioning System (GPS) identifies the user's location and provides directions. Second, these devices may also provide landmark information. Landmark details serve a number of purposes: they allow validating positioning information, enabling a user to continue following a planned

route even if satellite signals are temporarily unavailable; they also allow finding specific points along the route, such as an entrance, an obstacle and so on. Today, most secondary aids use GPS, combined with geographical information systems (GIS) (Ali and Sankar 2012). GPS accuracy is rapidly enhancing from the meter-level down to a few centimetres. Emerging technologies – mainly driven by the development of autonomous vehicles, improved aviation and naval navigation systems – may achieve centimetre-level positioning accuracy even on standard mobile phones and wearable devices (Chen, Zhao and Farrell 2015).

Secondary aids include both electronic travel devices (ETDs) consisting of several hardware components specifically designed to assist the disabled person and assistive applications in mobile phone technology. ETDs are usually wearable devices including a small computer (provided with dedicated software for information processing, often with speech and voice recognition) coupled with GPS and GIS systems (Ball 2008). They may also include a Braille compass (a directional device using Braille characters). Early ETDs provided information mainly via speech audio outputs. Today, audio signals (non-speech) and haptic outputs are also commonly used (Ball 2008). Another approach, which is becoming increasingly important, is based on the development of assistive applications to be used in standard mobile phone technology (Doughty 2011). Smart mobile phones include components such as a multi-megapixel camera, high-quality directional microphone, tri-axial accelerometer, GPS receiver, digital voice recorder, touch-screen, electronic temperature chip, several vibration units, magnetic and electric field sensors as well as 4G, Wi-Fi and Bluetooth communications. Through low-cost downloadable applications, all these technologies can also be used for assistive purposes.

- Embedded technologies: technologies that are embedded in the environment, aimed at making it accessible and user-friendly and overcoming the main barriers met by disabled persons. Most of them are low-tech and include 1) good lighting, 2) well-designed signage systems, including tactile and audio information and alarms, 3) tactile paving and surfaces to warn of hazards and to direct people, and 4) colour contrasts, including colour-contrasting strips to make items easier to recognise. High-tech devices are electronic signal systems embedded in the environment which are activated by the presence of the disabled person (Hersh and Johnson 2008a). Talking signs are repeating, directionally selective voice messages transmitted by infrared light to a hand-held receiver. Radio frequency

identification (RFID) tags are also used to broadcast signals to be transmitted to the user either as an audio signal over a headphone or by vibration (Chen et al. 2010). Similarly, Bluetooth technology is used to create signal systems and alarms (Hersh and Johnson 2008a).

- Mixed systems: semi-autonomous systems that possess full autonomy for local navigation, enabling the visually impaired to avoid obstacles. Some of these systems (robotic guides and walkers) have already been tested (Ulrich and Borenstein 2001). Moreover, they could be used for pedestrian navigation, allowing path planning and localisation, also relying on signals broadcasted by embedded technologies.

5.4.3.3 AT for accessible information and communication

Technology for accessible information and communication includes technologies for specific purposes, such as education, working and employment, leisure and recreation. They comprise accessibility tools for television, computer, Internet navigation and mobile phone communication (Hersh and Johnson 2008b). A clear distinction should be drawn between low vision aids and systems tailored to the needs of blind people. Low vision aids aim at maximizing the remaining sight by 1) increasing the object size, e.g. larger print keyboard stickers, 2) decreasing the viewing distance, e.g. magnifiers of various types, spectacles etc., 3) video magnification, e.g. closed-circuit television (CCTV), computer operating systems provided with magnification accessibility features, 4) telescoscopic magnification, e.g. contact lens telescopes. These tools are applied to different devices, such as computers, screens, tablets and phones etc. Systems tailored to the needs of blind people turn visual information into other sensory modalities (Figure 17) (Maidenbaum, Abboud and Amedi 2014), they are based on *speech, text and Braille conversion technologies* (e.g. Braille printers, Braille keyboards, Braille text recognition software etc.), *text and screen readers* (including audio-books and alike), *voice recognition software* (e.g. voice command for mobile phones). Specific applications include 1) audio support software, 2) text-to-speech software, 3) portable reading devices, 4) Braille computer input and output hardware and software, 5) tactile images and screens, 6) audio operating systems for computers (Hersh and Johnson 2008b). They mostly use haptic or audio technologies, or a combination of both.

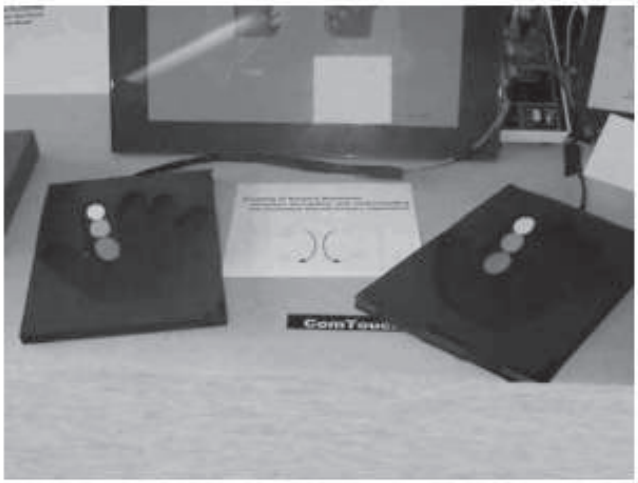


Figure 17: Com Touch haptic interface for PC (source Tangible Media Group).

5.4.3.4 AT for daily living

A vast array of devices is designed to assist blind and visually impaired people in dealing with daily living activities (Figure 18). They include devices for 1) personal care, 2) time keeping, alarms, alerting, 3) food preparation and consumption, 4) environmental control and household appliances, 5) money, finance and shopping (Hersh and Johnson 2008c). They use various labelling systems (e.g. tactile, RFD, talking labels) and various talking readers (e.g. talking bar

code readers, talking health monitoring devices such as blood pressure readers and glucose readers etc.). They also include tactile and vibrating clocks and a alarms, talking kitchen tools, talking microwave ovens, talking washing machines and talking vacuum cleaners etc. Money, finance and shopping tools include talking wallets and purses, talking ATMs and so on. All these devices use technologies described above.

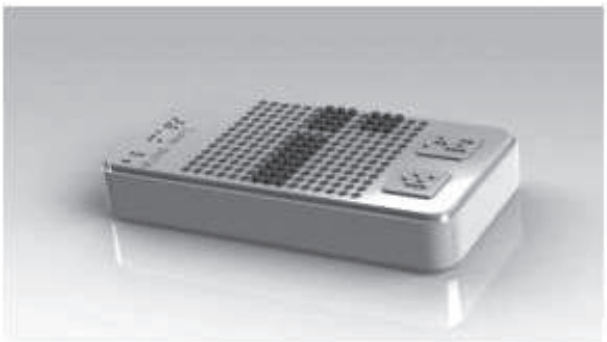


Figure 18: Blind Map (Source: Ars Electronica).

5.4.3.5. Phone and tablet applications for blind and visually impaired people

In recent years, few phone and tablet applications for blind and visually impaired People have been introduced. Though, these could be classified into previous categories, but due to their number and increasing importance they deserve a separate mention. They use existing phone or tablet technology (Ireland Citizens Information Board 2016). A few example includes (1) *magnification apps,* which use the phone camera as a magnifying glass; (2) *colour detection apps*, which use the camera to identify and speak the name of the colour of an item; (3) *money identification apps*, which use the camera to identify the value of a note; (4) *object identification apps*, which use the camera to identify objects, also by reading labels and barcodes; (5) *crowdsourcing apps*, which circulate photos taken by disabled persons among anonymous web volunteers who describe what they see; (6) *Braille apps*, which teach Braille and allow typing Braille on the touchscreen; etc.

5.4.4. Types of Assistive Devices for Locomotor Disability

Locomotor impairments are often the result of orthopedic or neuromuscular disorders such as amputation, paralysis, spinal cord injury, cerebral Palsy, multiple sclerosis, stroke, Traumatic Brain Injury (TBI), muscular dystrophy, etc. Characteristics of mobility impairments include presence of muscular weakness, manipulative, positioning, and ambulatory difficulties, poor muscular strength, and in some cases pain. Mobility impairments describe a wide range of impairments from lower extremity impairments that may require someone to use a cane or walker to assist walking; to upper extremity impairments which can limit the use of one's hands. Due to the wide variety of mobility disabilities and diagnoses, it is impossible to generalize the functional ability of someone with a mobility impairment. Also because of the wide range and levels of mobility impairments, the category of AT for people with mobility impairments encompasses many different types of devices. Numerous AT devices are available to help people with mobility impairments with transportation, activities of daily living (dressing, eating, brushing teeth, etc.), environmental control (control of lights, TV, radio, etc.), and computer access.

Existing ATs for locomotor disability can be divided into low tech, mid tech and high tech devices. They are discussed in the section below.

5.4.4.1. Low Tech/ No Tech Assistive Technology:

Low tech devices are often a simple and cost effective solutions that utilize skills someone possesses to complete tasks that require skills that the person does not possess. *Canes* and *walkers* are examples of low tech devices that are commonly used to assist people who's mobility impairment inhibits their ability to walk normally. A *manual wheelchair*, is another low tech device because it lacks a power source, utilizes an individual's ability to use their hands and arms to propel themselves forward out of necessity, when a mobility impairment prevents them from walking.

Low tech devices are often used to assist with activities of daily living. One of the most common devices is an *enlarged grip*. This is used to increase the diameter of the handle of several commonly used devices such as eating utensils, toothbrushes, combs, etc. that someone with a mobility impairment may have difficulty gripping. Other low tech devices that can be used for everything like for helping to turn a page in a book, pressing a button on a remote control, and pressing keys on a computer are head pointers, mouth sticks, and typing aids (Figure 19.*)*. These devices consist of a small rubber point at the end of a rigid, plastic protrusion that is used by a part of the body (i.e. head, mouth, or hand) the user can control. They are used by people with various mobility impairments who have difficulty isolating a pointing motion with a finger to perform tasks that require a point, such as pressing small buttons. The examples listed here are not the only low tech AT devices for people with mobility impairments; they are simply some of the most commonly used devices. The definition of low tech devices is broad enough that any simple device one can use to assist with performing a task can be considered a low tech AT device.

Figure 19: Mouth pointers and driving controls are other examples of how AT can benefit the lives of persons with mobility impairments.

5.4.4.2. Mid Technology:

Most AT devices for people with mobility impairments fall under the categories of low tech or high tech, there are however a few types of devices that fit into the mid tech category. Examples of mid tech devices are automatic page turners (Figure 20) and feeding devices. Automatic page turners turn a page of a book when the user activates a button. This provides people with upper extremity impairments independent access to books. Feeding devices contain a movable arm that pushes food off of a plate onto a fork or into the users mouth following a button activation. One other common device that fits in this category is the *automatic door opener*. These are found in many buildings to provide access to someone with a mobility impairment that has difficulty opening a door by simply pressing a button. Again, this is a sample of mid tech devices, not an all inclusive list.

Figure 20: Automatic page turners provide people with upper extremity impairments independent access to books.

5.4.4.3. High Tech:

High tech AT devices typically falls into one of the three sub-categories, transportation, environmental control, or computer access. There are many examples of assistive devices in each of these categories. The examples given in this section do not cover all of the devices available.

AT for transportation refers to the wheelchair and devices that someone with a disability uses to assist in vehicular transportation. Manual wheelchairs were considered low tech devices. *Power wheelchairs* (Figure 21) and *power assist wheelchairs* (wheelchairs similar to manual wheelchairs that provide a battery powered boost when a wheel is pushed to allow use by people with minimal mobility in their upper extremities) are considered high tech AT. These wheelchairs are considered high tech based on their power and control systems, which manual wheelchairs do not possess. Wheelchair usage can cause difficulty getting in and out of vehicles for longer distance transportation. Buses and vans can be equipped with electronic wheelchair lifts to help wheelchair users get in and out of these modes of transportation successfully. If someone has only a lower extremity mobility impairment, he/she still has the ability to operate a vehicle with some specific modifications. *Hand controls* can be installed in a car that allows a user to control the gas and brake with one hand while steering with another. These high tech devices make independent transportation possible for people with lower extremity mobility impairments.

Figure 21: Power wh people with an inability to propel a manual wheelchair. ECUs can also be incorporated into a power wheelchair's control module allowing the user to control lights, TVs, and other household electronics independently.

Some mobility impairments cause people to have difficulty controlling devices within their environment such as lights, televisions, radios, doors, and telephones. Devices are available to control each of these devices individually as are devices that allow someone to control each of these devices from one central unit. Anything allowing someone to

control household devices is called an *environmental control unit (ECU)*. ECUs are either stand alone devices that are controlled by scrolling through a menu using a switch to select control options or computer-based devices controlled through voice control. With the increased use of infrared technology, the controls of an ECU are more frequently being incorporated into a user's power wheelchair control module (Figure 22). This provides the user a limited level of mobility when controlling devices through an ECU because it does not require them to be near a central device, just within reach via infrared. ECUs give people with mobility impairments the same level of independence and control of many electronic devices as those without impairments.

Figure 22: Power assist wheelchairs have motors in their wheels that provide an extra boost when propelled manually to help those lacking strength or who fatigue easily to use a manual wheelchair.

Computers can be an important tool for working, gathering information, and communication. They can be imperative for someone who's mobility impairment makes working from home more conducive than working in an office. Although many other high tech devices are also available to help people with upper extremity mobility impairments to access a computer, however because of their high cost they are mostly unavailable to people without a means to purchase them.

5.5 Assessment Of Pwid Needs To Identify The Appropriate Assistive Devices

Intellectual Disability (ID) is defined by the American Association on Intellectual and Developmental Disabilities (2013), the Diagnostic and Statistical Manual of Mental

Disorders V (2013), and the International Classifications of Diseases 10 (2016) as an IQ below 70, manifested during the developmental period (<18 years of age), with impairments in adaptive functioning, such as communication skills, social skills, personal independence, school, or work functioning. India has a prevalence of 10.5/1000 in ID, of which the urban population (11/1000) has slightly higher rate than rural (10.08/1000) (Lakhan, Ekudayo & Shahbaz., 2015).

Compared to the general population, people with ID have a higher prevalence of co morbidities which could be better managed with assistive products. Thus, the following domains of assessment need to be addressed in this specific population.

(a) Impairment in cognitive and adaptive functioning intrinsic to ID should be adequately taken care while selecting or deciding assistive technology products. That means, communication skills and physical examinations by the clinician should be adapted to the intellectual and emotional level of the person with ID, to get the correct diagnosis and ensure the prescription of appropriate assistive product(s).

(b) The use of every assistive product requires information, instruction, and support which should be both accessible as well as understandable to the person with ID, if it is to be used effectively. For that a multidisciplinary team should be involved for the training and support of people with ID. For example, hearing aids require a customized habituation training program adjusted to an individual's level of ID. This needs to be implemented in collaboration with the speech and language therapist, behaviorist, and caregiver together to help the person with ID to accept and benefit from the use of the new product.

(c) People with ID often experience comorbidities; such as sensory impairments and dementia. These comorbidities may require the use of various assistive products. Thus, the needs of the users with ID must be more often taken into account, which can be catered through developing an increased awareness among the caregivers of PWID and health care personnel.

A list of features that makes an assistive device most appropriate and effective for users of ID are as follows.

1. Devices designed to suit users and their environments

a. Compatible with the ID users' aspirations, emotional needs, and ways of life;

b. Compatible with the users' culture and local customs;

c. Unobtrusive or attractive in appearance by local standards;

d. Physically comfortable from an ID users' perspectives;

e. Sturdy enough that the users feel safe;

f. Useful in a variety of situations;

g. Durable, dependable and reliable, especially in rural areas, remote areas and rugged conditions;

h. Compatible with the ground surface and other conditions of a user's physical environment.

2. Inexpensive devices

a. Low in purchase price, so that a larger number of users than is presently the case can buy them, and Governments and/or NGOs can provide them free of charge or at subsidized rates;

b. Easy (and affordable) to assemble or produce, for anyone with an interest in empowering people with disabilities, an aptitude for technical work, and appropriate short-term training;

c. Easy and affordable to maintain, so that keeping the devices in working order requires minimal regular consumption of expensive or scarce resources;

d. Amenable to repair with the use of locally available materials and technical skills, in or near the users' own communities.

3. Easy-to-use devices

a. Easily understandable by users with limited exposure to technology;

b. Easily moved from one place to another;

c. Easy to operate without prolonged training or complex skills.

5.6 Selection & Use Of Appropriate Assistive Devices For Pwid And Maintenance

The success of an assistive device is measured by whether its users actually use the device, do so in an effective and liberating way that gives them access to their environments, and are satisfied with the device in the long term. To achieve this goal, every assistive device should have four primary qualities. Devices should be designed in consultation with users and their families in a way well suited to the users' diverse social and physical environments; inexpensive to produce, purchase and maintain; easy to use; and effective.

"Appropriate technology" is designed with consideration given to the environment, cultural, social and economic factors that influence communities and individuals with ID. Thus, an assessment process must begin with a data collection system that provides information about the needs of person's with intellectual disability. The following are few points that needs to be kept in mind during selection of appropriate assistive device:

a. Assessment of the individual with ID: While assessing for an appropriate AT for individual with ID, a clinician need to address two important questions.

(1) What does the individual with ID need to do? The goal at this time is to establish the consensus about what the purpose of the assistive technology process will be. For example, the purpose may be "writing" or "talking."

(2) What are the PWIDs special needs and current abilities? The goal here is to assess the barriers which keep the PWID from doing whatever needs to be done. Parallely, focus should also involve assessing the "abilities" that the PWID possesses. No matter how big the needs, everyone has abilities that can be built upon and enhanced. A clinician must review areas of cognitive abilities, motor abilities, sensory abilities, language abilities, and social/emotional abilities

b. Assessment of the Environments: When assessing the environment, a clinician need to address the following important questions:

(1) What is the physical arrangement? The clinician need to outline the environments in which the PWID is suppose to function as well as the physical characteristics of that setting (e.g., home, the regular classroom; special classroom; cafeteria, playground, etc).

(2) What materials and equipment are currently available? The clinician needs to define the devices and materials, and adaptive techniques or equipment available to the PWID in the current environmental context (e.g., availability of alternate communication boards, curriculum materials used with the student; peer tutoring; classroom communication device used with all students; computer in classroom).

(3) What are the attitudes and expectations? Assess the expectations that currently exist within the PWID and their families. It needs to be determined whether these expectations are realistic or enabling the PWID to perform at expected levels of independence.

(4) What are the concerns? Note concerns across various settings where a PWID will function. Further observation may need to be made of the environmental barriers.

c. Assessment of the Tasks. When assessing the tasks, a clinician need to address the following important questions:

(1) What tasks enable progress toward mastery of goals? The purpose of this step is to determine what opportunities are present that enable the PWID to move toward the goals and objectives included in the intervention plan. If the answer is "none," AT tools will not solve the problem.

(2) What tasks make a PWID actively involved in the environments? One place to begin intervention is to identify "what everyone else is doing." It should be kept in mind that participation in the same activity does not always lead to the same results for all participants. So these needs to be kept in mind that goals for PWID should be selected in such a way, so that they can be accomplished within the activities that are being done by other individuals.

(3) What are the critical elements of the activity? At this point, the clinician should list the elements of the activity that the PWID should be expected to perform. Further task analysis may be recommended to more clearly identify the task skills that are needed.

The informations gathered from this assessment section can be summarised in the assessment form given below.

Assistive Technology Process
Assessment Summary of Student Need for Assistive Technology

Name _____ Date _____
Use this form to analyze data and define the specific needs the student has for assistive technology.

STUDENT Area(s) of Need _____	
ENVIRONMENTS	TASKS
Specific Concerns/Needs: *What do we want the student to do?*	

Adapted from Joy Zabala, 1998

5.7 Schemes Of Mosje– Adip Scheme, Ddrs And Sc/St Scheme

The ministry of social justice and empowerment is a government of India ministry. It is responsible for welfare, social justice and empowerment of disadvantaged and marginalized sections of society, including scheduled castes (SC), other backward classes (OBC), the disabled, the elderly, and the victims of drug abuse. Few important schemes under the ministry like ADIP Scheme, DDRS, and SC/ST Scheme have been discussed in this section.

5.7.1. Assistance to Disabled persons for purchasing/fitting of Aids/appliances (ADIP) Scheme:

5.7.1.1 Objective:

The main objective of the scheme is to assist the needy disabled persons in procuring durable, sophisticated and scientifically manufactured, modern, standard aids and appliances that can promote their physical, social and psychological rehabilitation, reducing the effects of disabilities and enhance their economical potential. The aids and appliances supplied under the scheme are confirmed to BIS & ISI specifications.

5.7.1.2. Eligibility of the Implementing Agency under the scheme:

The scheme is implemented through implementing agencies such as (a) Societies, registered under the Societies registration Act, 1860 and their branches, if any, separately, (b) registered charitable trusts, (c) District rural Development Agencies, Indian Red Cross Societies and other autonomous bodies headed by District Collector/Chief Executive Officer/District Development officer of Zilla Parishad, (d) National/Apex institutes including ALIMCO functioning under administrative control of the Ministry of Social Justice and Empowerment/ Ministry of Health and Family Welfare, (e) State Handicapped Development Cooperations, (f) Local Bodies like Zilla Parishad, Municipalities, District Autonomous Development Councils and Panchayats, and (g) Hospitals registered as separate entity, as recommended by State/Central government.

5.7.1.3. Eligibility of the Beneficiaries:

A person with disabilities fulfilling following conditions would be eligible for assistance under ADIP Scheme through authorized agencies: (1) He/she should be an

Indian citizen of any age, (2) Should be certified by a Registered Medical Practitioner that he/she is disabled and fit to use prescribed aid/appliance. Holds a 40% Disablement Certificate, (3) Person who is employed/self-employed or getting pension and whose monthly income from all sources does not exceed Rs. 20,000/- per month, (4) In case of dependents, the income of parents/guardians should not exceed Rs. 20,000/- per month, and (5) Persons who have not received assistance from the Government, local bodies and Non-Official Organizations during the last 3 years for the same purpose. However, for children below 12 years of age this limit would be 1 year.

5.7.1.4. Quantum of Assistance:

The quantum of assistance and income limit under the ADIP scheme is as follows:

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

Traveling cost would be admissible separately to the PwD and one escort limited to bus fare or railway, subject to a limit of Rs 250/- each person, irrespective of number of visits to the Centre. Further, boarding and lodging expenses at the rate of Rs 100/- per day for maximum duration of 15days would be admissible, only for those patients whose total income is upto Rs 15,000/- per month and the same will be allowed to attendant/ escort. 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. The extent of subsidy provided is Rs 25,000. The minimum age for availing motorized tricycle and wheelchairs is 16 years. The assistance will be provided once in 10 years.

For providing modern assistive devices for all categories of PwDs both physical and mental and multiple disability impaired groups, e.g. Daisy Book players and other Talking Devices, Net Book Laptop and Digital Magnifiers for visual impairment and Behind the Ear (hearing aid) for hearing impairment, the items will be decided by an Expert Committee constituted in the Department of Disability Affairs with the approval of Minister for Social Justice & Empowerment. The extent of financial support would be

limited to Rs. 10,000 for each disability and Rs. 12,000 for students with disabilities in respect of devices costing upto Rs. 20,000. Further, all expensive items costing above Rs. 20,000, except cochlear implant, eligible for assistance under the scheme, subject to income ceiling, would be listed out. Government of India shall bear 50% of cost of the items thus listed by the Committee and the remainder shall be contributed by either the State Govt. or the NGO or any other agency or by the beneficiary concerned subject to prior approval of Ministry on case to case basis; limited to 20% of the Budget under the Scheme.

Ministry of Social Justice and Empowerment has recognized Institutes 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 has also identified and recognized 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.

5.7.1.5 Types of Aids/Appliances to be provided under the scheme:

- Locomotor Disabled: All types of prosthetic and orthopeadic devices, Mobility aids like tricycles, wheelchairs, crutches, walking sticks and walking frames/ rolators. Motorised tricycles for persons with locomotor disability, that is likely to cost more than INR 6,000, may be procured and provided in exceptional cases subject to prior approval from the Ministry of Social Justice and Empowerment on case to case basis. Extent of subsidy would however continue to be INR 6,000 for all other devices, all types of surgical foot wears and MCR chapels, and all types of devices for ADL (activity of daily living).
- Visually Challenged: Learning equipments like arithmetic frames, abacus, geometry kits etc., Giant Braille dots system for slow-learning blind children; Dictaphone and other variable speed recording system, and CD player/Tape recorder for blind students from X standard, Science learning equipments like talking balances, talking thermometers, measuring equipments like tape measures, micrometers etc; Braille writing equipments including Braillers, Braille shorthand machines, typewriters for blind students from X class, Talking calculators, Geography learning equipment like raised maps and globes; communication

equipments for the deaf-blind, and Braille attachments for telephone for deaf-blind Persons; Low vision aids including hand-held stand, lighted and unlighted magnifiers, speech synthesizers or Braille attachments for computers; Special mobility aids for visually challenged people with muscular dystrophy or cerebral palsy like adapted walkers; Software for visually handicapped persons using computers those are likely to cost more than INR 6,000 may be procured and provided in exceptional cases subject to prior approval of Ministry of Social Justice and Empowerment on case to case basis. For all other devices ceiling is INR 6,000.

- Hearing Impaired: Various types of hearing aids, cochlear implant, Educational kits like tape recorders / CD players etc, Assistive and alarming devices including devices for hearing of telephone, TV, doorbell, time alarm etc, & Communication aids like, portable speech synthesizer etc.
- Mentally Differently Abled: Any suitable device as advised by Rehabilitation Professional or treating physician like Teaching & Learning Material Kit of age group 0-3 years (Resonance Board, Water Play Set, Different texture gloves and socks, Pre –Braille book, visual stimulation book, auditory stimulation kit, olfactory stimulation kit, pre cane) etc. For details refer section 5.2.1.1.

5.7.2. Deendayal Disabled Rehabilitation Scheme (DDRS)

5.7.2.1. Objectives:

The objectives of the scheme are: (1) To create an enabling environment to ensure equal opportunities, equity, social justice and empowerment of persons with disabilities, and (2) To encourage voluntary action for ensuring effective implementation of the People with Disabilities (Equal Opportunities and Protection of Rights) Act of 1995.

5.7.2.2. Approach & Strategy:

The approach of this Scheme is to provide financial assistance to voluntary organizations to make available the whole range of services necessary for rehabilitation of persons with disabilities including early intervention, development of daily living skills, education, skill-development oriented towards employability, training and awareness generation. With a view to inclusion of persons with disabilities in the mainstream of society and actualizing their potential, the thrust is on education and

training programmes. In order to achieve the objectives of the scheme the key strategies are as follows:

- To enhance educational opportunities at all levels and in all forms and enlarge the scope of vocational and professional opportunities, income generation and gainful occupations.
- To support all such measures as may be necessary for promoting formal as well as non formal employment and placement opportunities.
- To implement outreach and comprehensive Community Based Rehabilitation programmes in urban and rural environments.
- To support manpower development activities to train required personnel at different levels for all programmes/ projects/activities for persons with disabilities.
- To support the development, publication and dissemination of information, documentation and training materials.
- To set up well equipped resource centres at different levels. To promote and support the development of self-help groups, parent organizations and independent living.
- To encourage coordination, cooperation and networking and multi-sectoral linkages.
- To support people with disabilities in projects which are environment friendly and ecopromotive.
- To support construction and maintenance of buildings, provision of furniture and fixtures and installation and maintenance of machinery and equipment.
- To establish and support facilities for sport, recreation, leisure-time activities, excursions, creative and performing arts, cultural and socially inclusive activities.
- To support and acilitate the availability of appropriate housing, homes and hostel facilities.
- To support the conduct of surveys and other forms of epidemiological studies.
- To promote research in various development areas, innovative strategies, assistive devices and enabling technologies and support production of such devices ensuring quality control.

- To support effort to ensure protection of human, civil and consumer rights of persons with disabilities.
- To support legal literacy, including legal counseling, legal aid and analysis and evaluation of existing laws.
- To support such other measures, which may meet the needs of the persons with disability and fulfill the obligations as prescribed in the People with Disabilities (Equal Opportunities and Protection of Rights) Act of 1995.

5.7.2.3. Grants-in-aid to NGOs:

To facilitate delivery of various services to persons with disabilities by voluntary organizations, the Ministry of Social Justice and Empowerment is administering DDRS scheme and providing grants-in-aid to NGOs for the following projects: Vocational Training Centres; Sheltered Workshops; Special Schools for the Persons with Disabilities; Project for Cerebral Palsied Children; Project for Pre-School and Early Intervention and Training; Home based Rehabilitation Program / Home Management Programme; Project for Rehabilitation of Leprosy Cured Persons (LCPs); Project relating to Survey, Identification, Awareness and Sensitization; Project for Community Based Rehabilitation; Project for Human Resource Development; Seminars / Workshops / Rural Camps, Project for Legal Literacy, Including Legal Counselling, Legal Aid and Analysis and Evaluation of Existing Laws; Environment Friendly and Eco-Promotive Projects for the Handicapped; Grant for Purchase of Vehicle; Construction of Building; Grant for Computer; Project for Low Vision Centres; Half Way Home for Psycho-Social Rehabilitation of Treated and Controlled Mentally ill Persons; and District Disability Rehabilitation Centres (DDRCs).

5.7.3. SC/ST scheme

The Ministry of Social Justice and Empowerment is the nodal Ministry to oversee the interests of the Scheduled Castes (SC). Though the primary responsibility for promotion of interests of the Scheduled Castes rests with all the Central Ministries in the area of their operations and the State Governments, the Ministry complements their efforts by way of interventions in critical sectors through specifically tailored schemes. The Scheduled Castes Development (SCD) Bureau of the Ministry aims to promote the welfare of Scheduled Castes through their educational, economic and social

empowerment. Efforts made by State Governments and Central Ministries for protecting and promoting the interests of Scheduled Castes are also monitored by MOSJE. Following are few schemes for persons belonging to SC/ST:

- Schemes for educational empowerment: Pre matric scholarships, post matric scholarships, scholarships for obtaining higher education and coaching scheme, which includes National Fellowship, National Overseas scholarship, Free coaching for SC and OBC students.
- Schemes for economic empowerment: National Scheduled Castes Finance and Development Corporation (NSFDC), National Safai Karamcharis Finance and Development Corporation (NSKFDC), Special Central Assistance (SCA) to Scheduled Castes Sub –Plan (SCSP), Scheme of Assistance to Scheduled Castes Development Corporations (SCDCs), Venture Capital Fund for Scheduled Castes and Credit Enhancement Guarantee Scheme for Scheduled Castes.
- Schemes for social empowerment: The Protection of Civil Rights Act, 1955, Act, 1955., Scheduled Castes and Scheduled Tribes (Prevention of Atrocities) Act, 1989, Scheduled Castes and the Scheduled Tribes (Prevention of Atrocities) Rules, 1995.

5.8. Let Us Sum Up:

The definitions, classifications, types of available assistive devices and the legislations discussed in this chapter provide the foundation for our discussion of Assistive Devices and their application. Although assistive devices can be categorized in many ways, however, it needs to be understood that yesterday's high tech is tomorrow's low tech, custom devices becomes commercial if more than a few people need them, and appliances often enable the use of tool. Thus, no fixed categorization is perfect or static. Depending on the patient's need, one need to recommend the appropriate assistive device from the vast range of products available.

5.9. Unit end exercises

1. What do you understand by assistive device?
2. How can assistive devices be classified?

3. Write an essay on “Assistive Devices for Intellectual Disability”.
4. Write an essay on “ADIP Scheme”.
5. What is the procedure for selecting an appropriate assistive device for PwID? Explain.
6. Write short notes on (a) Cochlear Implant (b) Communication Aid and(c) Wheelchairs

5.10. References:

American Association of Intellectual and Developmental Disabilities (AAIDD), Definition of Intellectual Disability, available at: http://aaidd.org/intellectual-disability/definition (Accessed on December 4, 2019).

American Speech-Language-Hearing Association. 2016. “Cochlear Implants.” http://www.asha.org/public/hearing/Cochlear-Implant/. Accessed December, 2019.

Ali, A. Jabar, and A. Hari Sankar. 2012. “Artificial Guidance System for Visually Impaired People.”International Journal of Man Machine Interface, 2(1):98–109.

Ball, Elizabeth M. 2008. “Electronic Travel Aids: An Assessment.” In Assistive Technologies for Visually Impaired and Blind People, by Marion A. Hersh and Michael A. Johnson, 289–321. London: Springer-Verlag London Limited.

Behrmann, M. & Schaff, J. (2001). Assisting educators with assistive technology: Enabling children to achieve independence in living and learning. Children and Families 42(3), 24-28.

Behrmann, M., & Jerome, M. K. (2002). Assistive technology for students with mild disabilities: Update 2002. ERIC Digest E623. ERIC Document Reproduction Service ED 463 595.

Blackhurst, A. E. (1997). Perspectives on technology in special education. Teaching Exceptional Children, 29(5), 41–48.

Borg, J., Berman-Bieler, R., Khasnabis, C., Mitra, G., Myhill, W.N., & Raja, D.S. (2015). Assistive Technology for Children with Disabilities: Creating Opportunities for Education, Inclusion and Participation - A discussion paper. UNICEF & WHO. https://www.unicef.org/disabilities/files/Assistive-Tech-Web.pdf

Borg, J., Ekman, B.O., & Östergren, P-O. (2017). Is centre based provision of hearing aids better than community-based provision? A cluster-randomized trial among adolescents in Bangladesh. Disability and Rehabilitation: Assistive Technology. http://dx.doi.org/10.1080/17483107.2017.1332110

Bouck, E. C., Shurr, J. C., Tom, K., Jasper, A. D., Bassette, L., Miller, B., & Flanagan, S. M. (2012). Fix it with TAPE: Repurposing technology to be assistive technology for students with high incidence disabilities. Preventing School Failure, 56, 121–128. DOI: 10.1080/1045988X.2011.603396

Bradley, Nicholas, and Mark Dunlop. 2008. "Navigation AT: Context-aware Computing." In *Assistive Technologies for Visually Impaired and Blind People*, by Marion A. Hersh and Michael Johnson, A. 31–260. London: Springer-Verlag London Limited. Edyburn, D.L. (2004). Measuring assistive technology outcomes in reading. Journal of Special Education Technology, 19(1), 60-64.

Bryant, D. P. & Bryant, B. R. (2003). Assistive Technology for People With Disabilities. Upper Saddle River, NJ: Pearson Education, Inc.

Chen, Jinying, Zhi Li, Min Dong, and Xuben Wang. (2010). "Blind Path Identification System Design Base on RFID." In *2010 International Conference on Electrical and Control Engineering (ICECE)*, 548–551. Wuhan, China. doi: 10.1109/iCECE.2010.141.

Chen, Yiming, Sheng Zhao, and Jay A. Farrell. (2015). "Computationally Efficient Carrier IntegerAmbiguity Resolution in Multiepoch GPS/INS: A Common-Position-Shift Approach. " IEEE Transactions on Control Systems Technology, 99: 1–16.

Doughty, Kevin. 2011. "SPAs (smart phone applications) - A New Form of Assistive Technology." *Journal of Assistive Technologies* 5(2):88–98.

Edyburn, D.L. (2005a). Assistive technology and students with mild disabilities: From consideration to outcome measurement. In D. Edyburn, K. Higgins, & R. Boone (Eds.). Handbook of special education technology research and practice (pp. 239-269). Whitefish Bay, WI: Knowledge by Design, Inc.

EHIMA. 2015. "Guidance Document for Classification of Hearing Aids and Accessories." European Hearing Instrument Manufacturers Association. http://www.ehima.com/documents/. Accessed December, 2019.

Gierrach, J., & Stindt, K. (2009). Assistive technology for activities of daily living. Assessing Students' Needs for Assistive Technology (ASNAT) 5th Edition – complete

version. J. Gierach (Ed.). (p.1-16). Retrieved fromhttp://www.wati.org/ content/ supports/ free/pdf/ASNAT5thEditionJun09.pdf

Hersh, Marion A., and Michael A. Johnson. 2008a. "Accessible Environments." In *Assistive Technologies for Visually Impaired and Blind People*, by Marion A. Hersh and Michael A. Johnson, 323-362. London: Springer-Verlag London Limited.

House, W. F. (1982). Surgical considerations in cochlear implants. *Annals of Otology, Rhinology, and Laryngology,91,* 15–20.

Hoyle, Brian, and Dean Waters. 2008. "Mobility AT: The Batcane (UltraCane)." In Assistive technology for Vision-Impaired and Blind People, by Marion A. Hersh and Michael A. Johnson, 209–230. London: Springer-Verlag London Limited.

Hersh, Marion A., and Michael A. Johnson. 2008d. "Mobility: An Overview." In *Assistive Technology for Vision-Impaired and Blind People*, by Marion A. Hersh and Michael A. Johnson, 167–208. London: Springer-Verlag London Limited.

Individuals with Disabilities Education Improvement Act of 2004, Pub. L. No. 108–446 (2004).

Jansson, Gunnar. 2008. "Haptics as a Substitute for Vision." In *Assistive Technology for Vision-Impaired and Blind People*, by Marion A. Hersh and Michael A. Johnson, 135–166. London: Springer-Verlag London Limited.

Johnson, L., Beard, L.A., & Carpenter, L. B. (2007). *Assistive technology: Assistive technology for all students*. Upper Saddle River, NJ: Pearson/ Prentice Hall.

Karungaru, Stephen, Kenji Terada, and Minoru Fukumi. 2011. "Improving Mobility for Blind Persons Using Video Sunglasses." Proc. of the 17th Korea-Japan Joint Workshop on Frontiers of Computer Vision, 1-5. Japan: Tokushima.

Lakhan, R., Ekundayo, O. T., & Shahbazi, M. (2015). An estimation of the prevalence of intellectual disabilities and its association with age in rural and urban populations in India. Journal of Neurosciences in Rural Practice, 6(4), 523-528.

Lucker, Jay, and Marion A. Hersh. (2003). "Alarm and Alerting Systems for Hearing-impaired and deaf people." In Assistive Technology for the Hearing-Impaired, Deaf and Deafblind, by Marion A. Hersh and Michael A. Johnson, 215–256. London: Springer-Verlag London Limited.

NAD – National Association of the Deaf. 2016. “Assistive Listening Systems and Devices.”https://nad.org/issues/technology/assistive-listening/systems-and-devices. Accessed December, 2019.

NC-DHHS. 2016. “Assistive Technology for the Deaf and Hard of Hearing.”

http://www.ncdhhs.gov/assistance/hearing-loss/assistive-technology-for-the-deaf-andhard-of-hearing. Accessed December, 2019.

NSW Government – Family & Community Services. 2016. “Augmentative and Alternative Communication - Guideline for speech pathologists who support people with a disability.” http://www.adhc.nsw.gov.au/__data/assets/file/0011/302402/Augmentative_and_Alternative_Communication_Practice_Guide.pdf. Accessed December, 2019.

Lions Clubs International. 2016. “White Cane.” http://www.lionsclubs.org/resources/EN/pdfs/iad413.pdf. Accessed December, 2019.

Ong, S.K., J. Zhang, and Andrew Y. C. Nee. 2013. “Assistive Obstacle Detection and Navigation Devices for Vision-Impaired Users.” Disability and rehabilitation. Assistive technology 8(5):409– 16.

Roth, Ginny A., & Elizabeth Fee. 2011. “The Invention of Braille.” *American Journal of Public Health* 101(3):454.

Spitzer, J. B., Ghossaini, S. N., & Wazen, J. J. (2002). Evolving applications in the use of bone-anchored hearing aids. American Journal of Audiology, 11, 96–103.

UNICEF (no date). *Filling the Gap in Assistive devices*. UNICEF. https://www.unicef.org/supply/files/Assistive_Technologies_Survey_Results_web.pdf

Ulrich, Iwan, and Johann Borenstein. 2001. “The GuideCane – Applying Mobile Robot Technologies to Assist the Visually Impaired.” *IEEE Transactions on Systems, Man, and Cybernetics – Part A:Systems and Humans* 31(2):131–136.

Wazen, J. J., Spitzer, J.B., Ghossaini, S. N., Fayad, J. N.,Niparko, J. K., Cox, K., Brackmann, D. E., & Soli, S. D. (2003). Transcranial contralateral cochlear stimulation in unilateral deafness. Otolaryngology—Head and Neck Surgery, 129, 248–254.

WFD – World Federation of the Deaf. 2014. “Working Document on Adoption and Adaptation of Technologies and Accessibility – Prepared by the WFD Expert Group on Accessibility and Technology.” https://www.wfdeaf.org/wp-content/uploads/2015/02/

Working-Documenton-Adoption-and-Adaptation-of-Technologies-and-Accessibility-October-2014.pdf. Accessed Decemberl, 2019.

WHO–World Health Organization (2015a). “Change the Definition of Blindness.” http://www.who.int/blindness/Change%20the%20Definition%20of%20Blindness.pdf?ua=1.

Accessed December 2019.

WHO – World Health Organization (2015b). “Deafness and Hearing Loss.” http://www.who.int/mediacentre/factsheets/fs300/en/. Accessed 6th December 2019.

WHO – World Health Organization (2017). Global priority research agenda for improving access to high-quality affordable assistive technology. WHO. http://apps.who.int/iris/bitstream/10665/254660/1/WHO-EMP-IAU-2017.02-eng.pdf. Accessed 6th December 2019

মানুষের জ্ঞান ও ভাবকে বইয়ের মধ্যে সঞ্চিত করিবার যে একটা প্রচুর সুবিধা আছে, সে কথা কেহই অস্বীকার করিতে পারে না। কিন্তু সেই সুবিধার দ্বারা মনের স্বাভাবিক শক্তিকে একেবারে আচ্ছন্ন করিয়া ফেলিলে বুদ্ধিকে বাবু করিয়া তোলা হয়।

— রবীন্দ্রনাথ ঠাকুর

ভারতের একটা mission আছে, একটা গৌরবময় ভবিষ্যৎ আছে, সেই ভবিষ্যৎ ভারতের উত্তরাধিকারী আমরাই। নূতন ভারতের মুক্তির ইতিহাস আমরাই রচনা করছি এবং করব। এই বিশ্বাস আছে বলেই আমরা সব দুঃখ কষ্ট সহ্য করতে পারি, অন্ধকারময় বর্তমানকে অগ্রাহ্য করতে পারি, বাস্তবের নিষ্ঠুর সত্যগুলি আদর্শের কঠিন আঘাতে ধূলিসাৎ করতে পারি।

— সুভাষচন্দ্র বসু

Any system of education which ignores Indian conditions, requirements, history and sociology is too unscientific to commend itself to any rational support.

— Subhas Chandra Bose

Published by : Netaji Subhas Open University, DD-26, Sector-I, Salt Lake, Kolkata-700 064 &
Printed at : The Saraswati Printing Works, 2, Guru Prosad Chowdhury Lane, Kolkata 700 006