CHAPTER - III

CONCEPTUAL FRAMEWORK
CHAPTER – III

CONCEPTUAL FRAMEWORK

3.1 Introduction
3.2 A Brain-Based Model of Reading
3.3 Stages of Reading Development
3.4 Reading Process
3.5 Sequence of Visual Development
3.6 Theories and Classification of Visual Functioning
3.7 Instructional Approaches in Reading of Visually Impaired
3.8 Low Vision and Reading
3.9 Visual Skills in Reading
3.10 Problems Faced by Low Vision when Reading
3.11 The Visual Environment
3.12 Magnification and Reading with Low Vision
3.13 Conclusion
3.1 INTRODUCTION

An important step in research is to form conceptual framework on the subject under investigation. Such a conceptual review helps us to understand the problem better and serve as a background material, which will help to bring out clearly the real contribution of the present study. This chapter highlights some of the research findings.

3.2 A BRAIN-BASED MODEL OF READING

Analysing the basic processes involved in reading helps to understand some reading difficulties for students with learning difficulties. As pointed out earlier, reading is a very complex process. We believe that reading instructional strategies for students with learning difficulties should be presented within the context of this broader emphasis on brain compatible instruction. Further, Sousa's model of the reading brain can provide teachers with numerous insights for instruction, as well as a guide for selection of strategies and tactics for students with reading problems who may demonstrate different instructional needs within the class. Within Sousa's model of the reading brain, four areas of the brain, working simultaneously, seem to be most heavily involved in reading: the visual cortex, Wernicke's area, the angular gyrus, and Broca's area (Sousa, 2001).
In Sousa’s Model of reading (see Figure 1) the brain perceived the word *dog* via the visual cortex, which is located at the rear of the brain—the actual brain areas are shown on the sketch of the brain below, which presents the left hemisphere of the brain. The visual stimuli *dog* is immediately transferred to several parts of the brain simultaneously. These include Wernicke’s area, which traditionally has been associated with various types of language functions including auditory processing and comprehension (see Joseph et al., 2001; Sousa, 2001), as well as the angular gyrus, which has been proposed as the primary location for written language (Joseph et al., 2001). Some believe that the angular gyrus is involved in this process in order to provide insight into what letters would be used to represent the specific sounds noted by Wernicke’s area.
The several areas of the brain are heavily involved in the process of reading—the process of translating graphemes (letters on the page) into phonemes (sounds). Even when a student is reading silently, this translation into letter sounds takes place in the brain during the initial stages of reading, and mistranslation can take place throughout this system, leading to reading errors.

![Figure 2: The Brain](image)

Next, Broca’s area becomes involved in the translation of the sounds into meaningful language. Broca’s area has been associated with not only language, but also grammar and syntax, so while Broca’s area is involved in the linguistic aspects of reading a one-word stimulus such as dog, it is also searching for and identifying meanings for this word, as well as relationships and meanings that relate this word to other previously read words. Thus, Broca’s area is believed to be the language area in which meaning is attached to the stimulus word, dog.
One must realize that while these four major areas of the brain are involved in noting the word, decoding the word by sounding it out, and attaching meaning to the word, the eyes and brain continue to scan the page for other words to begin the process all over again. Thus, this word reading process is repeated many times each minute when a student reads, and often the eyes and visual cortex are scanning a word prior to the association of meaning with words read previously. Therefore, the timing of these mental processes becomes involved in reading, and the process becomes even more complex. In fact, with only one or two misread letters or words, the reading process can become very confusing.

For students who manifest reading difficulties, reading problems can occur at any point in this highly interactive reading process (Sousa, 2001). Perhaps because of quick scanning, a child thinks he or she sees the word bale instead of the word tale in a sentence—the visual cortex has thus introduced an error into this complex process that will, in all probability, lead to a lack of comprehension on the other end. Alternatively, either Wernicke’s area or Broca’s area could introduce the error with any word read, which will lead to comprehension problems in the final reading of the text.

With this level of reading complexity in mind, emphasizing specific instructional tactics that may be associated with each major area.
3.3 STAGES OF READING DEVELOPMENT

Carillo’s reading cone describes the 5 stages of reading development.

❖ STAGE 1 – PRE-READING SKILLS

This stage covers the pre-school years during which children learn to discriminate shapes, sizes and colours. Visual tracking from left-to-right, eye-hand motor co-ordination following instructions and directions and listening skills are some of the basic skills. Children who later have difficulty in reading will also demonstrate problems in some of the areas of matching shapes, size and objects. They may also find it difficult to distinguish animal sounds, loud and soft sounds and sounds of vehicles.

❖ STAGE 2 – INITIAL READING

The emphasis in this stage is to learn the letter sound association, using picture clues to associate an object with the written word and building a basic sight vocabulary. The child attempts to analyse words and to read with confidence.

❖ STAGE 3 – RAPID DEVELOPING OF READING SKILLS

An important feature of this stage is silent reading, fluency and ease in oral reading. Children begin to read for pleasure and acquire basic grounding in reading habits.

❖ STAGE 4 – WIDE READING

About the time a child reaches middle school, his vocabulary and comprehension skills have expanded. He can read independently, using a wide range of materials.
3.4 READING PROCESS

Johnson and Myklebust (1967) described reading as visual receptive language involving a complex integration of many processes such as attention, discrimination, perception, memory, conceptualization and evaluation. Other writers have divided reading into 2 separate process.

1. Learning to associate symbols with sounds (Decoding)
2. Learning the meaning of word (Encoding)

3.4.1 ESSENTIAL COMPONENTS OF READING ACQUISITION

a) EARLY DECODING EMPHASIS

The child should know the language he is going to read. Child must learn to dissect spoken words into components of sound. Child must learn to recognize letters of the alphabet in various forms. Child must learn the left-right principle by which words are put in order in a continuous text. Child must learn that there are patterns of highly probable correspondence between letters and sounds. Child must learn to recognize printed words from whatever cues he can use their total configuration, the sounds represented by those letters, the meaning suggested by the context. The child must learn that printed words are signals for spoken words and that meaning can be apprehended from these printed words. Child must learn to reason about what he reads.
b) EARLY MEANING (ENCODING) EMPHASIS

Child should learn the language he is going to read. Child should learn to recognize printed words from whatever cues he can use, but initially only from total configurations. Child should learn that printed words are signals for spoken words, and that meanings can be apprehended from these printed words. Child must learn to reason and think about what he reads. Child should learn the left-to-right principle but initially only as it applies to complete words in continuous texts. Child should learn to recognize and discriminate the letters of the alphabet. Child should learn to dissert spoken works into component parts. Child should learn pattern of correspondence between letters and sounds.

As the child begins to recognize letters of the alphabets, he simultaneously learns to attach meaning to the printed words. The child learns to recognize words using the surrounding context, the shape of the letters, the total appearance of the word and the sound those letters make. As he begins to associate meaning with the words, he starts to reason and think about what he is reading.

3.4.2 THE VALUES OF READING

With the availability of mass media, reading is becoming increasingly important. Greater complexities of living are compounded by the rapidity of change, characterizing every sphere of a life. There often seems hardly time for reflection before there is apparent necessity of moving on to something else, at work and during leisure at home and in school.
Reading encourages perspective, even more so during rapidly changing time. The printed electronics, and even for those who can take advantage of the newer devices reading can still help satisfy needs, as it guides boys and girls in applying techniques of critical evaluation.

3.4.3 ELEMENTS IMPORTANT TO GROWTH IN READING

The important elements that facilitate growth in reading are

1. Physical health
2. Mental health
3. Intelligence
4. Maturity
5. Background of experiences
6. Attitude toward reading

3.6 SEQUENCE OF VISUAL DEVELOPMENT

TABLE – 3

<table>
<thead>
<tr>
<th>Visual Functions</th>
<th>Visual Tasks in Normal development Milestones</th>
</tr>
</thead>
<tbody>
<tr>
<td>Optical Response to Light, Visual awareness, Focus,</td>
<td></td>
</tr>
<tr>
<td>Fixation, Tracking horizontal</td>
<td></td>
</tr>
<tr>
<td>Vertical Circular Accommodation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1 - 3 Months</td>
</tr>
<tr>
<td></td>
<td>Optical Functions : Show awareness of visual stimuli and give indication of receiving visual information. Respond visually to light/reflecting object Move eyes to search and explore visually Attend Visually to pattern</td>
</tr>
<tr>
<td>Visual Functions</td>
<td>Visual Tasks in Normal development Milestones</td>
</tr>
<tr>
<td>----------------------------------------------</td>
<td>-----------------------------------------------</td>
</tr>
<tr>
<td>Optical and Perceptual Functions: Light, dark, intense color, and contour</td>
<td>Optical Functions: Develop and strengthen voluntary control of eye movements. Begin to select and discriminate color and shape in concrete objects.</td>
</tr>
<tr>
<td></td>
<td>Focus and refocus on light-reflecting and colored object (shift gaze).</td>
</tr>
<tr>
<td></td>
<td>Fixate on concrete object/person with complex shape, unique line arrangement, and/or/bright color</td>
</tr>
<tr>
<td></td>
<td>Track moving concrete object/person of variable size and color intensity</td>
</tr>
<tr>
<td></td>
<td>Imitate observed gross body movement</td>
</tr>
<tr>
<td></td>
<td>Select and move to concrete object at increasing distances.</td>
</tr>
<tr>
<td>Gross Shapes, colors, sizes in concrete objects</td>
<td></td>
</tr>
<tr>
<td>Pictures of objects and people</td>
<td></td>
</tr>
</tbody>
</table>

4 - 12 Months

1 - 3 years

Optical and perceptual Function: Through exploration and manipulation, discriminate, recognize, and use concrete objects for intentional purposes.

Move body within specified area and distance

Manipulate concrete object in relation to self, other object and from verbal instruction Scribble/mark with pen/brush

Match concrete geometric objects by shape
<p>| Recognition and identification of: Faces, people, and colors | Recognize/identify distinctive features in concrete objects / people (e.g., circle, nose, arm, clothing) |
| Shapes of concrete objects, and pictures of objects | Selecting / identify specific concrete objects/people |
| Details in concrete objects and pictures of objects | Assemble parts of concrete objects |
| Likenesses and differences in abstract figures | Manipulate concrete to match model |
| Symbolic representations | 2 - 4 years |
| Optical and Perceptual Functions: | Discriminate and identify shape and detail in pictures of objects, people, and action. |
| | Match concrete object/pictures of objects by color/shape/size/use/function |
| | Recognize/identify outline pictures of objects / people |
| | Copy/draw lines/shapes after seeing models |
| | Arrange concrete objects to match picture |
| | Match pictures of objects with inner detail to concrete object / picture |
| Visual memory for: Concrete object, people, and color | Select specific inner details (single elements &amp; actions) in picture. |
| Pictures of people, shapes and objects internal details abstract figures and symbols | Select and categorize object/picture by size, color, and use |
| | Imitate position of objects in picture |
| | Identify single elements in picture |</p>
<table>
<thead>
<tr>
<th><strong>Visual Functions</strong></th>
<th><strong>Visual Tasks in Normal development Milestones</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Spatial perception of:</td>
<td>3 - 5 years</td>
</tr>
<tr>
<td>Single objects in space</td>
<td></td>
</tr>
<tr>
<td>Relationship of objects to self/other objects</td>
<td></td>
</tr>
<tr>
<td>Distance of objects/people</td>
<td></td>
</tr>
<tr>
<td>Body position</td>
<td></td>
</tr>
<tr>
<td>Visual-motor coordination:</td>
<td></td>
</tr>
<tr>
<td>Reach, grasp, manipulate, and place objects</td>
<td></td>
</tr>
<tr>
<td>Imitate body position, movement, and action</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Complex object manipulation</td>
<td>4 - 5 years</td>
</tr>
<tr>
<td>Copy, reproduce lines, shapes and symbols</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Visual/Perceptual Figure-ground differentiation</td>
<td>5 - 6 years</td>
</tr>
<tr>
<td>Visual closure</td>
<td></td>
</tr>
<tr>
<td>Whole, part, part/whole relationships</td>
<td>6 - 7 years</td>
</tr>
</tbody>
</table>
3.6 THEORIES AND CLASSIFICATION OF VISUAL FUNCTIONING

A functional vision assessment of the individual is the basis of many educational and rehabilitation programs. Functional vision can be used to derive input for planning and performing a task. Visual functions, on the other hand, refer to such visual behaviours as shifting one’s gaze or scanning an environment.

The extent to which one uses available vision is often referred to as visual efficiency. Two individuals may have the same clinical measures, such as a visual acuity of 20/100 and a visual field of 30 degrees, but use their vision differently. One person may make quick visual decisions, use vision for most tasks, and feel comfortable moving from one environment to another. The other may prefer tactile and auditory approaches to completing tasks and use vision only for facilitating conversations and for locating landmarks and cues during travel. Although neither person may have made a choice regarding his or her visual efficiency, providing children and adults with the opportunity to become visually efficient is at the heart of that for which professionals in low vision services strive.

Various theories attempt to explain how children and adults with low vision develop or use their available vision. For example, some professionals in the low vision field believe that the sequence of normal visual development in children without visual impairments is a basis for establishing assessment and instructional programs for children with low vision. According to this approach,
then, children who have low vision develop visual skills in relatively the same order as do children with normal vision, although perhaps at a different pace.

An example of this approach is reflected in the Diagnostic Assessment Procedure, which is part of the Program to Develop Efficiency in Visual Functioning (Barraga & Morris, 1980). This theory does not apply to adults who lose vision, but it explains the milestones in the optical and visual development of children.

This theory, by Corn (1983), includes the components of three dimensions—visual abilities, environmental cues, and stored and available individuality that need to be present for visual function to take place (see Figure-3). The visual abilities dimension includes visual acuity, visual fields, motility, brain functions, and light and color perception (see Figure 4). The environmental cues dimension includes color, contrast, space, illumination, and time (see Figure-5). And the stored and available individuality dimension includes cognition, sensory development-integration, perception, psychological makeup, and physical makeup.

According to this model, all the components must be present to some degree for visual function to occur. During development, a child's visual abilities "develop" while other compensations for or hindrances to visual function have an interactive effect. For example, a child with limited visual acuity may need to have the size of an object increased and also need specific physical capabilities to handle an optical device for visual function to emerge or be enhanced.
Hall and Bailey (1989) proposed a third model for increasing visual functioning by differentiating between vision stimulation programs and vision training programs. Vision stimulation programs offer a rich, stimulating environment, and the stimuli provide inherent reinforcement to encourage and facilitate the efficient use of vision. Through direct and planned reinforcement procedures, vision training programs systematically teach a set of specific visual skills that are otherwise learned incidentally. The specific skills include visual attending behaviors, visual examining behaviors, and visually guided motor behaviors. Undergirding these three sets of behaviors are certain visual capabilities, such as visual discrimination, fixation, and convergence. They presented three alternatives for teaching specific visual behaviors of: (1) arranging the environment to foster the use of desired visual behaviors, (2) targeting for systematic instruction specific visual attending behaviors that have not developed appropriately, and (3) fostering the use of visual behaviors in specific tasks that are facilitated through the efficient use of vision.

These theories address different aspects of visual development and visual functioning. Together, they lay a foundation from which a professional can understand the visual functioning of an individual with low vision. The expectations of others, the need to practice visual skills, and society's concepts of low vision may also have an impact on how and to what extent persons with low vision choose to use their available vision or determine that other methods of functioning are preferable or more efficient.
In addition to theories that attempt to explain functional vision, other methods of classification have been devised. Colenbrander (1995) identified ranges of clinical measures from which one can predict the extent to which persons with low vision will function with vision, with vision and optical devices, or with non-visual approaches such tasks as reading and orientation and mobility (O&M). This classification method was based on the International Classification of Diseases, 9th Revision (1977) recommended by WHO.
Figure 3: Model of Visual Functioning
Figure 4: Components of the Visual Abilities Dimension
Figure 5: Components of the Environmental Cues Dimension
Figure 6: Components of the Stored and Available Individuality Dimension
3.7 INSTRUCTIONAL APPROACHES IN READING OF VISUALLY IMPAIRED

Reading readiness has frequently been reserved for five- and six-year-olds and has been the responsibility of kindergarten and first-grade teachers. Within the concept of individual differences, it is apparent that many older students will not have the skills necessary for reading. In order to read, the learner must pay attention to and integrate (1) visual attention to print, (2) directional rules about position and movement, (3) talking like a book, and (4) hearing sounds in words (Mass, 1982).

Regardless of a student's age, prerequisite skills must be evaluated and/or developed. Prerequisites common to success in reading are an adequate background of experience, concepts, and general information; visual and auditory discrimination ability; oral language facility (in terms of both production and comprehension); physical and emotional intactness; reasoning ability; interests in learning to read; and, of course, a degree of native intelligence that will permit learning to take place (Edwards, 1966).

By definition, handicapped students lack many of the prerequisites considered essential to reading. Teaching them to read requires recognizing, assessing, and remediating or compensating for problems related to vision, hearing, language, intelligence, emotional development, and physical factors.

In vision there are three categories of visually handicapped children: the blind, the partially sighted, and those who have visual defects. Since a reader
reacts visually to graphic symbols, the visually impaired student is at a tremendous disadvantage. Provisions must be made for an adequate alternative method for the input of information or for an adequate method to develop the student’s seeing ability.

In the case of the blind student, a complicated skill must be acquired—learning to read by touch. Braille, a system of six embossed dots arranged in two vertical rows of three, is used for this purpose. These dots can be covered simultaneously by the pad of the fingertip. Grade-one Braille is written with full spelling; grade-two Braille makes use of contractions and short forms.

The readability of the dots representing the letters of the alphabet is related more to their formation than to their number. Good readers use a uniform pressure in reading Braille. Although touch reading is much slower than normal reading, a good Braille reader can read as many as ninety words per minute (L’Abate & Curtis, 1975).

Classroom teachers may feel that the responsibility of teaching students to read Braille is overwhelming. Even though Braille is difficult to learn by touch, using it visually is quite simple. Sighted students are curious about it and view it as a code to be broken. Teachers and students can decode Braille very easily by referring.

In most cases, the classroom teacher is not responsible for teaching Braille, but rather for content in the total curriculum and any problems in the
student's reading that may influence performance. The resource or itinerant teacher assumes responsibility for the specifics of Braille reading and the selection of suitable books and reference material. A special reading teacher may be paid for by the State Commission for the Blind or by the local Department of Social Services.

Partially sighted students are unable to perform tasks ordinarily requiring detailed vision without using special aids, such as magnifiers, special lighting, or large type. They usually have limited distance vision but frequently can see objects and materials held a few inches from their eyes (Ward & McCormick, 1981).

A majority of partially sighted students, including those identified as legally blind, read print rather than Braille materials. Many partially sighted students can read regular size print, particularly at the first- and second-grade levels where the print is rather large. With appropriate teaching approaches, they can use many of the same materials as their peers and achieve comparable levels of attainment.

The quality of print is an important determinant of legibility. Teachers should do everything possible to insure that print materials are clear, attractive, and meaningful. Reading materials that display, the greatest contrast between the print and the paper are the easiest to see. Black print on white paper with fairly large letters and good spacing is best; purple ink used in commercial duplicating is often difficult to see. Teachers should make duplicated copies on white paper and give the darkest, clearest copies to the visually impaired student.
Readability can be improved by using black masters and primary type with good spacing. Elite or fancy type, handwriting, crowded letters, colored paper, and blurred or faint copies all add to the difficulties for visually impaired students (Davis, 1981).

Visual defects affect visual acuity. The most common disorders are: astigmatism, which causes a generalized blurring of the vision and is often the result of irregular corneal curvature; myopia, or nearsightedness, in which sight is clear in proximity but blurred at far distances; and hyperopia, or far sightedness, in which sight is clear at a distance but blurred in proximity. Referred to as refractive errors, these defects can usually be corrected by glasses, which can help the eye to focus and lower eye strain but may fail to provide normal vision. When corrected by glasses, these errors do not constitute handicaps.

3.8 LOW VISION AND READING

Reading is one of the most highly valued activities in human culture. To quote from Hamadach (1990) “The struggle for literacy is also a struggle for justice, for access to knowledge and for equality. Literacy is an essential precondition for the effective exercise of human rights. “When eye disorders deprive or limit people’s access to the printed word, the issue is vision disability, not literacy, but the individual consequences may be just as severe. Because of the fundamental importance of reading, low vision is sometimes defined as the inability to read a newspaper at a normal distance with best correction (glasses or contact lenses).
3.8.1 Pre-Reading Skills

Children with Low Vision who are taught print must acquire a few prerequisite skills. The pre-reading skills according to WHO are (a) discrimination of detail in pictures (b) Identification and perception of patterns, numbers and words.

3.8.2 Pre-Reading and Reading Ability

Pre-reading encourages the reader to learn better. Some of the pre-reading skills involve

1. Identification of letters, words.
2. Matching letters, pictures, shapes, words.
3. Classification of artificial materials and real objects.
4. Coloring work.

These activities help the low vision student to develop.

1. Sequencing.
2. Eye-hand co-ordination.
3. Figure ground discrimination.
5. Understanding of spatial relationships.
6. Auditory Discrimination.

3.9 VISUAL SKILLS IN READING

1. Fixation: The reader fixates on a control point within a group of letters or short words decodes the information and then jumps the
eyes forward on the line to the next group of letters or words. This process is repeated in successive fixations to the end of the line, after which the eyes moves quickly for the beginning of the next line. These quick eye fixations are called saccadic movements.

2. Width of perceptual span refers to the number of letters one can see at one go.

3. Eye movements must be efficient and automatic.

4. The use of non-optical low vision devices such as typoscope, a marker under or above the line, following a line with finger, appropriate lighting.

These visual tasks may be more difficult for a person with low vision and may have to move systematically and deliberate instruction with large print and CCTV.

It is estimated that about 10% of the general school population experience difficulty in reading. It has been suggested that reading difficulty is the main cause of failure in school. Reading experiences strongly influence the student's self-image and failure in reading can lead to anxiety and lack of motivation. Reading is a complex task, which involves visual auditory processing and obtaining meaning from symbols (letters and words). Reading includes 2 basic process - decoding process and comprehension. Decoding helps the learner to understand the meaning of words in isolation and in context.
Students with learning problems have difficulty with oral reading and silent reading for comprehension. Some of the difficulties that students with reading problems show are omission of words, incorrect pronunciation of words, dyslexia, distortion of words or long hesitation prior to reading, and lack of comprehension of material that was previously read.

Students with low vision generally need a larger than normal print size (or) magnification effect and a closer working distance to gain the resolution needed to read efficiently.

3.10 PROBLEMS FACED BY LOW VISION WHEN READING

- Attempting to brush away blues, rubbing eyes excessively, frowning.
- Shutting or covering one eye, tilting head or thrusting it forward when looking at near or distant objects.
- Difficulty in reading or in other work requiring close use of eyes.
- Blinking more than usual, crying often, irritability when doing close reading.
- Stumbling / tripping over small objects.
- Holding books / small objects close to eye.
- Inability to participate in games requiring distance vision.
- Excessive sensitivity to light.
- Red – rimmed, encrusted or swollen eyelids, recurring sites, inflamed or watery eyes, crossed eyes.
- Complaints of not seeing well, of dizziness, headaches, or nausea following close eye work or blurred / double vision.
3.11 THE VISUAL ENVIRONMENT

After selecting appropriate large print media according to the individual children the need to consider a proper visual environment which allows for maximum comfort and visual performances while reading in large print. In designing the proper visual environment for children with visual impairment and low vision, careful consideration should be given to the individual needs. Visual performance in reading large print is affected by brightness, contrast, time, distance and image size. Reading becomes easier if these factors, which are included in the visual task are carefully controlled to suit the special needs of each visual learner.

**Brightness:** Brightness, or a sufficient quantity of light is essential to the visual learner for accomplishing visual tasks like reading. In classrooms designed for visually impaired, illumination should be provided that can be varied according to the individual needs of the child. The reading of pencil writing and duplicated materials of poor quality requires considerably more illumination. Textbooks and printed materials must be of good quality. Glare in any brightness condition that causes discomfort, annoyance, loss of visual performance or eye fatigue. Glare while reading in large print can be prevented by careful selection of Textbooks which use non-glossy inks and paper.

**Contrast:** Contrast between the visual task and the background improves visual efficiency mainly in reading.
**Time:** Children with Low Vision or partially sighted children usually read at much slower speeds than their normally seeing classmates. For this reason time limits are extended on standardized tests.

**Distance:** The visual learner should move the visual task to the proper distance to perform most efficiently. Many children with myopia can function satisfactorily in school by simply moving to and fro in the room so that they can discriminate the details on the chalkboard or screen. Children with hyperopia will generally function best when working with reading materials at a distance. A book can be brought closer to eye without doing any harm when enlargement is necessary. Some children with low vision may need to move within one or two inches of the printed page in order to read the words satisfactorily, and they should be encouraged to do so. Physical comfort and a healthy posture can be maintained by placing reading materials of large print on special adjustable desks, cards, etc.

**Size of image:** The visual learner should have the proper image or print size for accomplishing the visual task. The image size needed by a visually impaired child will vary according to the individual eye condition. Some children with low vision may be able to read the larger print in the primary grade levels of school, but they may have considerable difficulty with the smaller print used in the middle and upper grade levels. Although some visually impaired may be able to read relatively small print for a short period of time by holding the book very close to their eyes, comfort can be enhanced by using a print size more suitable to the refractive ability of their eyes.
The proper visual environment which allows for maximum comfort and visual performance is essential for the visual learner.

3.13 MAGNIFICATION AND READING WITH LOW VISION

Magnification increases the size of an image that is received by the eye by spreading the image over a larger portion of the retina. For persons with low vision, an image that is too small to be resolved can be enlarged through magnification. The four types of magnification – relative distance, relative size, angular, and projection – all have the same effect of increasing the amount of spread of an image on the retina.

Persons with low vision generally need magnification of the text to gain the resolution needed to read efficiently. They are

<table>
<thead>
<tr>
<th></th>
<th>Relative distance magnification</th>
<th>Moving close to the reading text</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Relative size magnification</td>
<td>Making the print larger</td>
</tr>
<tr>
<td>2</td>
<td>Angular magnification</td>
<td>Making it appear closer to the eye through a lens system</td>
</tr>
<tr>
<td>3</td>
<td>Projection magnification</td>
<td>Projecting the image of, such as with a closed-circuit television.</td>
</tr>
</tbody>
</table>

Magnification has an effect on the perceptual span. As the size of letters increases through magnification, the perceptual span decreases.
3.13.1 RELATIVE-DISTANCE MAGNIFICATION

Relative-distance magnification (also called linear or approach magnification) occurs when an object is brought closer to the eyes. As the object is moved closer to the eyes, the amount of information presented on the retina increases. Therefore, the distance is manipulated to gain magnification. For example, the image of a soda bottle can be doubled by moving it from a distance of 4 feet to a distance of 2 feet. Relative-distance magnification is the simplest way to achieve magnification, since it requires only that the individual move closer to the object he or she wishes to view.

Replace the print with a sample of material in a larger size print or with more spacing and contrast will the student achieves greater perception. A suggested sequence of print is the

1) 20 - 24 point print (5M) Newspaper headlines, large type reading cards, hand-printed materials.
2) 14 - 18 point (2-3M) large-print materials, large type texts or library books and material typed on a large print typewriter.
3) 8 - 10 point (1-1.5M) clear typed print with good contrast for some students, spacing and contrast are more important than the size of the print to maintain clarity use a new typewriter ribbon.
4) 8 - 9 point (1M) regular book print in good clear print on opaque off white paper.
5) 7 - 8 point (1M) magazine print similar to newspaper print but with better,
if the glossy paper creates glove, use a filter sheet.

6) 7 - 8 point (.08M) newspaper print, paperback book print and other
materials printed on poor – quality paper and on which the ink is blurred,
making reading difficulty. Teach the student to localize the headline
without an aid and then add an optical aid. Also, teach student to notices
the spacing between column and the students does not read all the way
across the page.

The size of the print may be also affected by the boldness of the line and
also the uniformity of inking, the contrast among letters in words and words
among themselves, the width of margins, the size of gutters, the space between
letters, words and lines and the styles of type.

3.13.2 RELATIVE-SIZE MAGNIFICATION

When the size of an object is increased and this larger object is viewed at
a similar distance to the original object, the amount of information presented on
the retina is also increased. This type of magnification is called relative-size
magnification because the size of the object is manipulated to gain magnification,
as with large print. Since it requires modification of the original object, though, it
is a more restrictive type of magnification than is relative-distance magnification.

➢ HISTORY OF LARGE PRINT

Historically large print or large type books were first introduced by Irwin in
the Clueland Public Schools in 1913 (Eakin Mc Farlard, 1960). These books
were printed in 36 point clear face type. Soon, 24 point type proved most legible among partially seeing children in the Cleveland schools. Nolan (1959) found no significant difference in reading speeds between 18 point and 24 point sizes. Although many low vision children can read relatively small print at a distance of one or two inches from the page, physical comfort and reading speed are factors that deserve careful consideration.

Large print materials may be obtained from a variety of sources. A limited number of text books and other books in large print may be secured from the publishers who specialize in large print reproductions. A catalogue may be obtained from the American Printing House for the blind with a list of its large-print books. Large print enlargements also may be obtained from the use of microfilm enlargement. A number of companies specialize in short-run enlargement services charging a specific rate per page. A third source which can be used for abbreviated materials, such as making copies of texts, it is the use of bulletin typewriters. Volunteer transcribers are often used to help the special teacher in the copying of small print material on these large type typewriters. A list of sources for special large print books and equipments for children with visual disabilities.

Large print is recommended when standard print is not within an individual's visual range even with the use of optical devices or when specific psychological factors necessitate its user. In such cases other reading media, such as recording and Braille, should be considered. The student's potential
reading speed should be used as a guideline in choosing reading media. When appropriate, the individual should be involved in the selection of the medium or media most suitable to meet his or her needs.

Large print is generally defined as print for text passages that is larger than the print used by that segment of the population with normal vision. The sizes of print most commonly used by the sighted population range from eight to twelve points in size. The American Printing House for the Blind takes the position that large print for use by the low vision population is print that is eighteen points in size or larger.

In addition to the size of the font itself, the x-height and t-height of a font can also be changed. (X-height is defined as the height of the letter "x" in any given font; t-height is defined as the height of the bottom of the crossbar of the letter "t" in any given font. Depending upon the font, t- and x-height may be different heights, or they may be the same.)

Other attributes that print designers are able to manipulate are: proportions, leading, spacing, character thickness, character edges, and character styles. These attributes could be manipulated either singly, or in combination, to maximize readability of a font. Line spacing and line length are other features of print that can be changed to guarantee good readability. APH has created a font, APHont™, that embodies characteristics identified through
research to promote readability in persons with low vision. APHont is available free-of-charge to qualified users from the APH web site.

➢ GUIDELINES

APH's recommendations are based on replicated research performed by APH and other agencies. Researchers studied the impact of various large print characteristics on reading speed, comprehension, literacy, and usability by large print users and found subjects had better scores in all areas tested when using APHont.

These guidelines are outlined in the following statements:

Each large print user should have access to:

1. A font that is at least 18 points in size.
2. X-height and t-heights of at least 1/8 inch.
3. A typeface without serifs.
4. Spacing between lines of print of at least 1.25 spaces.
5. Headings and subheadings that are larger and bolder than regular large print text.
6. Paragraphs that are block style and use 1 inch margins. The left margin should be justified and the right hand margin should not be justified. There should be no first-line indentations to delineate paragraphs.
7. Printed materials with no columns or divided words.
8. Black print on white, ivory, cream, or yellow paper with a dull finish so as not to promote glare.
9. Print that is not used over a background design or other graphical material.

10. Graphics that are not only enlarged, but maintain the same contrast, clarity, and appropriate coloration as those prepared for their sighted peers.

11. Graphic materials, such as maps, graphs, and charts, which also adhere to type size, font, and other large print guidelines.

12. Full-color or high-quality black line art rather than gray-scale or shaded drawings.

13. Books that weigh no more than 32 ounces and are no larger in dimension than 9 inches by 12 inches by 2.5 inches.

➤ APHont™: A FONT FOR LOW VISION

APHont™ was developed by a licensed Fontographer to specifications developed by APH. APHont was based on extensive research. It embodies characteristics that have been show to enhance reading speed, literacy, comprehension and usability for large print readers.

➤ FEATURES

- Even spacing between letters.

Example: willow (APHont) willow (Arial) willow (Times New Roman)
• Higher crossbars.

Example: attention (APHont)
attention (Arial)
attention (Times New Roman)

• No serifs.

Example: thoughtful (APHont)
thoughtful (Arial)
thoughtful (Times New Roman)

• Wider letters.

Example: snowfall (APHont)
snowfall (Arial)
snowfall (Times New Roman)

• Bold letters.

Example: astronaut (APHont Bold)
astronaut (Arial Bold)
astronaut (Times New Roman Bold)

• Underslung descenders like "j" and "q".

Example: adjust (APHont)
aqueduct (APHont)
adjust (Arial)
aqueduct (Arial)
adjust (Times New Roman)
aqueduct (Times New Roman)

• Rounder letters.

Example: footlong (APHont)
footlong (Arial)
footlong (Times New Roman)
• Larger punctuation marks.

Example: “Ouch!” (APHont)
“Ouch!” (Arial)
“Ouch!” (Times New Roman)

APH makes no claim that APHont is an appropriate font for children who are just learning to read.

➢ ADVANTAGES FOR USERS OF LARGE PRINT

• Little or no instruction is needed to use LP
• A Low Vision Clinical evaluation is not required for LP
• Student may be less self-conscious when reading LP (doesn’t need to use any special aids)
• LP books are funded by production agency, whereas parental or other funding is required for magnifiers

➢ DISADVANTAGES FOR USERS OF LARGE PRINT

• Enlarging can emphasise the imperfections in print
• Pictures are in black & white (and shades of grey)
• Labels on graphics or maths symbols may need further enlargement
• Large print is not readily available, post school - students may become non-functional readers
• Large print books are very bulky, especially textbooks

3.12.3 ANGULAR MAGNIFICATION

The apparent sizes of objects can also be increased through the use of various lenses or lens systems, such as the lenses found in a pair of binoculars.
Angular magnification makes an object at a distance appear closer to the eye. Since the object appears closer, the image is spread over a large portion of the retina, thereby producing a magnification effect. Optical devices are common examples of the use of angular magnification. Because such devices can be used in a wide variety of situations, they provide the user with a great deal of flexibility and independence.

The development of devices to print for someone without sight to read has always attracted considerable public interest and financial support. Despite the large allocation of resources on research and development, relatively few reading devices are generally available at a reasonable price.

An early device was the optophone which represented printed characters by patterns of musical notes, but few blind people managed to master the operation of this device.

The next major advance was the optacon which represents printed characters on a small vibrotactile display. This device was commercially successful but has been suspended because of the introduction of a new model using current technology.

The other approach is for the device to recognize the characters and display the information in a non-visual form such as Braille and synthetic speech.
Optical aids are prescribed to meet certain visual task needs. Because the type of task varies from individual to individual many different types of near aids have been developed.

The aid can be classified into the following:

1. Head-borne magnifiers,
2. Stand magnifiers,
3. Hand held magnifiers,
4. Electronic magnifiers.

Items that come in large print or allow the production of large print can prove to be most valuable to the low vision student. Large print books, daily living materials and recreation materials can improve visual function without the use of optical aids.

Reading distances are often close to the page orientation to a line or sets of lines may be difficult. To assist in overcoming this problem the student may use a typoscope. Reading stands can be used to avoid back strain or to facilitate proper positioning of the reading surface.

➢ ADVANTAGES OF MAGNIFIERS

- Magnifiers allow immediate access to print anywhere
- Maps and graphics can be viewed in true colours
- Lower overall cost per child than Large Print
- Lighter and more portable than Large Print
• No ordering and waiting time for materials
• May be more cosmetically desirable than using huge books
• Allow greater independence (and choice in reading materials!)
• Can be used post school

➢ DISADVANTAGES OF MAGNIFIERS

- Magnifiers must be prescribed by Optometrist
- Magnifiers and clinical appointments are usually funded by parents
- The cosmetics of magnifiers may cause self-consciousness
- Optical problems associated with the optics of magnifiers need to be tolerated
- Instruction is required in use of magnifier
- Some time and commitment is required, if student is to attain skill
- Reading speed and comprehension will probably be reduced in early stages of use

3.12.4 PROJECTION MAGNIFICATION

When an image is projected, as with an overhead projector or a movie camera, the size of the image is increased. Projection magnification literally increases the size of the image to be viewed through the projection process. For example, a person can double the size of a movie image by moving the projector from a distance of 10 feet from the screen to 20 feet while remaining in the same seat.
Electronic devices, such as computer screens and televisions, also provide projection magnification. For example, a 20-inch television provides twice as large an image as does a 10-inch television. A CCTV, used to project the image of printed and graphic materials to increase their size, is an electronic device used by persons with low vision to gain magnification, generally for reading and writing, and will be discussed later in the chapter.

CLOSED CIRCUIT TELEVISION (CCTV)

Low vision reading aids such as video magnifiers have remained essentially unchanged for 20 years despite improved computer technology. The traditional and predominant product is a Closed Circuit Television (CCTV) system that magnifies printed text placed under the camera and displays the magnified text using a computer monitor or television screen. Users navigate the text by means of an x-y table under the camera. These reading aids provide independence for people with low vision who would otherwise have to rely on other people to read them any printed material.

CCTVs have a simple and learnable interface; they also have several limitations. Discomfort can result from using the product for extended periods and viewing can be physically, visually and mentally exhausting. Physical requirements for dexterity and coordination to use the x-y table can be further complicated among the elderly, the predominant user group, who may also have other health issues such as arthritis. Due to the magnification required reducing resolution and viewing on a screen, the visual load can be high (Harpster et al,
1989). Users also need to remember the beginning of the previous line for long periods, which can cause a heavy mental workload.

Technological innovations currently available could eliminate these limitations. Optical Character Recognition (OCR) software has now progressed to a stage where it could enhance text to reduce the visual fatigue. Processed text could be presented automatically, in either a single line or as a single column of text, eliminating the need for the x-y table and assisting with the flow of text. Synthesized speech could also be utilized and would prolong the life of the machine by accommodating worsening eye conditions. However, increasing functionality should not be at the cost of usability, pleasurable or learnability. The goal then is to develop a new system that takes advantage of new technology, improves usability in terms of reading speed and comprehension, reduces physical demands by eliminating the x-y table, and maintains the learnability of the existing technology.

Recent product development literature has focused on enhancing the pleasure of products by assessing users’ needs (Jordan, 2002). To have pleasure, however, products must not only appeal to the user but there must also be an absence of negative emotion. It is therefore important to not only determine what aspects make a product pleasurable for a specific user group, but also to determine what aspects of a product elicit negative emotion. Technology related anxiety or frustration with consumer electronic products is common for many people, especially the elderly (Rosen & Weil, 1995).
Identifying what causes the frustration or anxiety can help reduce it, making a more pleasurable product. In addition, identifying why some people avoid technology may assist with designs that encourage use.

Sitting back and reading a book in an armchair may be something many of us take for granted and scanning the newspaper during breakfast is part of many people’s morning ritual. For people with low vision however, reading even the simplest of letters from their grandchildren can be exhausting as well as frustrating. In addition, writing tasks such as signing cheques, filling in forms and addressing envelopes can be daunting.

CLOSE CIRCUIT TELEVISION VIDEO MAGNIFIERS (CCTVS)

The traditional and predominant video magnifier is a CCTV. Text, such as a book or letter, is placed under a fixed zoom lens, which projects an image of the text onto a monitor in larger fonts, controlled by the size dial. Contrast and reverse polarity of the text allows easier reading for some eye conditions. False colours can be added on more advanced models, for further enhancement. Users navigate the text by means of an x-y table under the camera.

CCTVs offer users the ability to read letters, food labels, recipes, seed packets and inspect small objects they would not otherwise be able to see. Many people with low vision use talking books instead, but nothing can compare to reading a novel or non-fictional title of one's own choosing for as long as desired. There is a limited range of talking books available and some users have negative listening experiences due to the voice of the person reading on the tape. CCTVs
overcome the problems of talking books by allowing people with low vision to read whatever material they would like.

Despite a simple and learnable interface, existing low vision aids have several limitations, including requirements for dexterity and coordination, which can be problematic among the elderly, given other health issues. Discomfort can result from using the product for extended periods with many users reporting being unable to read for more than 10 minutes at one sitting and reading a novel is almost impossible.

Reading or writing with CCTVs can be physically, visually and mentally exhausting. Physically, the user must continue to move the x-y table or page under the camera for the duration of reading. In addition, because the screen is often placed above the camera, optimal ergonomics are difficult as the screen height is not adjustable. Visually, reading off a screen is more taxing. In addition, returning to the beginning of a line causes motion disturbance, due to the speed at which text is moving across the field of view. Perhaps because of this, some people with low vision experience motion sickness and are unable to use the machines at all, others only for short periods at a time. The cognitive load of remembering actions required to operate CCTVs is low, however users must constantly remember what the last line of text started with as they can only see a portion of the text on screen and have to return to the beginning of the line manually.
Like the human limitations, technical limitations include magnification of print imperfections, impossibility of digital text enhancement and a limited magnification range. For example, for users wanting to look up phone numbers in large phone books printed on low quality paper, every smudge and grain of the paper is magnified, reducing the ability to distinguish between words. While OCR software is available, it is not currently utilised in CCTVs. OCR could be particularly beneficial for enhancing fonts and character spacing. Many low vision sufferers find words with serifs more difficult to read. The flourishes on each letter can cause the letters to merge and reduce the speed of reading.

CCTVs are also usually big and bulky, taking up space, drawing attention to the user's condition and causing poor posture. Navigation with an x-y table requires full arm movements and the space required to move the table extend the space required past the physical footprint. The size and clinical look of the product also highlights the user's condition causing possible social alienation. Because the camera needs to be far enough above the x-y table to allow a book's pages to be turned, the screen is often at a height that causes suboptimal posture. If the screen is too high or too big to fit on the CCTV, some users place the screen to the side. By placing the screen to the side and having to have the hands operate the x-y table at an angle to the body, a twisted body posture results.

Despite the shortcomings of existing CCTVs, they provide people with low vision a degree of independence. Many sufferers have previously had to rely on
friends, family or neighbours to read them their personal mail and bank statements, and have had to labour over filling in forms. The goal then is to develop a new system that takes advantage of new technology, reduces physical demands, improves usability and maintains the learnability of the existing technology.

In addition to dealing with the biomechanical and technological elements of the product’s usability, assessment and enhancement of positive emotional aspects of electronic equipment is needed to ensure pleasurability. Technology related anxiety or frustration with consumer electronic products is common for many people, especially the elderly who are the main users of low vision products. Given the increase in elderly consumers, and that the elderly are more likely to experience technology related anxiety, it is important to make the experience of using accessibility products such as low vision reading aids as pleasurable as possible.

People with low vision need to easily identify the most important controls. They do not have the benefit of visual identification and require special consideration when designing interfaces with machines. Readers utilise different shaped controls so they can easily be identified tactilely rather than visually. High contrast colours for the controls also help them stand out from the body of the control panel. Eliminating unnecessary actions reduces frustration and memory load, making the product more pleasurable to use and easier to learn.
Appliances such as reading aids assist in maintaining independence and quality of life for people with low vision. Technology, such as the enhanced functions of this redesigned low vision reading aid can assist people with low vision. When designing any appliance, designers and engineers need to consider the physical and emotional limitations and capabilities of the entire user demography. When considering the limitations of people with low vision, user testing is especially important as few, if any, designers or engineers can truly identify with the unique situation these people live in.

**COMPUTER READING FOR LOW VISION**

Computers are another effective type of enlarging system for various tasks. Software with variable sizes and types of fonts, enlarged monitors, and screen magnifiers are readily available for computer use. Computers also provide users with choice of colors for print and background shown on the screen, control of the speed and type of scrolling material to be viewed, and control of the size and location of the viewing window. The vertical position of a computer screen is also advantageous to persons with low vision who cannot see the type on a typewriter, which is positioned a greater distance from the eyes.

In addition, many computer printers can produce printed information in various sizes and styles of type. For example, someone who prefers to work with 18-point type on the computer screen can then print it in 24 point type, such as a lecturer who needs to read material at a greater distance form the page when presenting a talk to an audience.
Using computing resources can increase the independence, capabilities, and productivity of people with disabilities. Computers can benefit people with low vision, blindness, hearing impairments, speech impairments, specific learning disabilities, mobility impairments, and health impairments.

Access to computing resources for people with disabilities involves two issues: access to the computers themselves and access to electronic resources. Electronic resources include applications programs such as word processors and spreadsheets and information resources such as encyclopedias and databases available over the Internet.

Computers help lower many barriers faced by people with disabilities. They demonstrate various technologies that make it possible for people who have disabilities to use computing resources. These are only examples, since abilities, disabilities, and learning styles are unique to individuals. Many accommodations are simple, creative alternatives for traditional ways of doing things.

For some people with low vision, standard written materials are too small to read and/or objects may be blurred. Others may only see objects within a specific field of vision. Still others may see an image with sections missing or blacked out. Learning via a visual medium may be more mentally fatiguing for people who have low vision than for people who have standard vision.

Persons with low vision need

- large print signs, handouts, labels
- good lighting
- large print key labels
- large monitors
- software to enlarge screen images
- software to adjust screen colors

Examples of general accommodations for people with low vision include large print books, handouts, signs, and equipment labels. The most heavily used career search handouts and employer information materials should be available in alternative formats, including large print and electronic versions. Provide seating with good lighting. Providing areas with dim lighting may also be helpful for those who are light sensitive.

There are several computer technologies that will assist people with low vision as well. Computers equipped with large print key labels and tactile home-row key indicators can help users with visual impairments locate keys. Large monitors and anti-glare screens can also assist those with low vision. Computers equipped with screen enlarger software can enable people with low vision to read characters on the screen without assistance: large monitors allow them to maximize the amount of text they can see at one time.

The ability to adjust the colors of the screen or change the foreground and background colors may help some people. For those sensitive to light, it can be helpful to reverse screen colors from black on white to white on black. Some operating systems have accessibility options such as this one built into them.
There are also accessibility software packages that will perform these functions in concert with standard software.

Most of the computer programmes are designed to drill and practice opportunity to help students to improve their reading skills. They contain high quality auditory information, photos and others type of visuals, and even on screen videos.

Technologies for other academic areas are like traditional spelling software which offers opportunity for drill and practice and the CBI (Computer Basic Instruction) which can enhance spelling performance and increase motivation to learn (Gornden, Vaughn & Schumn 1993).

Texts on computer are available with enlarging print and flexible layout to overcome the problem of low vision. Computer and multi-media are the technology that is often associated with the students having low vision.

The classroom teacher need not depend on high technology devices and as far as possible he / she should use residual visions to use the available technology.

The micro computers have many features that make it an idea tool for educational instruction of low vision persons. Fortunately, several means of providing fuller access has become increasingly available. These means are grouped in what is called is Access Technology. Access Technology is defined
as the equipment, interfacing software instruction and instructional materials enabling independent use of microcomputers by low vision children.

- **COMPUTERIZED REFORMATTING OF TEXT**

  Any word processing or desktop publishing programme that allows the user to control type size and style as well as the spacing between the lines, words, and letters would make useful contribution to the learning by the low vision children. These programmes can reformat any text that is entered into the computer to be printed into a size and with spacing that student can read more easily. With these programmes, a format that is helpful to a given student can be developed and perfected.

  By having sets of these style sheets or templates for several different students’ text that is entered and reformatted for one student could easily be reformatted in additional formats for other students with different needs in the same or future class. Such a factor as increased letter size, greater distance between words and more spacing between sentence beginnings and endings can help students to discriminate more easily between the component parts of the text.

3.12.5 **OTHER MAGNIFICATION SYSTEMS**

  The advancement of microchip technology has spurred the refinement not only of microcomputers, but also of optical systems that are most apparent in televisions, CCTVs, and videocassette recorders (VCRs). Because microchips have become smaller and faster and are capable of performing multiple tasks at
once, researchers and manufacturers have begun to develop new devices that persons with low vision can use. These systems incorporate the latest technology to produce images that are optically correct, and they are capable of modifying images.

The Johns Hopkins Low Vision Enhancement System (LVES) is an example of a device that reflects these advances in technology. This head-borne device is worn on the face like a pair of giant eyeglasses. Three miniaturue cameras, which are engineered into the frame, function similarly to an on-line camcorder; they display their black-and-white video images back onto a screen in front of the person’s eyes. The images produced by the LVES are equivalent to those one would see when sitting in front of a 60-inch television screen at a distance of four feet.

The LVES may be connected to a VCR to allow the user to view movies. It can also be connected to a computer or a compact video disk to allow a person to scroll across a screen. Individuals who will benefit the most from using the LVES are those who have visual acuities ranging from 20/100 to 20/800 in the better eye.

3.13 CONCLUSION

Reading provides one of the chief avenues to information in school setting. Hence printed materials occupy a position of major importance in the educational process. The quality of these materials and the manner in which they
are utilized, may therefore contribute significantly to the relative effectiveness of their use by the reader.

Present emphasis on “sight utilization” as opposed to “sight seeing” has raised numerous questions regarding the extent to which the use of print materials should be promoted among the children with low vision. The lack of evidence regarding these questions underscores the need for research in this area. The present study is undertaken to measure the reading efficiency of low vision children in various print media using Tamil Font in middle school level.

To sum up, this chapter listed the order according to importance in reading and selection of suitable print media for low vision children.

1. To provide a synthesis of framework of visual abilities and environmental cues of visual functioning for low vision children.
2. To apply the concept of magnification in reading of low vision children.
3. To make the low vision students to read successfully in suitable print media.

The above aspects should be taken into consideration in the reading of low vision children. A practical approach, keeping view of the use of sensory channel and suitable print media and print size should be the base of reading for children with low vision.