



Learning-Related Vision Problems in School Age Children in Imo State University Primary and Secondary Schools

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Abstract

Basic visual skills are important to the learning dispositions of children and their capabilities to carry out academic tasks. This article investigates learning-related vision problems (LRVP) in school-age children. This study involved 108 male and 92 female students. Data for this study was gathered using a questionnaire, penlight, ophthalmoscope and retinoscope. The results revealed that children in the 10-12 year old age group were more affected by learning related vision problems (46%) than the 13-15 year old group, while the least affected with only 12% prevalence were those between 16 and 18 years. The clinical signs and symptoms, showed that Ocular Motility Dysfunction (OMD) had the highest frequency distribution (75%) followed by Executive Function Deficiency (EFD) (69.5%), Rapid Naming Deficiency (RND) (60.5%), Visual Spatial Orientation Skill Deficiency (VSOSD) (57%), Accommodative Vengeance Dysfunction (AVD) (44.5%), Visual Motor Skill Deficiency (VMSD) (33%), Non-motor Visual Analysis Skill Deficiency (NMVASD) (5.5%), and Auditory Visual Integration Deficiency (AVID) (.05%). Children with learning-related vision problems had difficulties learning and lessened reading capabilities.

Keywords: Learning-related, vision problems, school age children, primary schools, secondary schools.

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INTRODUCTION

Vision plays a vital role in the reading process. Children who lack good basic visual skills often struggle unnecessarily in school. A major portion of all learning is done visually. Reading, spelling, writing and homework rely on vision (Classroom Connection, 2006). When a child struggles to read, write or fully participate in school, a visually-related learning disability could be the cause. With an accurate diagnosis and the right support, people with such learning disabilities can reach their full potential and flourish in school and in life (SUNY College of Optometry, [n.d]).

Optometry has a long history of caring for individuals with learning problems. Parents, teachers and therapists often seek diagnostic evaluation to determine whether vision impairment could be a contributing factor to learning problems (Garzia et al., 2008). The intervention methods/plans developed by optometry are often built into

conventional therapeutic approaches for these individuals. In these cases, doctors of optometry act as members of a specialized multidisciplinary team of health care providers and special education professionals in the complete care of individuals with learning difficulties (Hoffman, 2006).

Learning is accomplished through complex and interrelated processes, one of which is vision. Determining the relationship between vision and learning involves more than evaluating eye health and visual acuity (clarity of sight). Problems in identifying and treating people with learning-related vision problems arise when such a limited definition of vision is employed (Bateman, et al., 2009). Consequently, children and adults continue to struggle with learning in the classroom and in the work place and developments in information technology and its ease of use are placing greater demands on people for efficient learning and information processing (Ololube, 2011).

Schoolchildren with learning difficulties are frequently encountered by optometrists (Bailey, 2010). Current research indicates a link between learning problems and certain visual factors that are referred to as learning-related vision problems. It is thus important that the primary care vision doctor identify children with learning-related vision problems within the context of the primary care examination (Borsting & Rouse, 2010).

Getz (2000) estimates that 75 to 90 percent of all learning in the classroom comes to the student either wholly or partially via the visual pathways. If there is any interference with these pathways, the student will probably have trouble with learning tasks (Wyman, 2011). Reading, spelling, writing, chalkboard work, and, in many schools, computers are among the tasks students tackle in most of their academic exercises. Each involves the visual ability of quickly seeing and understanding visual information, frequently at less than arm's length from the eyes (Garzia et al., 2008). Good vision is thus essential for students of all ages to be able to reach their full academic potential (Murphy, 2010).

The motivation for this study is based on the premise that children's early vision problems if undetected and untreated can interfere with the children's ability to perform to their full learning capability. The standards of learning competencies, which must meet changing societal needs and conditions, are increasing. Full participation in science, technology, business and the professions requires increasing levels of learning, particularly reading. Learning problems are thus a public health issue of widening significance (McAlister et al, 1996). They can decrease the quality of life for the affected individual, delay academic achievement, and reduce employment and earning opportunities. Self-esteem and peer relationships can be negatively affected (Smith et al., 2000; Elbaum & Vaughn, 2005). According to Kauffman and Trent (2004), there is also the possibility of lasting effects on family function, with stresses placed on both the community and family for financial and service resources.

The basis of this study sets the stage to understand the role of vision in children's literacy related developmental problems. This work examined whether the learning related vision problems interfere with children learning capabilities and self-esteem. It further sought ways of humanizing the quality of children's learning. Evidence from a recent Internet search suggests that the theme of this study has not been previously undertaken in Nigeria.

This study compared the average developmental level of children in Owerri municipality in the Imo State of Nigeria. This study is important because it provides information about children's developmental learning abilities. To this end, this study is helpful to educators and primary eye care providers looking to identify clinical signs and symptoms of learning related vision problems that could hamper academic performance in school age children. It is written for policy makers in the education sector so as to bolster the formulation of learning policies and conditions that can help alleviate the problem and improve academic performance.

BACKGROUND INFORMATION

Learning is accomplished through complex and inter-related processes. The eyes and the visual system grow and develop from the brain, making vision a fundamental factor in thinking and learning (Solan, 1993). Vision can be defined as the mental process of deriving meaning from what is seen. Vision is a cognitive act, which enables us to look at an object to, not only identify it, but also determine its location, its size, its distance from the observer, its rate of movement, its texture and everything else that can be determined by visual inspection (Simons, 1993).

Vision is also a process involving an input, a computing, an output and a feedback mechanism (Solan & Ciner, 1989; Simons, 1993). According to Simons (1993), there are three inter-related areas of visual function:

- Visual pathway integrity including eye health, clarity of sight and refractive status.
- Visual efficiency including accommodation, binocular vision and eye movement control.
- Visual information processing including spatial awareness/identification, discrimination and integration with other senses.

Learning Related Vision Problems (LRVP) represent deficits in two broad visual systems: visual efficiency and visual information processing (Borsting, 1996). Visual efficiency comprises the basic visual physiological processes of visual acuity (and refractive error), accommodation, vergence and ocular motility. Visual information processing

involves higher brain functions, including the non-motor aspects of visual perception and cognition and their integration with other motor, auditory, language and attention systems (Garzia et al., 2008).

Different forms of learning problems are encountered in optometric practice, the most severe of which is a learning disability. A learning disability is a disorder in one or more of the basic psychological processes involved in understanding or using spoken or written language, which may manifest itself in an imperfect ability to listen, think, speak, read, write, spell or do mathematical calculations.

Learning disabilities are a heterogeneous group of disorders that result in significant difficulties in academic achievement (Denckla, 1996). Learning problems in spoken language can be represented as delays, disorders or discrepancies in listening and speaking and articulation. In written language they may manifest as difficulties in performing mathematical functions or comprehending basic concepts. Problems in reasoning result in difficulties organizing and integrating thoughts and turning them into effective actions (Torgesten, 2004; Harris et al., 2004). Attention deficits with hypersensitivity are co-morbid with learning disabilities (Rowland et al., 2002). Other associated traits such as impulsiveness, low frustration tolerance, and difficulties with social interactions and situations are also common (Kavale & Mostert, 2004).

LEARNING RELATED VISION PROBLEMS

Fusion Problems

We have two eyes, each of which forms its own image. Yet we do not see double objects because our brain fuses the two images into one. Thus we possess 'binocular vision'. It is because of good fusion that our vision is three dimensional and we are able to locate an object in space accurately (<http://www.eye-exercises-for-good-vision.com/binocular-vision.html>). However, if the eyes are not aligned, the images being recorded are slightly different. If the disparity is so great that the brain cannot fuse the two pictures, the result is double vision. Unfortunately, about ten percent of school aged children have fusion problems resulting from convergence insufficiency or convergence excess. In near-work (reading, etc.), children with fusion problems can only achieve visual alignment for short periods of time. As their ability to accurately focus their eyes breaks down, their eyes tend to point at slightly different areas on the page, resulting in visual strain and eventually, blurred, scramble or double vision (Children's Vision Information Network, [n.d]).

When the eyes align and focus normally, the print on the page is single and clear. Reading requires the eyes to aim at the same point on the page. Vision is clear, single and comfortable as long as both eyes are aiming at the same point (see Figure 1). Moreover, children with eye teaming problems find it difficult to maintain the convergence required for near work. As the eyes tire, they move in or out and end up focusing at different points on the page, giving rise to blurred or double print (see Figure 2).

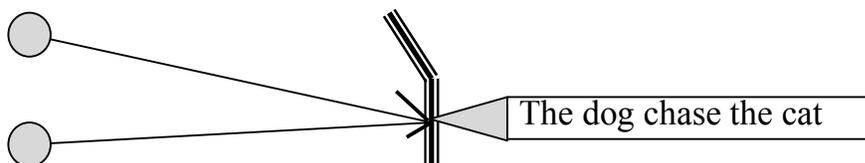


Figure 1: Clear, Single and Comfortable Vision when Fusion is Intact.

Source: <http://www.childrensvision.com/reading.htm>

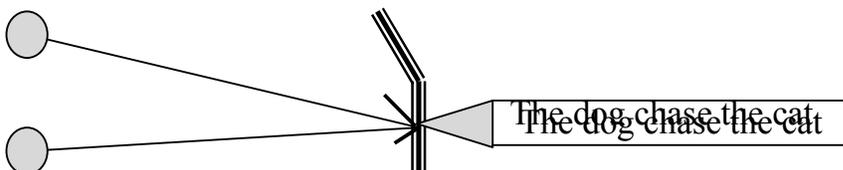


Figure 2: Blurred or Double Vision when Fusion is Broken.

Source: <http://www.childrensvision.com/reading.htm>

Tracking Problems

Tracking is the ability to move the eyes across a sheet of paper. It is the ability to control the fine eye movements required to trace a line of point, which is especially important in reading (Getz, [n.d]). Children with tracking problems will often lose their place, skip or transpose words and have difficulty comprehending because of the difficulty moving their eyes accurately. Many are forced to use their fingers to trace the line because their eyes cannot. When we read, our eyes do not move smoothly across the line. Instead, our eyes make a series of jumps and pauses as we read. Children with tracking problems cannot control their eye movements at close range (<http://www.childrensvision.com/reading.htm>).

Focusing Problems

Problems with focusing (refractive errors) are the most common eye disorders. They are mainly problems of accommodation. These problems occur when the image of what you are looking at does not focus precisely on the back of the eye (retina) and appears blurry (Better Health Channel, 2011). For children with accommodation problems, print will become progressively blurry as they read for longer periods of time, and their eyes will fatigue from the strain of trying to keep the print clear. Sometimes children with focusing problems will hold their books very close or lay their heads down. Headaches are very common. Reading glasses are often prescribed to help shore up inadequate focusing systems, but sometimes therapy is needed to improve a child's focusing ability (<http://www.childrensvision.com/reading.htm>).

RESEARCH METHODOLOGY

This research employed a quantitative assessment design. It used a five-point likert-scale (never, seldom, occasional, frequent, and always) questionnaire comprised thirty questions, which was administered to children aged 6-18 years. Each questionnaire contained the clinical signs and symptoms of learning related vision problems, subdivided into eight groups (*Ocular Motility Dysfunction, Accommodative Vengeance Dysfunction, Visual Spatial Orientation Skill Deficiency, Auditory Visual Integration Deficiency, Non-motor Visual Analysis Skill Deficiency, Visual Motor Skill Deficiency, Rapid Naming Deficiency and Executive Function Deficiency*). Each child was guided on how to answer the different questions. The completed questionnaires were categorized based on the answers provided. Two hundred male and female school-aged children between the ages of 6 and 18 years of Imo State University Primary and Secondary Schools (Owerri) participated in this study. This study was conducted between 2009 and 2012.

The visual screening/eye examinations were conducted on subjects at their school premises. The methods used for the assessment of visual function are as indicated in the flow chart below. After assessment of visual function, oral interviews were conducted with an emphasis on their reading and learning experiences, including eyestrain when reading, tearing, headaches from prolonged reading, and preference for a particular seat in a lecture hall. Participants were also asked to read a number of texts and answer the questions that followed in a given amount of time to tentatively assess their academic performance. The data gathered from the oral interview was coded and added to the data from responses to the questionnaires.

In addition to the above, the following instruments were used to examine children so as to eliminate other unrelated conditions.

Penlight: This was used to provide a diffuse and even illumination for external eye examination and to observe the eye movements in different directions of gaze.

Ophthalmoscope: This was used to assess the interior part of the eye in order to rule out pathologies. Direct ophthalmoscopy was used in this study.

Retinoscope: This instrument was used to determine the refractive status of the eyes under study.

Other instruments/materials used include:

- Occluder
- Trial lenses and frames
- Reading materials (a passage)

This study focused on learning related vision problems and identifying childhood developmental vision problems for early intervention. To satisfy this investigation, a number of statistical analyses were conducted using SPSS Version 18, including descriptive statistics (frequencies and percentages) (Render, Stair & Hannan, 2005; Kpolovie, 2010).

The research instrument was quantitatively analyzed and a Cronbach alpha coefficient of .792 was arrived at. The research instrument was thus accepted as very reliable in that it allowed for the consistency or repeatability of what the researchers set out to measure. The benchmark used for the instrument reliability test was in accordance with reliability theory (Cronback et al., 1972). To this end, the reliability test was used to determine the percentages of variance in the distribution of scores obtained from test that can be attributed to the true scores, and to determine the standard error of measurement in the full range of scores (Kpolovie, 2010). Thus the internal consistency of learning related vision problems was investigated by estimating scale reliabilities and Cronbach's alpha coefficients.

Questionnaires with columns for the personal data of the children as well as clinical signs and symptoms of learning related vision problems were administered to the children. Each child was guided on how to fill in the questionnaire. The completed questionnaires were screened and then graded according to the responses provided. The results were analyzed using tables and bar charts.

RESULTS

Descriptive Analyses of Respondents' (Children's) Demographic Variables

In this study (see Table 1 and Figure 1 for detail), the first set of data analyses conducted were descriptive statistics (frequency [N], percentage [%], mean and standard deviation). Data from section 'A' of the questionnaire yielded information about students' personal data.

The data showed that majority of the respondents were male (108/54%), while 92 (46%) of respondents were female. In terms of age, the majority (92/46%) were 10-12 years old, while the 13-15 year olds comprised 84 participants (42%), and the 16-18 year olds comprised 24 participants (12%).

Table 1: Frequency and Percentage Distribution for Gender and Age: showed a higher prevalence of males 108 (54%) than females 92 (46%).

Demographic Variables		Frequency (N)	Percentages (%)	Mean	Std. Deviation
Gender	Male	108	54	3.3000	.70711
	Female	92	46	3.5200	.70682
Age	10-12 years	92	46	3.7000	.50508
	13-15 years	84	42	3.4800	.64650
	16-18 years	24	12	3.2400	.68690

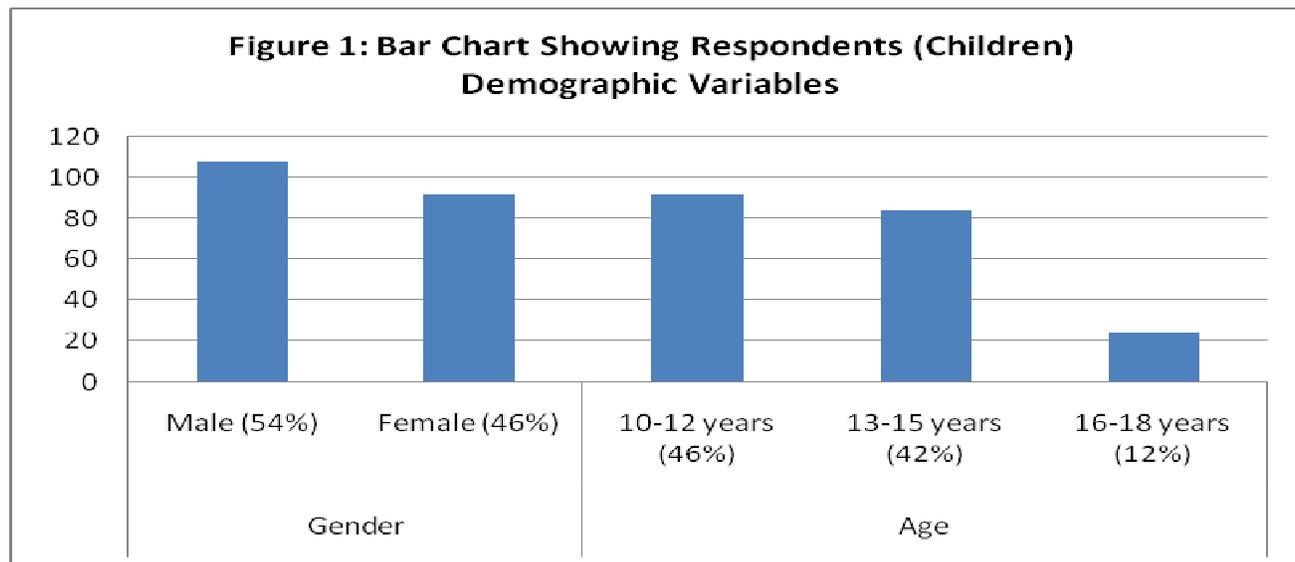


Table 2: Frequency and Percentage Distribution of Learning Related Vision Problems (LRVP)

Clinical Signs and Symptoms	Frequency Present	Percentage (%)	Frequency Absent	Percentage (%)
Ocular Motility Dysfunction (OMD)	150	75	50	25
Accommodative Vengeance Dysfunction (AVD)	89	44.5	111	55.5
Visual Spatial Orientation Skill Deficiency (VSOSD)	114	57	86	43

Auditory Visual Integration Deficiency (AVID)	1	.05	199	99.5
Non-motor Visual Analysis Skill Deficiency (NMVASD)	11	5.5	189	94.5
Visual Motor Skill Deficiency (VMSD)	66	33	134	67
Rapid Naming Deficiency (RND)	121	60.5	79	39.5
Executive Function Deficiency (EFD)	139	69.5	61	30.5

DISCUSSION

The results showed that those in the 10-12 age group (46%) were more affected by learning related vision problems (LRVP) than the 13-15 age group, while the least affected with 12% prevalence were those between 16 and 18 years.

Table 2 which highlights the distribution of LRVP in terms of the presenting clinical signs and symptoms, showed that OMD had the highest frequency distribution (75%) followed by EFD (69.5%), RND (60.5%), VSOSD (57%), AVD (44.5%), VMSD (33%), NMVASD (5.5%), and AVID (.05%).

Deficiencies in ocular motility have been associated with learning problems (Biscaldi et al, 2000). Ocular motility is typically evaluated by chair side tests of fixation stability, and of saccadic and smooth pursuit eye movements. Although almost all learning tasks require sequences of fixation-saccade-fixation hence, the emphasis is on saccades. There are several important reasons for testing pursuit eye movements:

- Pursuits are vital for visually guided movement.
- It is an important part of the neurological control process for smooth pursuit eye movements.
- To successfully maintain the target, a sustained level of attention is required (Chen et al, 2002).
- Difficulties encountered in crossing the midline may signal problems with visual spatial orientation (Surburg, 1999). The ability to maintain steady fixation on a stationary target can also be deficient (Fischer & Hartnegg, 2000)

Rapid naming involves the rapid or automatic ability to recognize a visual symbol, such as a number, and retrieve its verbal label rapidly and accurately. Hence, rapid naming has been consistently and strongly predictive of word-level reading difficulties and word identification ability (Meyer et al., 1998; Garzia et al., 2008).

CONCLUSION

Based on the results in this study, it can be concluded that learning related vision problems interfere with the learning and reading capability of affected children. It was also found that the self-esteem and confidence of children in pursuing their desire academic ambitions can equally be affected when clinical signs and symptoms such as asthenopia, blurred vision to delayed learning of the alphabet, difficulty with reading and spelling, and skipping words and missing lines when reading are present.

Vision related learning problems had a relatively high prevalence in the population studied. Children, such as those in this study, would benefit from the use of appropriate lenses, prisms and vision therapy, either alone or in combination. The goal of optometric intervention is therefore to improve visual functions to the appropriate level of clarity, comfort and convenience.

RECOMMENDATIONS

Based on the observations made during the course of this study and analysis of findings, the following recommendations are made so as to enhance learning and reduce the prevalence of LRVPs among students:

- Every student should have a routine eye examination to test both near and distant vision. However, vision screening should not be a substitute for a complete eye and vision assessment by an eye doctor (optometric physician/eye care provider).
- Comprehensive eye and vision examinations should be made mandatory for all children first entering school and, regularly throughout their school years to ensure healthy eyes and adequate visual skills essential for successful academic achievement.
- The importance of continuing eye care should be discussed with parents and caregivers. Parents and guardians should pay close attention to their children and wards with regard to their academic performance.
- Optometrists should involve themselves more actively in vision screening, and identifying and managing vision problems that may impair learning.
- Communication with education professionals about the diagnosis, proposed management plan and expected outcome should be initiated. This therefore, requires the coordinated efforts of the patient's classroom teachers, special education teachers and therapists.

- Other education and healthcare professionals should be informed about the presence and nature of the learning related vision problems and their relationship to extant learning difficulties.

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