CHAPTER - II

REVIEW OF RELATED LITERATURE

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2.0 Introduction

Alison Jones (2007), stated that, a literature review is very important while writing a thesis or an article it helps to map the area of our study or it will give answer to our questions. It is always essential for all the research and it helps to understand and helps to follow a line for our investigation and the review will give the ground for our research, rationale and answers to questions of the researcher in relation with other field.

Lokesh Koul (2008) a careful review of the research journals, books, dissertations, theses and other sources of information's on the problem to be investigated is one of the important steps in the planning of any research study. Based on the above views the investigator explored the related studies pertaining to the study and presented under various headings.

2.1 Visual Impairment - Prevalence and Etiology

A study was conducted by **Sight Savers in India (1995)** to find out the main reason for blindness and vision impairment and the study carried over at Orissa and Chhattisgarh with 166 children, and revealed that, in Orissa 54% of children were affected by cataract a corneal diseases and in Chhattisgarh the main cause was the retina related diseases.

Vision 2020 The Right to Sight, Global initiative for elimination avoidable blindness, Action Plan 2006 -2011 states that, at present the global estimate of people with functional problem is not currently available but probably it may be 40-65 million people suffering from visual impairment. Also the population of low vision will increase because of age related macular degeneration; glaucoma and diabetic retinopathy are the important causes for vision impairment. And the Action plan reports that low vision services are not available in many countries specifically in developing

countries if it is so, available only in the main cities from which only 5% of the people were able to access the services.

As of the “Position Paper on Clinical Low Vision Evaluation and Treatment of Students with Visual Impairments for Parents, Educators and Other Professionals”(2014), it is projecting that 0.2% of school going children in the united states are identified with visual impairment, it means with around 16% of these children are considered as low vision or totally blind. Yet, the exact reason for childhood blindness was unidentified because non availability of population data figures or other related reports. Due of this reason commonly the children with 20/70 visual acuity worse than better was admitted for special education services also additionally they will see if the child has limited in peripheral vision or if it is in the progressive nature they were admitted and provided special education.

While referring, the study of Adedamola L, et.al., (2012) “Etiology of blindness and low vision in the 86 students studied in the schools for the blind in Oyo State” it reveals that, 55% of the visual impairments due to congenital or with developmental cataract, 37% with optic atrophy and 9% were identified with retinitis pigmentosa. And further the study reveals that, 55% of the students identified one year to teenage years, 36% were infants and 9% adults were identified with visual impairment. Regarding distance visual aids nearly 91% of the students were benefitted and 11 students improved near visual acuity with the help of near vision devices. But before that no students were using spectacles or any other form of low vision aids.

Titiyal JS and et.al., (2004) studied 703 school children studying in 13 blind school of Delhi to identify the primary causes and temporal trends of blindness and severe visual impairment children in school for the blind in North India and explored the chronological trends the major causes is identified that from the different age group of 5-8 years, 9-12years, and 13-15 years is due to retinal disorder, cataract and mostly because of

insufficiency of vitamin A. And the study stated that, about 50% of the children can be cured or they are under treatable condition.

In **Sri Lanka**, **Sight Savers (1995)** studied 243 children aged between 5-15 years with visual impairment studying in 12 schools for the blind, 30 integrated education schools and 6 multiple disability schools were examined using the standard WHO methodology for childhood blindness. The study revealed that 58.5% were blind and 42.5% had low vision. 43% of children affected visual impairment due to hereditary factors. The main causes of visual impairment were retinal disease (37%), whole globe causes (31%), cataract (20%) and glaucoma (7%). With the use of low vision devices, 25% of children had an improvement in their vision.

A study conducted in **Pakistan (2003)** followed WHO guidelines, studied 1000 children in 46 schools. The survey revealed that among 1000 children 77.5% of children enrolled in these schools were blind and the rest of the students had low vision. The main cause for the blindness is due to hereditary diseases (60%) the other causes were 51% affected by retinal disease, 51% had whole globe problems and 3.7% had corneal problems. And after prescribing low vision devices about 11% were had significant improvement in their vision.

Kansakar I, and et.al., (2009) conducted a study on **Causes of vision impairment and assessment of need for low vision services for students of blind schools in Nepal.** The main aim of the study was to evaluate causes of vision impairment of students enrolled in school for the blind in Nepal and assess the need for low vision rehabilitation services in these students. For this study adopted survey method, surveyed 12 registered schools for the blind with the team of ophthalmologist and along with one optometrist and adapted WHO protocols. 345 students were enrolled in the 12 schools out of 345, 285 students were examined (82.61%) for the study. The age group of the students were 5-29 years. The prevalence of visual impairment was found that about three - fourth of the

students were become blind within one year of age group and 52.3% of students born with blindness. After refraction, they found that 9.12% had mild visual impairment, 7.37% had severe visual impairment and 83.51% were totally blind. The main causes they found that 35.79% suffered from corneal and retinal diseases and optic dystrophy. The main etiological factors are vitamin A deficiency, measles (42.11%) and 25.26% had hereditary causes.

And the study reveals that, out of 285 students, 48.07% had preventable causes 16.14% can easily treatable and 64.21% were had avoidable causes. And 28.2% of students were able to read 2M print size after near vision assessment and 15.78% were benefitted with telescopes and distant low vision devices. At the end, they concluded their study that to achieve the Vision 2020 need to provide possible quality life to visually impaired need to focus low vision assessment, eye health education to general public and community health workers should implement with the help of governmental and institutional support is essential to achieve Vision 2020.

A study was conducted by Parikshit Gogate and et.al., (2011) on **"Severe Visual Impairment and Blindness in Infants : Causes and Opportunities for Control"** and concluded that childhood blindness has an adverse effect on growth, development, social, and economic opportunities. Severe visual impairment (SVI) and blindness in infants must be detected as early as possible to initiate immediate treatment to prevent deep amblyopia. Although difficult, measurement of visual acuity of an infant is possible. The causes of SVI and blindness may be prenatal, perinatal, and postnatal. Congenital anomalies such as anophthalmos, microphthalmos, coloboma, congenital cataract, infantile glaucoma, and neuro-ophthalmic lesions are causes of impairment present at birth. Ophthalmia neonatorum, retinopathy of prematurity, and cortical visual impairment are acquired during the perinatal period. Leukocoria or white pupillary reflex can be cause by congenital cataract, persistent hyperplastic

primary vitreous, or retinoblastoma. Screening in the first few weeks of life can prevent blindness. Retinoblastoma can be debunked with chemotherapy; however, enucleation may still be required. Neonatologists, pediatricians, traditional birth attendants, nurses, and ophthalmologists should be sensitive to a parent's complaints of poor vision in an infant and ensure adequate follow-up to determine the cause. If required, evaluation under anesthesia should be performed, which includes funduscopy, refraction, corneal diameter measurement, and measurement of intraocular pressure.

2.2 Common Causes of Low Vision

According to **Holbrook, M.C. & Koenig, A.J. (2000),** the common causes of low vision is nearsightedness, farsightedness and astigmatism, and also due to Albinism,.Aniridia, Aphakia, Cataracts, Coloboma, Glaucoma, Macular Degeneration, Nystagmus, Optic Atrophy, Optic Nerve Hyperplasia, Retinitis Pigmentosa, Retinopathy of Prematurity, Lazy eye (amblyopia): and due to misalignment of eyes (strabismus).

The statistics of Babies Count (Hatton 2013) states that out of 5,931children (0-3 years), 24.9% had cortical (cerebral) visual impairment (CVI) as the main reason for visual disability, and 11.8% had retinopathy of prematurity (ROP) and 11.4% with optic nerve hypoplasia (ONH). In infants and toddlers with CVI, ROP, and ONH, are the most common causes of visual impairment in USA.

Khan.S.A (2000) conducted a study to obtain data on the characteristics of low-vision patients seen at a tertiary eye care hospital in India, reveals that, the main causes for low vision were due to retinitis pigmentosa (19%), diabetic retinopathy (13%), macular diseases (17.7%), and degenerative myopia (9%).

Clare Gilbert & Allen Foster (2001) Childhood blindness in the context of VISION 2020 -describes that the major causes of blindness in

children vary widely from region to region, it is largely determined by socioeconomic development, and the availability of primary health care and eye care services. In high-income countries, lesions of the optic nerve and higher visual pathways are predominate cause of blindness, while corneal scarring from measles, vitamin A deficiency, the use of harmful traditional eye remedies, and ophthalmia neonatorum are the major causes in low-income countries. Retinopathy of prematurity is an important cause in middle-income countries. Other significant causes in all countries are cataract, congenital abnormalities, and hereditary retinal dystrophies.

Srijana Adhikari and et.al., (2014) studied the causes of blindness and visual impairment in children in three ecologically diverse regions of Nepal, out of 10,950 children aged between 0-10 years, 5,403 from terai, 3,204 from hills, and 2,343 from mountains, was enrolled in the study, and identified the main cause of blindness was due to amblyopia (42.9%) followed by congenital cataract. Corneal opacity (39%) was the most common cause of unilateral blindness. And, concluded that more than two-third of the causes that lead to blindness and visual impairment was potentially preventable, and further suggested that nutritional and genetic studies are needed to determine the factors associated with ocular morbidity and blindness in the regions.

2.3 Importance of Early identification

Gary Heiting, OD (2015) viewed that eye exams for school going children are extremely important, The American Optometric Association (AOA) says that 25 percent of all school-age children have vision problems. Early identification of a child's vision problem is very important because it is easy to provide treatment when problems are diagnosed early. And it is appropriate and necessary that infants should have their first complete eye examination before they attain the age of six months and they need further eye examination before they enter into the first grade or at the age of 5-6 years.

The American Optometric Association (2014) also insisting that an eye exam is required to all school going children once in two years to deduct the problem at the early stage. And if the children wearing eye glasses need to examine annually or as per recommendation of the eye specialist. It is very vital to have health and normal vision which will help them to execute their work better at schools and it will help the children to develop their basic skills related to vision for learning.

The early deduction and identification of vision problem will help to identify the problems such as:

- Near vision
- Distance vision
- Binocular vision
- Eye movement skills
- Focusing skills
- Peripheral awareness and
- Eye hand coordination

The following eye tests are commonly used for eye testing that is,

- **LEA Symbols** for young children are similar to regular eye tests using charts with letters, except that special symbols in these tests include an apple, house, square and circle.
- **Retinoscopy** is a test that involves shining a light into the eye to observe the reflection from the back of the eye (retina). This test helps eye doctors to prescribe eye glassless.
- **Stereopsis** testing uses special patterns of dots and 3-D glasses to measure the child's eyes work together as a team.

The following studies conforms the importance of early identification and early education of children with visual impairments.

The Council for Exceptional Children (2003) states that, Infants and young children with visual impairments have the same needs as like other children and have unique developmental needs. Vision is the primary organizing and integrative sense for the sighted child; the remaining senses, particularly the tactile and auditory, become more important for the child with a visual impairment. The specific intervention, particularly in maximizing efficient use of all senses and in symbolic operations and concept development, is introduced; many young children with visual impairments will not be able to form accurate concepts of the world around them. Children with visual impairments require specific interventions designed to promote optimal use of vision and all senses, including the use of environmental adaptations and optical devices which can be achieved by early identification and through early education.

According to (Schore, 1994) infants and young children with visual impairments have different perceptions of the world than children with normal vision. Concepts are built on perceptions, of the objects and events in the world, which result from information processed by senses. As a result, an understanding of the world that results from information obtained primarily through tactile, auditory, olfactory, and kinesthetic information, rather than vision, must be different. Vision is particularly important to gain information about objects, people, and events at a distance. Although hearing does provide some information about distance, it typically does not provide the stable and consistent information provided by vision. Thus, development in all areas, including cognitive, social-emotional, communicative, and motor development, as well as the development of daily living skills, may be quite different for children with visual impairments. These differences in development, combined with lack of access to the visual environment, must be considered and addressed through early intervention.

While referring the article of **Deborah Chen (2000)** states that, vision and hearing are the primary source to facilitate learning of infants with developmental delays or disabilities need to receive comprehensive

ophthalmological and audiological evaluations. Unfortunately, this is not common practice. Without accurate information about the status of an infant's vision or hearing, it is not possible to provide appropriate service and intervention at the earlier stage. It leads to child's inattentiveness in certain activities or delay in speech and language development influenced by an unidentified vision or hearing problem with obvious motor development delay.

Further, research indicates that, infants who are eligible for early intervention services are more likely to have vision impairment or with hearing loss than infants without disabilities. Children who have developmental delays, cerebral palsy, or down syndrome have a higher incidence of refractive errors and other ophthalmological problems than children without disabilities. About 70 percent of children with visual impairments have an additional disability. Over 75 percent of children with down syndrome have a hearing loss, and over 35 percent of children with hearing loss have an additional disability. So it is important to have a multidisciplinary approach and providing the early intervention service at the earlier stage.

2.4 Elements of vision

According to Birgitta J. Blokland (2014) there are different eye conditions and each one creates a different form of vision distortion. In order to access the adequate services the elements of vision such as distance, size, contrast, colours, position of the objects and lighting conditions are important parameters in the assessment of functional vision of low vision students and it is essential to determine the extent of sight loss and its impact on daily life. The elements of vision supports in rehabilitation planning and to adapt various environment conditions at home and in school to adjust the situation with various lighting conditions, colours, contrast, size and distance.

Also, the elements of vision aids in training to access information and helps to plan to undertake daily activities, leisure time activities, orientation and mobility and etc.

Daniel Kersten (2004) states, that **larger object** are not always easier to see. The children with reduced visual fields can only see parts of large objects. The shapes and material properties of objects quickly and reliably despite the complexity and objective ambiguities of natural images. Typical images are highly complex because they consist of many objects embedded in background clutter. Moreover, the image features of an object are extremely variable and ambiguous owing to the effects of projection, occlusion, background clutter, and illumination.

Karl R. Gegenfurtner (2003) in his article quotes that, the perception of **colour** is a central component of vision. Colour facilitates object perception and recognition, and has an important role in scene segmentation and leads to visual memory. Moreover, it provides an aesthetic component to visual experiences that is fundamental for perception of the world.

Alan J. Koenig (1995) clearly states in the book of Learning Media Assessment of students with visual impairment, the **working Distances** and **size preference** observe and record the student's natural choice of working distance while visually examining the classroom materials, while reading or looking at pictures, and during writing, drawing, or coloring. Record the object size and distance for visual identification of objects and object size for tactual identification. And also record specific information regarding the student's ability which will provide useful information’s about the complexity and familiarity of the object, as well as the time taken by the student to identify the object and then decide the size and distance required for the student.

Good contrast is an important factor for people with low vision. Improving contrast can make objects or print easier to see without changing the size or distance.

M.Abrahamsson, & et.al., (1988) focusing that, the **contrast sensitivity function** (CSF) and visual acuity was determined in children and adults with unilateral amblyopia due to strabismus or anisometropia with central fixation. The preschool children were examined repeatedly during the occlusion treatment. All amblyopes had CSF deficits. The strabismic children had a more marked visual acuity deficit in relation to the contrast sensitivity losses, whereas these parameters are affected similarly in anisometropic amblyopes. The relationship between recovery of visual acuity and CSF during the initial month of occlusion treatment was of prognostic significance for the outcome of visual acuity improvement.

Richard, J.C Bowman, (2001) described that each low vision students needs different **lighting conditions**. It is not possible to change environment light but it is possible to provide suitable lighting according to the individual needs. In fact the bright lighting is not necessary the best for visually impaired it will depend upon the child's visual condition. For example the children with corneal opacities, cataract, albinism and aniridia should avoid focal light sources in front of the child it may cause glare. The diagnosis with retinitis pigmentosa needs adequate lighting is essential in the dark areas. The children with cone dystrophies should avoid excessive bight lighting it will cause discomfort and leads to poorer vision and the students with macular disorders and optic nerve disorder students needs bright focal light sources placed behind the child and directed on to target will improve the detailed vision. Also he recommends fluorescent tube is cheap and provides diffused light and stays cool.

Karen Plumley (2008) states that students with **sensitivity to light** should be allowed to wear a glare-reducing visor or cap and seated away from bright windows. When light reflects off shiny desktops, a small

tablecloth can be used to cover the surface. Additionally, use a blackboard instead of a shiny whiteboard in the classroom will minimize reflective visual stimuli throughout the classroom. Conversely, if a child needs *more* light a table lamp can be provided for close work.

Ciochetta Ilaria and et.al., (2015) conducted a study to evaluate the **effects of intermittent light** stimulation provided by therapeutic glasses mnemosline on visually impaired samples. The mnemosline device is an eye mask which is placed on the lenses it contains two red LEDs with flash frequency centered on the frequencies of the brain's alpha rhythm. For the study they included 7 samples with different eye conditions they were asked to wore the glasses for about 10 minutes and studied the reading speed. Out of seven samples 4 samples subjectively improved 100% of visual performances after stimulation. With this study they concluded that the assessment is effective in increasing the functional parameters considered and Mnemosline could be an alternative or addition to the usual home-visual training techniques used in visual rehabilitation centers.

2.5 Use of optical and non optical devices

A study was conducted by **Nikhil Pal (2006)** and his team on the “Need for optical and low vision services for children in schools for the blind in North India”. The aim of the study is to determine the need of optical devices to improve the residual vision to blind children studying at school for the blind. To determine this cross sectional study conducted in 13 blind schools in Delhi, North India.

The team assessed 703 children aging below 16 years. Out of 703 children 133 children had useful residual vision after prescribing near vision spectacle magnifiers. Further, the study reveals that, about 20% of the children were improved their functional vision after refraction and about 35% improved with spectacles particularly the children with aphakia coloboma, refractive error and microphthalmos students benefited from spectacles and

41% of the children were able to read N10 size with the help of spectacle magnifiers. By this study they concluded that the children with aphakia, congenital anomalies were benefitted out of refraction and with low vision devices.

The low vision clinic of **Chang Gung Memorial Hospital (2002)** underwent a study to determine the clinical effectiveness of optical and video low vision aids (LVA) and analyzed the characteristics of the visually impaired. The aim of the study was to identify the improvement of distance and near visual functions of 203 new patients identified and treated from 1998-2001 in their clinic.

From their study spectacles helped a lot to improve both the distance and near visual requirements. Out of 203 patients, 21 patients were given spectacles to improve distance and near vision acuity and 3 patients with hemianosia were assisted with fresnel prisms along with spectacles. 84 patients were benefited with telescopes, and one patient additionally provided head-mounted device. 118 patients were assisted to read news paper with optical magnifiers and 91.9% were able to use closed circuit television for reading.

Survey of low vision among students attending schools for the blind in Nigeria: A descriptive and interventional study conducted by **Adedamola, L. and et.al., (2012)** found that, 94.3% visually impaired children had visual acuity in the range of 3/60 to no light perception (NLP) before correction and this was reduced to 87.2% after refraction and with visual aids. And again they found that, Unaided visual acuity between 6/60 and 3/60 was found in three (3.5%) students before correction while two (2.3%) reach this range of visual acuity after correction, both coming from the category of those that were blind before correction, giving a low vision prevalence of 2.3%. A small proportion of students (2.3%) had uncorrected visual acuity between 6/18 and 6/60. The proportion in this visual acuity category improved to 10.5% after correction of some of the subjects with uncorrected visual acuity

of between 6/60 and NLP, giving a proportion of visual impairment of 10.5%. None of the students was using any form of visual aids prior to the investigator's visit.

The findings **of Sight Savers International 1995** conforms that, 76% of children with low vision were benefited from low vision devices only two children is using the devices previously. Also this study imparts the importance of establishing the vision assessment before enrolling them in the schools and it will help them to receive necessary support to develop stronger system and to avail benefits out of low vision devices.

Nagomi, G. and Tyagi, S.K (2007) studied the efficacy of optical devices in increasing the reading speed of students with low vision with the objectives of comparing mean reading speed and mean critical print size before and after introduction of optical devices(s), to study the effect of visual acuity on reading speed and critical print size and to study the effect of varying magnification on reading speed and critical print size for student with low vision. They studied 190 students studying from 6-9 grades and they were classified on the basis of their vision loss namely blurred vision, peripheral vision and central vision loss to test their reading ability either normal print or large print. It was an experimental study; it was designed on the lines of pretest and posttest single group design. The treatments for all subjects were given training in the use of optical devices for reading. For testing reading speed the authors used a Tamil passage as a tool. The passage was in 12 point print size for all the 190 students provided optical devices such as hand held, stand and spectacle magnifiers. The subjects were instructed to use optical devices at least 20 minutes every day and they were asked to practice 20 minutes every day for two months. In the post test they assessed the print size 8 point to 20 point, and prescribed optical devices with their required magnification were grouped as (i) 2x &2.5X (ii) 3x and 3.5x and (iii) 4x &5x and (iv) 6x & 7x.

Then they administered post test by using the same tool and derived the following results by calculating mean reading speed and print size. It was found that the optical devices were enhanced their reading speed of students with blurred vision, central vision and peripheral vision loss and they found that there was a significant impact of optical devices on critical print size of low vision students. And from the result it is understood that the reading speed of students using low power magnification was better than that the using of higher power magnification.

2.6 Vision assessment and visual efficiency training

A study on “impact of low vision rehabilitation on functional vision performance of children with visual impairment” conducted by **Suma Ganesh and et.al.,(2013)** on the impact of low vision rehabilitation on functional vision of children with visual impairment with the tool developed by LV Prasad-Functional vision questionnaire specifically designed to measure functional performance of visually impaired children of developing countries were used to assess the level of difficulty in performing various tasks. Chi-square test was used to assess the impact. After the intervention the acuities improved significantly for distance (0.2 ± 0.27; $P < 0.0001$) and near vision (0.42 ± 0.17; $P = 0.001$) after introduction of low vision devices.

In their study they found that, most common problem reported by the low vision students were difficulties related to their academic activities. ie.80% of the students had problem in copying from the blackboard, 77.2% reported problem in reading and 77.2% were not able to write in a straight line. The raw score of pre test before introducing low vision devices was 15.05 and which was improved to 7.58 after introducing low vision devices. The post rehabilitation improved the functional vision in academic related activities like copying from the blackboard ($P< 0.0001$), reading text book at arm’s length ($P<0.0001$), and writing along a straight line ($P=0.003$). It was also recommended an early visual rehabilitation which will help to improve and enhance the learning abilities of low vision students.

Barraga Natalie (1964) conducted a study on “Increased visual behavior in low vision children” For the study she selected ten pairs of blind children aging from 6-13 years who has some remaining vision were matched by pretest scores on a test of visual discrimination. Criterion groups designated as print comparison group have slightly higher recorded distance acuities and used vision as the primary means of learning. The experimental groups were provided 45 minutes of training designed to increased the functional use of remaining vision with the specific lesson plan of four sequential stage for discrimination, recognition of visual stimuli, geometric form in solid black and in outline shapes, grouped objects in colour and in outline with full inner details, and letters and word symbols. Materials were gradually decreased in size.

After completion of the training session subjects were tested again with the test of visual discrimination and analyzed the results which gave a statistically significant difference between experimental and control group and near vision acuity improved to 7 subjects out of 10 subjects. And the visual discrimination test yield a test re test stability co efficient of 0.98.

Taha A. Labib, Mohamed. A. El Sada, (2009) and et.al., studied on “assessment and management of children with visual impairment with the aim of to evaluate the role of low vision aids in improving visual performance and response in children with low vision. This study was conducted with the sample of 50 patients that met the international criteria for a diagnosis of low vision. Their ages ranged from 5 to 15 years. Assessment of low vision included distance and near visual acuity assessment, color vision and contrast sensitivity function. Low vision aids were prescribed based on initial evaluation and the samples visual needs. Samples were followed up for 1 year using the tests done at the initial examination and a visual function assessment questionnaire. They prescribed distance and near vision aids were prescribed according to the visual acuity and the visual needs of every patient. All samples in the age group 5-7 years were integrated in mainstream schools. The remaining samples that were already integrated in

schools demonstrated greater independency regarding reading books and copying from blackboards.

After one year they confirmed that low vision aids could play an effective role in minimizing the impact of low vision and improving the visual performance of children with low vision, leading to maximizing their social and educational integration.

2.7 Classroom Management and Role of Teachers and Administrators

Elsie Rao (2000) describes that the majority of the low vision students will have very poor distance vision, which makes it difficult for them to see the chalkboard or to gather detailed information from the black board. But they can read print and gain information from pictures, charts, and graphs when the material is viewed closely. Each low vision student's needs are unique, and the following suggestions will be helpful to teachers and administrators while working with a low vision student in the classroom situation.

The class teacher should,

1. Permit the student to sit in the preferred seating in consultation with special educators, preferably away from glare sources such as windows.
2. Allow the students to sit with their sighted peers.
3. Encourage the children with low vision to wear sunglasses or a hat with visor and full hand sleeve to protect from direct sun light it will be useful in the inside the classroom also.
4. Give extra space around his / her seat for keeping large print materials/ optical aids/ reading stand/ lamp and the like.
5. Advice them to use non optical devices such as felt tip pens, writing slit, broad line and checked notes books will help them to improve good contrast and to increase visibility.

6. Check illumination in the classroom, preferably avoid glare in the surface of black board.
7. Provide handouts (notes) instead of asking the child to copying the notes from black board.
8. The teacher should make her handwriting clear and large.
9. Regarding print size, the teacher can get suggestions from the low vision specialist and handouts should in large print with good contrast.
10. Permit extra time to complete their tests and assignments if they required.

The administrators should:

1. Create awareness among the teachers and peer groups to help the children with low vision in school and in their classroom.
2. Label the environment to encourage and motivate print reading ability of the child.
3. Paste pictures and diagrams with good contrast on the wall at children's height will stimulate their vision.
4. Paint the top of stairs with a contrast colour or paste colour strips will enable them to identify the steps easily and molding around the doors and windows in a different colour will help the low vision student to locate their classroom.
5. Buy some toys, games, puzzles with bright colour to stimulate the vision of low vision children. Provide lighting in the dark areas especially in the rest rooms required on a cloudy day.
6. Availability of a plug near the seat of low vision child will help her / him to plug in his lamp / tape recorder. Black board should provide proper contrast otherwise a low vision child will find it quite a strain to read from them. These should be regularly painted for this reason.
7. Ensure computers are equipped with required software.

8. Allow and encourage them to participate in school activities along with their classmates.

2.8 Applications of Technology

Susan and et.al., authors of Teaching students with visual impairments-A guide for the support team (2003) revealed that various technology needs to be introduced for children with low vision and visually impaired need a variety of specialized materials and equipment in order to coup-up with regular children in the school environment. The reading and writing medium should be determined in consultation with ophthalmologist and with the help of low vision specialists. Some children with low vision prefer to use Braille for academic purpose and large print for functional use.

Low Technology Solutions

The following are the low technology solutions **(**Blennzict, 2012) provided for effective use of remaining vision for academic, mobility and for daily activities.

- Dark pencils and felt-tipped pens
- Dark-line pads, exercise books, and graph papers
- Writing and reading guides
- Slope boards and desks
- Adjustable stands for notebook computers
- Large print keyboard overlays
- Adjustable copy holders with line markers
- Angle-poise lamps
- Magnifiers
- Monoculars
- Perkin braillers and
- Abacus

Large Print

Karen Scammell (2003) stated that the preferred large print size for the students will be determined by the low vision specialists after prescription of low vision devices**.** Hence, children with low vision may be able to use the same print as like other students up to V grades, when they goes to grade 6, the size of print will become smaller in size and quantity of reading material need to make large print. And even we can enlarge print and graphic materials on the photocopier or computer for students with low vision. Select materials with clear type and pictures, adequate spacing and margins, good quality paper with non-glossy finish and maximum contrast between print and background. The student may not require large print for all materials in all classes. For example, a student may only need mathematics books, dictionaries and maps in large print. The nature of the eye condition may make it necessary to provide large print at certain times of the day when the student is fatigued.

Low Vision Devices

Magnifying devices will enhance the size of print on the page and on the blackboard, and they can be used to make the details in near and distant objects more visible. Students using magnifying devices may experience decreased reading speeds because of the reduced visual field. Young students may not have the necessary fine motor control to use magnifiers efficiently. Some older students, generally from grade 5 onward, should be encouraged to become proficient in the use of magnifiers because they provide access to a variety of regular print materials. Various **hand-held**, **pocket** and **stand magnifiers** that can assist students are available. Consideration must be given to working **distance, field of view, depth of focus**, **weight, style** and **appearance** of the device. **Telescopic lenses** on glasses and monocular may enable the student to locate stationary and moving objects at a distance, such as street signs, bus numbers and print on the blackboard.

2.9 Advanced Low Vision Technology

Lucy Barker & et.al., (2015) reported that optical reading aids for children and young people with low vision, Cochrane Eyes and Vision Group's low vision technology is advancing to meet the growing needs of the children with low vision which aids the children to enhance their vision as well as ability and helps to minimize their problem and easy to use. Some of the recent technologies are discussed under various headings:

Lex

Lex is a highly portable camera system that helps to read the text materials. Weighing just 720 grams it is the ideal portable solution for computer users of all ability levels. Simply place the document under the camera, press enter on the keyboard and within a few seconds, the document is being read aloud with the chosen visualization, text size, colour and formatting.

Readit - magnify

Readit is a highly advanced portable auto reader / CCTV system for close up work. It reads faster, and it read back the document if needed, within a minute it reads up to 30 pages and easy to use and it helps to read the news paper layouts or tins of food.

Read Easy +

It will read practically any printed text loudly within seconds, with the choice of human sounding voice. Simply place the document up against the right hand edge of Read Easy+'s case, press "Capture" and within a few seconds the document is being read out loudly.

The Typing Tutor

The typing tutor speaks guides around the computer keyboard. It introduces to the users all the keys available, and the user will become confident and accurate with the usage of keyboard. Need not worry about

making mistakes - the Tutor is there to tell where the student went wrong, and gives guidance in finding the keys to press.

Large Print Keyboard

The USB large print keyboard provides easy to see computer keys with extra large key legends for greater visibility and efficiency. Designed to use low profile keys, with the largest legends available in the market. High quality keyboard rated for greater than 10 million keystrokes.

Mouse type magnifier

A powerful, portable, hand-held digital reading aid device designed for people with low vision. The size of a computer mouse has ergonomic design and is easy to operate. It connects directly to any TV/PC Monitor with video input port or USB port within seconds, allowing to read news papers, magazines, recipe cards and even medicine labels. In addition, PC connection version could save snapshot pictures or video records on the PC hard disk for further review. Viewing modes include black on white, white on black, full color and high contrast. Rechargeable battery could last 4 hours.

HD-Quality, Close-up and Near Distance Magnification

CANDY 4 is a handheld or stand magnifier. It has crystal-clear, high-contrast HD image, intuitive user interface with easy-to-locate buttons, comfortable and balanced handle design, lightweight compact size ideal for use at school, office or home. This has unique close-up or near-distance viewing, available magnification from 2 x to 18 x and a long-lasting user-replaceable lithium battery.

CCTV- Closed Circuit Television

Karen Scammell (2003) the closed circuit television is an electronic magnifying. The teacher should begin instruction in the use of magnifying devices with highly motivating materials such as comic books, fortune cookies, stamps, menus, names of products in the grocery store. Provide

opportunity for repetition of tasks. The higher the magnification, the smaller the area that can be seen at one time and the more important it is to hold the magnifier at a given distance.

Screen Reader/Speech Synthesizer

Screen readers provide auditory feedback when using the keyboard as well as auditory access to information displayed on the monitor. These systems consist of a software program and speech synthesizer. The software program sends information from the computer to the synthesizer, where phonemes are combined into words and the words are spoken. Most systems allow choices in volume, voice quality and speed of output. Students with limited or no reading vision will find these devices useful, especially when connected to braille and regular printers for output (JAWS, Intellitalk, IBM ScreenReader/DOS).

Voice Access

Voice access systems allow the user to interact with the computer screen by using voice commands instead of the keyboard. They are particularly useful for students who have difficulties with fine motor control as well as visual impairments. These systems include special software and sound cards to allow for voice output of information on the screen. As with screen readers, they can be connected to braille and regular printers for output (Dragon Dictate, Naturally Speaking).

Scanner

The scanner will scan print text of good quality. It must be used in conjunction with optical character recognition software. Then the scanned text can to be printed be saved in braille or listened to through speech access.

Optical Character Recognition Software

This software recognizes scanned text and when used in conjunction

with a computer system equipped with a speech synthesizer and braille printer, can convert standard print materials to speech or braille. The user can control the speech rate, volume, voice quality and amount of text read at one time (letter by letter, single word, sentence, etc.) (Arkenstone, Open Book Ruby Edition, Kurzweil).

Electronic Braillewriters

These small electronic devices have standard six-key braille keyboards that allow the user to write, read, edit and sort approximately 200 pages of braille. They can be connected to personal computers as well as regular and braille printers.

The Mountbatten Braillewriter includes an embosser, translation system, note-taker capabilities and speech editor. It would be useful for students with limited dexterity or strength who have difficulty using the manual Perkins Braillewriter.

Print-to-Braille Software

Print-to-braille software allows a computer user to produce braille documents from print or electronic data (CD-ROMs, internet, scanner). When combined with a braille printer, a variety of teacher-designed materials can be prepared for a student. This software is generally used by school personnel, but may be also used by students (Duxbury, Mega Dots).

Talking Calculator

Calculators with voice output allow students to do a wide variety of mathematical calculations. Most units have earphones and some keypads have tactile indicators for significant keys.

Language Master

The Language Master is a speaking reference guide. It contains dictionary definitions, spellings, a thesaurus, word games and word lists.

Screen Enlarger

Screen enlarger software programs display information on a computer screen in a variety of magnification levels. The entire screen, a portion of the screen or just one line may be enlarged. Students with low vision may benefit from these programs (Zoom, Text, Magic, Visaibility).

Screen Reader/Speech Synthesizer

Screen readers provide auditory feedback when using the keyboard as well as auditory access to information displayed on the monitor. These systems consist of a software program and speech synthesizer. The software program sends information from the computer to the synthesizer, where phonemes are combined into words and the words are spoken. Most systems allow choices in volume, voice quality and speed of output. Students with limited vision will find these devices useful, especially when connected to a regular printer for output (JAWS, Intellitalk, IBM Screen Reader/DOS).

Non-optical adaptations for improving access to the screen display include: adjustable lighting, polarized screen filters; monitor hoods to reduce glare; adjustable document holders; and adjustable computer stand for close viewing.

Page Glare

According to **Assistive Technology Training Online Project 2005 describes that,** Common white paper often reflects a significant glare, which can make the reading process more difficult. Try covering the page with a transparent colored plastic or an acetate sheet, available at stationary stores, to tone down the brightness and find the best color for a student.

Large Print Calendar

The Large Print Calendar contains both large print and Braille labels, which can be used in a variety of ways in the classroom.

Screen Magnification

A screen magnification program enlarges the image on screen. It is useful to magnify the text and graphics on the screen for users who require large text and graphics. Most magnification programs have variable magnification levels (from 2 times to 16 times). Some have split-screen viewing of magnified and unmagnified windows. Most magnification programs have a review or scroll function so text can be tracked easily and at appropriate speed.

2.10 Conclusion

In spite of limited studies conducted on low vision particularly in the area of visual efficiency, low vision devices and in depth analysis of related review of literature helped the investigator to understand the genesis of the study proposed. The study highlights the need and importance of early identification, important devices and visual efficiency training. This review helped the investigator to conduct the study effectively by identifying the variables, selecting the appropriate vision training strategies, applying the right methodological processes and systematic analysis with ease.