An Approach to Assist Teachers in Recognizing Students Having Visual Anomalies

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AN APPROACH TO ASSIST TEACHERS IN RECOGNIZING STUDENTS HAVING VISUAL ANOMALIES

by

Donald E. Socha

A Dissertation Submitted to the Faculty of the School of Education of Loyola University in Partial Fulfillment of the Requirements for the Degree of Doctor of Education

February

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LIFE

Donald E. Socha was born on October 11, 1935, in Chicago, Illinois.

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CHAPTER I

INTRODUCTION

The public schools in this country accommodate millions of children. Increased emphasis is being placed on extensive reading for information and recreation. Excessive near-point use of the eyes is the cause of frequent visual problems which lower students academic achievement even to the point that intelligent children may drop out of school.¹ The fact that printed and written symbols are used in all phases of the communication of information justifies a statement made several decades ago by the optometric profession that more than eighty per cent of our knowledge comes to us through the visual system.² This means that all of the millions of children in school are extremely dependent upon their visual abilities for academic success.

A child usually learns an adequate pattern of seeing; everything may go well until he is confronted with new demands placed on him, that of reading extensively or engaging

¹Gordon Bixel, "Vision--Key to Learning or Not Learning," Education, LXXXVII, No. 3 (1966), 180.

²Section on Optometric Child Care and Guidance, "The Primary Visual Abilities Essential to Academic Achievement," Child Vision Care, Series 8, No. 7 (Duncan, Oklahoma: Optometric Extension Program Foundation, 1964), p. 38.
in other lengthy, exacting, near-point tasks. This reading load has constantly increased so that educators estimate that the elementary school child of today reads from five to ten times as much compared to school children at the beginning of this century.  

"This additional load forced upon him is something with which visually he cannot successfully cope."  

The child with a poorly developed binocular visual system is one whose sight is usually adequate but whose binocular development is imperfect. As a result of the constant stress required to maintain the near-point visual functioning required for school achievement, the child can very well become an underachiever.  

The child having visual problems can often read satisfactorily for a short period of time. Then, unknowingly, the conscious mind steps in and the child continues to read, but with little or no retention. As long as the conscious mind is involved in the function of either focusing or converging on print, reading is inefficient. The child usually is not aware that anything is wrong, but his reading is labored and his comprehension is below his intellectual 

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3 Bixel, "Vision--Key to Learning or Not Learning," 183.  


capacity. This is what causes reading teachers much frustration. They have attempted all the methods of reading instruction acquired over many years of study but, in these cases, without success. The mind of the child wanders, often about subjects in which he may have no interest. The child may catch himself reading the last sentence but may not remember if he read the preceding material. He assumes he did, but he does not remember its contents and must look back a page or more before he can remember anything he read.

There is now both ample evidence and rhetoric identifying the present decade as the one most critical for the millions of children who must succeed in an academic setting which places a premium upon reading.

Since reading is an activity heavily dependent upon vision and visual abilities, it is imperative that there be a greater understanding of vision and perception. It is imperative also that the existing confusion between sight and vision be clarified.

Vision problems can and should be detected by the teacher in the classroom. This involves more than a test

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6 Bixel, "Vision--Key to Learning or Not Learning," 182-83.

of clearness at distance, especially since most learning takes place within reach of the student. Effective methods are available. One is the use of a teacher's checklist of observable clues to classroom visual problems. Another, still to be tested, is a self-instructional programmed handbook constructed by this writer to assist teachers in recognizing students having visual anomalies. The experiment to be conducted as a part of this dissertation attempted to determine the extent of the effectiveness of the programmed handbook.

Statement of the Problem

Many educators have difficulty understanding why an intelligent child with good sight cannot derive meaning from the materials read due to a visual problem. Such children find it intolerable to concentrate on printed material for more than a short amount of time. Frequently they must look away. If they look out of the window or at their classmates, the teacher may think they are daydreaming or unwilling to put forth the necessary effort required for the task at hand. If they disturb the class procedure, they may be considered to be trouble makers. If they receive poor grades, they may

be considered to be incompetent or lazy.9

One area that appears to be positively related to academic achievement is the area of binocular coordination. According to Spache:

Many children entering school have not developed coordinated movements of the eyes. Their eyes do not follow an object in motion with equal binocular movements of the eyes. One eye may lag behind the other, or over-reach, or even remain still while the other is reaching out in space. Visually speaking, because of lack of binocular coordination, the child may not receive exactly the same images from both eyes since they may not bear upon the same object. These conflicting images are reflected in inaccurate perception in discrimination and, if persistent or severe, lead to a tendency to suppress or ignore one of the images. To accomplish this the child may permit one eye to drift or it may turn away almost constantly in what is called strabismus, cock-eye, or wall-eye. Practically every thorough study of child vision indicates that these various difficulties in binocular coordination are highly significant in reading failure at almost all ages of children.10

The teacher should be able to detect vision problems that could prove to be an educational handicap. The teacher becomes more familiar with the child than any other individual. Even though there are likely to be many pupils in the class, the teacher is the one who, over a period of time, will have an opportunity to observe and evaluate a child's performance.

9 Bixel, "Vision--Key to Learning or Not Learning," 180-81.

It is the teacher who must understand what to look for in those who are not learning. Teachers need to be knowledgeable regarding child development in the full meaning of the term—including visual development.

As dedicated to their profession as many teachers are, frequently they become as frustrated as their students by some of the learning problems exhibited in the classroom. They could give, with proper knowledge, a reliable screening of those needing additional diagnostic consideration. This further testing would not be limited to just those who are not doing well. Many do well enough but could do much better if they could receive the necessary attention. For these ideas to be actualized, it is necessary to instruct teachers in what constitutes a vision problem and in what manner they can best spot those students who probably require professional assistance.

Purpose of the Study

The purpose of this study is the construction, implementation, and evaluation of an effective approach to aid teachers in recognizing students having visual anomalies that could result in students becoming scholastically disabled.

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The approach to be used is a self-instructional programmed handbook constructed by the writer which is designed to teach classroom teachers the differences between sight and vision, the inadequacy of the usual ten to fifteen minute eye examination to discover all visual problems, the symptoms which indicate possible visual problems, and the type of professional eye examiner who is qualified to administer developmental vision testing and training.

The classroom teacher is in a position to observe the visual performance of each child. Identifying children who should be referred for clinical assistance is every teacher's responsibility. The school health services have the obligation to determine the health needs, including eye health, of all the school children. The visual performances required to successfully engage in the curricular experiences are best determined by the classroom teacher. When every teacher has an understanding of vision, visual development, and visual skills and their significance to academic success, the children will have a greater opportunity to realize their potential.

Hypotheses

This study is based on the following six null hypotheses which were tested through employment of appropriate tests of variance and significance.

I. There is no significant difference between pre-

II. There is no significant difference between pre- and post-test mean performance of teachers on the testing instrument of those not receiving the handbook.

III. There is no significant difference between post-test mean performance of those teachers not receiving the handbook and those teachers receiving the handbook, *Sight ≠ Vision, A Handbook for Teachers*.

IV. There is no significant difference between pre-test mean performance of teachers with a bachelor's degree and those teachers with a graduate degree.

V. There is no significant difference between pre-test mean performance of teachers with less than six years of teaching experience and those teachers with six or more years of teaching experience.

VI. There is no significant difference between experimental and control teachers in the identification of visual problems.

**Significance of the Problem**

A comprehensive study made in Texas brought out the fact that many visual problems are developmental in nature.¹³

Of the 160,000 first graders tested, approximately 20 per cent revealed visual problems. When these same children were again tested as they entered third grade two years later, an additional 20 per cent of these children had visual problems or a total number of 40 per cent of the 160,000 were diagnosed as having visual difficulties. The 100 per cent increase from first grade to third grade may be attributed to the near-point activity demanded of the child and indicates the inability of the child to adjust to the increased visual demand placed on him.

The child who can read a 20/20 row of letters on a chart can no longer be referred to as having perfect vision. His eyes can be healthy and have clear eyesight but lack coordination and effortless functioning. Children are not born with normal vision—they must learn to see. Vision develops in the brain as the child develops.

In addition to other possible problems, the underachieving child usually has a visual problem. For the last forty years, optometrists have examined children who had healthy eyes, who could turn their eyes in all directions, and who could see clearly at distance and at near. These children were often underachieving. If the visual system is functioning improperly, it does not take a child long to fall far behind his expectancy level and to be labeled an "underachiever." It was not that the eyes were at fault;
it was the manner in which they operated, how they worked together as a team along with the brain and, in turn, with the whole child.\textsuperscript{14}

The changes in convergence and accommodation from the distance relaxed posture to the near-point posture involve exacting control, control that is not present at birth. The fine development of binocular skills must be achieved through the normal learning process. The eyes of the child working at a near-point distance of six inches must converge and accommodate twice as much as when working at a distance of sixteen inches. The demand on these functions is, in many cases, physiologically impossible to maintain for prolonged periods of time. The teacher who lacks an understanding of the visual system usually admonishes the child to "try harder" or "concentrate more" while in reality he is expecting the impossible from the child. To reduce the stress, the child may exhibit improper behavior, inattention, and avoidance of additional near-point tasks.

It is possible that many of the millions of students in America who are not working to their potential may have some area of the visual processing system functioning poorly if at all. Near-point acuity requires an entirely different "hook-up" between convergence and accommodation. Some

children learn to see very well at distance but have difficulty using vision at near-point, especially at visual tasks that require concentrated attention with both eyes within a small area for long periods of time.

A. M. Skeffington in 1966 estimated that by 1970 there would be 37,000,000 dropouts in our society. He suggests that eighty per cent of these failures occur because students have visual perception problems and cannot read up to standard. Children who are denied the opportunity to achieve because of visual problems become increasingly afraid of challenging situations in which there is the possibility of failure. Behavioral problems appear and multiply as their failures and feelings of inadequacy increase.\(^\text{15}\)

In a study by Stem regarding the visual problems as being learned problems, she lists the following survey results:

1. In 1,000 infants examined, not one case of astigmatism was found. Ninety-eight per cent of the children ranged from 3/4 minus to 3/4 plus corrections.

2. Later studies revealed:
   a. Six per cent of children starting school had seeing or visual problems.
   b. Forty-six per cent had seeing or visual problems by grades 4-7.

\(^\text{15\text{A. M. Skeffington, "Future of Optometry," Journal of the American Optometric Association, XXXVII, No. 9 (1966), 837.}}\)
c. Sixty-one per cent of high school seniors had seeing or visual problems.

d. Eighty-five per cent of college seniors had seeing or visual problems.  

These facts have implications for teachers and teacher education. It appears that the task of informing teachers of the differences between sight and vision and the symptoms of which to be aware in order to make referrals early enough in the educational life of a student is decidedly imperative.

Definition of Terms

The meanings of the following pertinent terms used in this study were taken from the Dictionary of Interprofessional Learning Disability Terminology compiled by Robert M. Wold, M.S., O.D., F.A.A.O.

Accommodation, Ocular: The changes in the crystalline lenses of the eye to gain a clear focus.

Amplitude of Accommodation: The difference expressed in diopters between the farthest point and the nearest point of accommodation (focusing).

Anomaly: A deviation from the usual norm.

Binocular Vision: The use of both eyes simultaneously in such a manner that each retinal image contributes to the final percept.

Convergence: The turning inward of the lines of sight toward each other.

Crystalline Lens: A transparent, colorless body

suspended in the front of the eyeball, immediately behind the iris and between the aqueous and vitreous chambers; its function is to bring the rays of light entering the eye to a focus on the retina.

**Diplopia**: The condition in which a single object is seen as two.

**Dysfunction**: Abnormal or imperfect functioning.

**Dyslexia**: An inability to read or difficulty in reading due to a central lesion.

**Esophoria**: The inward turning, or the amount of inward turning, of the two eyes relative to each other as manifested in the absence of a fusion stimulus, or when fusion is made impossible, such that the lines of sight cross at a point in front of and nearer to the eyes than the object of regard.

**Esotropia**: The inward turning of the two eyes relative to each other as manifested in the presence of a fusion stimulus, e.g., cross-eyed.

**Exophoria**: The divergent turning, or the amount of divergent turning, of the two eyes relative to each other as manifested in the absence of a fusion stimulus, or when fusion is made impossible, such that the lines of sight cross at a point beyond or further from the eyes than the object of regard.

**Exotropia**: The outward turning of the two eyes relative to each other as manifested in the presence of a fusion stimulus, e.g., wall-eyed.

**Fixation**: The process, condition, or act of directing the eyes toward the object of regard causing, in a normal eye, the image of the object to be centered on the fovea.

**Focus**: The adjustment of the elements of the optical system to achieve a sharp image.

**Fovea**: The area where the cone receptors dominate, thus allowing efficient and acute sight as well as color perception.

**Fusion**: The act or process of blending, uniting, or cohering. In vision, the process by which a single cortical image is perceived as a result of two separate ocular ones.
Gaze: Fixating steadily or continuously.

Myopia: A condition wherein the eyes are in focus for some near object but cannot see a distant object clearly.

Ocular Teaming: The ability to simultaneously accommodate, focus, and converge (aim the eyes) to the same place without expending excessive effort.

Optometry: An academic discipline, a profession, and a science dealing with the study and correction of sight, vision, and developmental visual processes and behavior.

Perception: The mechanism whereby the organism or intellect recognizes a stimulus and makes sense out of it so that it can be utilized by the integrative systems.

Saccadic Speed: The speed of movement of the eye in changing fixation from one point to another.

Sight: The ability to see light.

Snellen Chart: A chart with letters or symbols on it utilized in the measurement of visual acuity.

Stereopsis: Visual perception of depth or three-dimensional space.

Strabismus: The condition in which binocular fixation is not present under normal seeing conditions.

Suppression: The inability to perceive normally visible objects in all or part of the field of vision of one eye, occurring only on simultaneous stimulation of both eyes and attributed to cortical inhibition.

Underachiever: A child whose academic performance is not commensurate with his level of general intelligence even though he may be performing at or near his grade level placement. He will usually show distortions in his spelling and a deficiency in his oral reading well below his achievement in silent reading.

Vision: The comprehension of information that is gathered into the brain through the various sense modalities, and the reconstruction of this information into a conceptual image that has meaning. It
involves sight, perception, integration and conception.

Vision Training: The arranging of conditions whereby a child or adult may learn adequate degrees of freedom of movement to permit efficient visual functioning for the interpretation of light energy patterns.

Visual Acuity: The smallest letters or symbols seen at a specified viewing distance. To look at; to see.

Visual Perception: The ability to receive and understand, at the brain or cortical level, visual symbols and their meanings.

Visual Process: The total sequence of events involved in the act of seeing from the incidence of light on the cornea to the cortical activity which results in a percept.

Visual Skill: The ability to perform a visual act, usually measured by psychophysical methods.

Visually-Inadequate Child: Any child who cannot handle the visual world in which he finds himself; a result of a defect in his ocular equipment or some lack of learning in his visual education.17

Organization of the Study

This study consists of six chapters, the first of which introduces the problem under consideration. Chapter two incorporates a review of the related literature regarding visual aspects of underachievers and the adaptability of programmed materials as a technique of self-instruction. Chapter three explains the development of the programmed handbook,

Sight ≠ Vision, A Handbook for Teachers, as the approach used to instruct teachers in recognizing students having visual problems. Chapter four includes an explanation of the construction and implementation of the testing instrument, the selection of the participants who were included in the experiment, and the distribution and collection of data. Chapter five presents an analysis of the statistical data obtained in the experiment. Chapter six consists of a summary and conclusion with respect to the results of the experiment, followed by suggested implications for further study.
CHAPTER II

REVIEW OF THE RELATED LITERATURE

There appears to be a minimum number of research studies in the field of education that are related to the instruction of teachers regarding the differences between sight and vision and the effect of inadequate visual abilities on academic success. Therefore, many of the findings cited in this study do not originate from other doctoral dissertations but are the results of studies conducted to determine if there is a relationship between visual skills and abilities and academic performance.

Visual Aspects of Underachievers

All children go through various stages of visual development, but they do not all reach the same level of development, nor do they go through the same stages at the same age. If a child arrives at the chronological school age with his visual equipment not yet fully developed, his chances for developing a problem, and quite possibly a behavioral difficulty, are enhanced.

School work usually requires that a student be able to use his eyes at near tasks, such as reading and writing, from two to five or more hours per day. If he is able to
focus his eyes at near-point for just a short period of time without tiring, he will probably stop working on the assigned task before he reaches the fatigue point and attempt to do something that is within his capability. Disciplinary measures from the teacher and school administration might prevent these actions for the time being but do nothing to relieve the cause. The child, by his behavior, is telling everyone who notices that he is not comfortable doing what has been asked of him, and the discomfort is sufficient to deter the learning experience that was intended.

Spache believes that the relatedness of certain visual functions may be related significantly to achievement. He reports on what is probably the most thorough vision study available—the North Carolina study.

Students with four year changes in the direction of esophoria or overconvergence showed a markedly decreasing grade average. Those with the opposite tendency to exophoria at near-point tended to show poor fusion, low depth perception, and poor visual acuity, but these developments were not accompanied by poor reading scores. Far-sightedness alone was not significant, but when combined with either of the phorias at far-point or with esophoria at near, it tended to result in pronounced reading deficiency. Here again we see the significance of the interrelatedness of visual functions that were ignored in so many other reports.¹

Evidence points to the fact that vision and visual perception are major keys in the development of a child and in the development of learning abilities. It appears that a great many children in our society apparently are handicapped and yet remain relatively undetected. These children are often labeled slow, lazy, difficult and inattentive with the result that, though they try to learn, they know only failure. Coleman reported on a study in which eighty-seven children in grades one through six, with severe language and reading deficits, were evaluated for visual and visual perceptual development. Almost fifty per cent of the sample had significant visual perceptual or visual dysfunctions judged severe enough to impede learning. The children in this program were two or more years below the grade norm in reading. Evaluation of total school performance reveals that a large percentage of school dropouts are reading failures.

Coleman concluded that vision is our most efficient sensory system to process information about our space world. He believes that knowledge of visual perceptual deficits within a child's make-up could lead to correction and compensation. Education cannot afford to wait passively for maturation to occur; it must expose a child to the kind of instruction that is appropriate to his particular stage of

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development.

Coleman continued in his belief that a significant percentage of children who experience failure in the first grades of school seem to be of normal or above average intelligence. It is Coleman's contention that a thorough analysis of the visual perceptual aspects of the child will aid in an understanding of his educational potential, reveal hidden disability, and establish a basis for compensatory educational techniques to aid in overcoming these deficits without the loss of ability or ego strength.

Swanson reported on 100 cases of learning disorders which were treated in his practice by optometric vision therapy.\(^3\) In structuring the design for the study of these cases, he decided to tabulate as much information as could be acquired from the completed case records.

Twenty-eight people in this study had 20/15 vision acuity, and 56 had 20/20 vision acuity—a total of 84 out of 100 with 20/20 visual acuity or better. More often than not, 20/40 is the usual breakoff point for referral to the eye examiner when the pediatrician, or the school nurse, or the general practitioner is testing the individual's sharpness of vision. As one can see, by using 20/20 on the Snellen Chart as the criterion for passing, 84 per cent of

this group of people with visually related learning disorders would have been incorrectly diagnosed as having adequate visual abilities.

In his summary, Swanson stated that optometric vision therapy was successful in 93 per cent of the cases. The accuracy of this figure was verified by a registered psychologist. The criterion for success was a definite indication of improvement in the person's learning ability as verified by subsequent tests and by reports of the parent, the patient, or the teacher. Fifty-seven parents reported improvement in their child. The teachers reported improvement in 48 per cent, and retesting showed improvement in 82 per cent.

Swanson concluded that the statistics on visual acuity once again indicated the total inadequacy of the Snellen Chart to correctly diagnose visual problems in persons with learning disorders.

According to Robinson, children with good binocular coordination read as well, or better, after fifty minutes, while those pupils who lacked a high degree of binocular coordination tended to fatigue more quickly when continuous reading was necessary to complete a task.

Kephart reported on the inconsistencies that occur in

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the messages received through the visual system of certain individuals.

Illustrations of this problem are those conditions in which inconsistent or transient deficiencies involving the input mechanisms occur. Thus, one slow learning child was found to have a problem in keeping the two eyes working together. When he looked at an object which was beyond arm's length away, the eyes worked together properly. As the object was moved in toward his face, somewhere near arm's length, the eyes would break apart and he would see a double image of the object. The distance at which the breakdown occurred was not always the same but depended upon fatigue and the general condition of his organism at the time. As a result, he sometimes saw singly and sometimes saw double. There was little predictability, and he could not know which condition would hold in a given situation or, when the breakdown occurred, which of the two images was the valid one. The result was continuous confusion, particularly in near-point tasks such as school work.

When poor binocular coordination occurs and one eye does not point in the same direction as the other eye, the child is likely to see double. Because this situation is intolerable, he may make some visual adaptation such as fusion or suppression. Metzger and Schur studied suppressions, academic performance, and near optometric findings.


They found a significant relationship between binocular performance and academic achievement.

They concluded that the child's school performance is influenced by the lack of coordinated use of the individual input patterns of each eye, and information obtained from the use of the MKM Monocular and Binocular Reading Test serves the optometrist and educator as another means of detecting the low achiever.

A reliability study was conducted in 1965 to determine whether the above named test was reliable on a test-retest basis. The conclusion of this study was "... the MKM Monocular-Binocular Reading Test is therefore reliable on a test-retest situation." 7

Research by Jobe on the complex act of seeing states:

Unfortunately, visual maladjustments do not always cause discomfort. There are many cases where the visual efficiency is very poor and retards the progress of the individual. The problem is to locate those individuals who are themselves unaware that they are being handicapped by their visual inefficiency. It is hoped that in the not too distant future it will be possible to screen out those students and place them in the proper hands. There is no reason today for anyone with normal visual potentialities to be visually handicapped in the performance of any task. 8


A clinical sign of binocular instability is the presence of a degree of foveal suppression. Bettman et al.\(^9\) indicated that forty-two per cent of dyslexic children show a minor suppression as opposed to nine per cent of normal children. Another suggestion that some degree of binocular instability exists in an appreciable percentage of academic underachievers is contained in the reports by several clinicians who describe such children as showing inexact fixation when the children view through a stereoscope a binocular target with monocular check marks. The children reported the superposition of the two monocular check marks, each one line of an X, one seen by one eye and the other seen by the other eye. The two lines were seen as exactly centered on each other, a perfect X, if fixation was exact. The monocular check marks do not appear as an X, but rather as a V, or an inverted V, if the eyes deviate slightly either inward or outward. This very small deviation is termed "fixation disparity." Reports of fixation disparity among academic underachievers are supported by the study of Silbiger and Woolf,\(^10\) who demonstrated a higher magnitude of fixation disparity during convergence stress in college

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\(^10\) Francene Silbiger and Daniel Woolf, "Fixation Disparity and Reading Achievement at the College Level," American Journal of Optometry, XLV, No. 11 (1968), 734-42.
students classified as poor readers than in those classified as good readers.

Another visual factor frequently reported in children who are underachieving is poor following or fixational eye movement; the eyes show bizarre movements instead of the direct, exact fixation ability that would be expected in normal children. Bettman et al., in their 1967 paper, reported that fifty-two per cent of underachieving children had bizarre eye movements, whereas only eleven per cent of achieving children had abnormal eye movements.

An Additional visual factor that has been associated with academic underachievement is a variation in the ocular refractive state during reading, measured by an objective test of eye focus. Comprehension or failure of comprehension is indicated by the state of accommodation. These children over-accommodate or under-accommodate when attempting to read. It is conceivable that correction by reading glasses of a deficiency in, or an excess of, effective accommodation in a child suffering from a learning disorder sometimes can be a factor in producing improved academic performance.


McKee studied the effects on intelligence, achievement, and reading.13 A 10 week period of optometric training for 31 high school students in an experimental group and remedial reading for 31 students in a control group resulted in an average I.Q. gain of 7 points for the experimental group and no gain for the control group. On the Iowa Silent Reading Test, control subjects improved by .8 years while experimental subjects improved by 1.4 years. For those subjects increasing in both speed and comprehension, the control group gained 2.5 years in speed and 2.1 years in comprehension, while the experimental group gained 4.7 years in speed and 3.0 years in comprehension indicating a statistically significant difference between the 2 groups.

A study by Steinberg was conducted to examine the relationship between reading achievement, visual skills, intelligence quotient, and hand-eye dominancy.14 The sample included 456 pupils who were attending the Joseph Pulitzer High School in New York City. Steinberg concluded that there seems to be a direct relationship between a defect in a visual skill and a defect in reading achievement as the


incidence of this defect was significantly greater in the group with poor reading achievement.

Simpson reported the effects of visual and perceptual motor training that may be valuable for remediation and enhancement of behavioral functions associated with successful academic achievement.\textsuperscript{15} Twenty-four first graders were selected in an experimental group with an age range of 6 to 7 years, an I.Q. range of 70 to 118, and 2 students who were diagnosed as brain injured. A control group was matched on the basis of age, I.Q., sex distribution, reading readiness scores, and experience of the teacher. The visual and perceptual-motor training became part of the regular classroom program which lasted several months. At the end of the first grade year when the norm score is 1.9, the Metropolitan Achievement Test was administered. Scores for those in the experimental group ranged from 1.7 to 3.5, with 2 students below the norm. Scores for those in the control group ranged from 1.3 to 2.8, with 7 below the norm. The respective mean scores were 2.48 and 2.15, indicating the experimental group's superiority by 3.3 months. This difference was statistically significant at a probability level greater than .05.

Physiologically, the amplitude of accommodation in

\textsuperscript{15}Dorothy M. Simpson, "Perceptual Readiness and Beginning Reading" (unpublished doctoral dissertation, Purdue University, 1960).
young people is more than adequate for the typical learning situation. Heinsen stated that except for a few who have very defective eyes, children are capable of focusing to see clearly at near-point. Besides the binocular considerations of stress between accommodation and convergence, there is also the matter of flexibility. Many children cannot focus their eyes with ease. Once they have produced the necessary accommodation, they cannot easily relax their accommodative effort. Much classroom activity requires children to copy from the chalkboard. A number of children have great difficulty at this task. Their lack of flexibility of accommodation in itself can interfere with classroom performance. When a child has his eyes tested by an eye examiner, it is not enough merely to measure his amplitude of accommodation by allowing him to demonstrate his ability to see clearly at different distances. Consideration must be given to the time factor involved. It is important to know if the person being tested can see clearly at different distances and if he can do so with ease.

There are five visual performance areas that can now be definitely related to the academic achievement of children in the modern classroom. Three of these are visual action patterns, or visual action organizations, that should be learned by the majority of children.

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before they reach school age. These three are: eye movement skills, eye teaming skills, and eye-hand coordination. Unfortunately, many children have not gained these skills to a degree that is adequate to the demands of the primary grades, and the teacher's first observations should be directed to these three. The other two visual performance skills that will be itemized here are products, or resultants, of the first three. These are: visual form perception and refractive status of the eyes. Although these two skills are not visible in explicit movements of the child, his observable performance in the visual tasks of the classroom will permit the teacher to make some valuable judgments of his abilities or disabilities in these two areas.17

The following account proposed in Child Vision Care will highlight the visual skills related to academic achievement, indications of visual problems, and related comments:

Five Visual Skills Related to Academic Achievement

I. Eye Movement Skill

Three aspects observable by the teacher:

1. Horizontal eye movements
2. Vertical eye movements
3. Diagonal eye movements

Indications of a visual problem:

1. Head turning instead of eye movements
2. Short attention span
3. Frequent loss of place on printed materials

17Section on Optometric Child Vision Care and Guidance, "The Primary Visual Abilities Essential to Academic Achievement," p. 42.
4. Frequent omissions of words and phrases
5. Repetitive omissions of the "small" words
6. Confusion of left and right directions
7. Uphill or downhill writing on paper
8. Poor orientation of drawings on page
9. Stumbling and clumsiness in all playground or classroom activity

Related comments:

The visual problem described above will not be identified by any of the standard screening tests used by the school nurse or special personnel. Any report that "his eyes are perfect" should be questioned, because this visual problem will not, ordinarily, interfere with 20/20 on the wall chart. If this child is properly tested at near-point distances (inside 16 inches), poor discriminations of detail will probably be observable.

II. Eye Teaming Skill

Two aspects observable by the teacher:

1. Horizontal teaming
2. Near to far and far to near teaming

Indications of a visual problem:

1. Complaints of seeing double
2. Repetition of letters within words
3. Confusion or repetition of words in the same sentence
4. Omission of words, small phrases, or numbers
5. Squinting, closing, or covering one eye
6. Extreme head tilt or working off to one side of the desk

7. Drawing and writing poorly placed on paper

8. Total postural deviations that continue in the same pattern of body distortions at all desk activities

9. Excessive blinking

10. Comprehension lower than the apparent abilities

11. Extreme fatigue on all visual materials

Related comments:

Problems in eye teaming may show up on some screening tests. Characteristically, the young child who is not obviously cross-eyed will pass the 20/20 with either eye, but if the covered eye is carefully observed during this screening test, it may be turned out of line behind the cover. Or, this child may have 20/20 with either eye, and have less ability when asked to report with both eyes open and uncovered. In any case, this child's parents should be informed immediately so that complete visual care can be given him without delay. Delay in visual care will either deter his academic progress, or allow him to learn to ignore, suppress, one eye. He may continue to do quite well in the subjects where he can learn by listening, but he will show extreme inadequacies in any independent reading or writing skills.

III. Eye-Hand Coordination Skill

The ability to make visual discriminations of size, shape, texture and object location is dependent upon the use, practice, and integration of the eyes and hands as paired learning tools.

Indications of a visual problem:

1. The child must feel of things, or run
fingers over the printed page, before any interpretive decision can be made.

2. Paper work shows extreme lack of orientation on page, as if eyes were not being used to "steer" hand movements.

3. Lines of numbers and writing are crooked, poorly spaced, and not kept on the ruled lines of the paper.

4. The child can only keep his place in a visual task by using his hand or fingertips to steer his ocular movements across the page.

5. Clumsy, careless, and messy craft work is done in any grade after kindergarten or mid-first grade.

Related comments:

The most common label used to describe inadequacies in early classroom performance is "immaturity." It is now quite evident that the most common immaturity is actually a lack of eye-hand skill. Time alone will not eliminate this problem; in fact, delay in proper visual care may aggravate the real problem. The child's parents should be notified immediately, and special help must be given the child if he is to succeed in academic demands. This child will need clinical help that goes beyond a 20/20 test on a wall chart and/or lenses for chalkboard clarity, and the parents should be so informed. The primary grade teacher should also provide several of the activities, already in use in many schools, that will establish eye-hand coordination skills related to the demands of the curriculum.

IV. Visual Form Perception

This is one of the major learning processes that allows the child to relate his primary experiences to the pictures and words he sees on the printed page. The ultimate purpose of this skill is the immediacy and accuracy of
the visual discrimination of likenesses and differences so that comprehension can be achieved, and the appropriate action can follow.

Indications of a visual problem:

1. Any confusion of forms that indicates difficulty in the visual recognition of likenesses and differences.

2. Frequent return by the child to the use of his hands for the further investigation of likenesses and differences.

3. Any evidence of a lack of skill in visualization (visual imagery or visual memory).

4. Any evidence of confusion of difficulty in the simple reproductions of symbols on paper.

Related comments:

This is an area of learning readiness that must be cooperatively approached by the teacher, the parents, and the vision specialist. Understandably, the kindergarten and first grade child should not be expected to demonstrate a high degree of skill in this area, but if a child is obviously poorer than his group, he should be given special attention. If a reasonable degree of skill is not acquired by second grade, the lack of form perception ability will be a hindrance in all academic areas, with the most difficulty showing in spelling and writing.

It is imperative to state here that all training in form perception must be done in the basic underlying processes of ocular motilities and eye-hand coordinations rather than in repetitive practice on the symbols and forms themselves.

V. Refractive Status

This area of consideration is of such supreme
importance that every adult concerned with children and their academic achievement needs to be aware of any evidence of a refractive problem. Distortions, or inadequacies of the eyes, which alter the visual information signals can hinder the child's comprehension processes. Some of these ocular distortions can so completely override the auditory and tactual information signals that comprehension can be completely voided.

Indications of ocular distortions:

1. Loss of comprehension in any reading task that is continued beyond a paragraph or two.
2. Continuing mispronunciations of similar letters or words.
3. Excessive blinking while reading or working at desk tasks.
4. Holding the book too closely or getting the face and eyes too close to the desk materials.
5. Avoidance of all near-centered visual tasks.
6. Any complaint of discomfort or inability to learn in a task that demands consistent visual interpretations.
7. Closing or covering one eye while reading or doing desk work.
8. Frequent errors in transfer from chart or chalkboard to paper.
9. Frequent errors in transfer from reference book to notebook or paper.
10. Squinting and scowling to see what the teacher has written on the chalkboard.
11. Moving nearer to the chalkboard to see what is written on it.
12. Redness or tearing of the eyes after short
periods of visual activity.

13. Frequent rubbing of the eyes during or after short periods of visual activity.

14. Complaints of eyeache or headache by mid-morning or early afternoon.

15. Observable fatigue and sag after intensive visual activities.

Related comments:

The fifteen items above are the most obvious of the symptoms of a visual problem related to a refractive problem. There may be other, less specific, symptoms such as the lack of interest, lack of motivation, irritability, etc. Only two or three of the fifteen trouble signs listed above will be verified, or even discovered, by the wall chart test and other screening devices. When the child is given an "eye test," and the report of "full 20/20" comes back, there must be further examination of visual abilities by a more thorough examiner. The child who is to gain over eighty per cent of his knowledge through his visual mechanism, and who will spend the majority of his daily classroom time in visual tasks at his desk, must have the full benefits of the visual examination that gives adequate and careful consideration to the academic demands put upon his eyes.18

Over the years some school systems have used the services of professionals to assist children who have serious difficulties. Special programs have been designed and administered for the mentally retarded, physically handicapped, partially sighted, and other children with clearly measured difficulties. But these children comprise only a very small

18Ibid., pp. 42-50, passim.
portion of the handicapped population; we need to look fur­
ther into the reasons why apparently normal, healthy chil-
dren are not achieving to their full potential.\(^1^9\)

The following research on self-instructional materials
is presented to ascertain the practicability of using pro-
grammed materials as the approach to be used in this study
to instruct teachers of the differences between sight and
vision so that they may become adept at recognizing students
having visual anomalies.

**PROGRAMMED LEARNING TECHNIQUES**

**Types of Teaching Machines**

Much research on teaching machines has been done by
psychologists interested in applying their theories of the
psychology of learning to new teaching techniques. Basical-
ly, these teaching devices present a subject to a student in
short increments called "frames." Each frame is followed by
a question. These frames may be anywhere from a sentence to
a paragraph in length and contain pictures, diagrams, and
even auditory information. They are presented to the student
in long sequences called teaching machine programs. These
are constructed in such a way that the student is led easily
and straightforwardly to eventual mastery of the material.

\(^{19}\)Virginia Stephens and Jane Challas, "Educators Look
Toward Optometry for Help in the Area of Underachievement,"
in *Visual and Perceptual Aspects for the Achieving and
It has been found through experience that a student retains the answer to a question for a longer period of time if he is given his score on the question immediately after answering it. All teaching machines tell a student immediately after he has answered each frame whether or not he has answered the question correctly.

The advantages of this instructional method are many:

1. Each student proceeds at his own individual pace.

2. By answering questions at the end of each frame, a student masters the information in a frame before going to the next frame.

3. The student finds out immediately whether or not he has answered a question correctly and so is able to correct any false impressions at once.

4. Complete records of students' performances on the teaching machine program are available so that improvements can be made in the program itself.

Experimental results so far indicate that these teaching machines can teach objective subjects more effectively than an average classroom lecturer.

The form of the specific devices depends upon the particular learning theories of the psychologists developing them. The subject of automated instruction is dominated primarily by the theories of two men, B. F. Skinner and

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Norman Crowder.

One of the first applications of a particular theory of learning to education was made by Skinner. His theories of the psychology of learning deal with the relations between response and reinforcement in the learning situation. From the results of many experiments performed on animals, he has concluded that the positive or negative reinforcement of a response will increase or decrease the occurrence probability of the response, respectively. In applying these ideas to the practical field of education, Skinner has made the assumption that the goals of the educational process can be reduced to the eliciting of certain responses by students when presented with associated stimuli. He recognizes, however, that education is also concerned with translating this conditioned behavior into what would be called "understanding." "The goal is not to build the verbal repertoire itself but to make sure that the student can correctly describe a state of affairs with responses already available in his repertoire with respect to similar states of affairs." 23

The goal of the information frame in Skinnerian teaching machines is to insure that the student will respond with


respond with the correct answer. If the student produces this desired response, then he is positively reinforced by being told that he has given the correct answer.

Norman Crowder's ultimate goals are the same as those of Skinner: namely, to develop the student's understanding of the subject matter. His means to this common goal, however, are quite different. Crowder's teaching machines bypass the intermediate goal of conditioned verbal behavior and attempt merely to explain the material to the student until he understands it. The questions at the ends of the frames are used to test how well the student has comprehended the information. Less emphasis is placed on correct answers by the student. Crowder is of the opinion that errors are an important source of information; they can and should be used by the teaching machine to improve its presentation of the material for the individual student. These completely different uses of the information and questions in a frame are the main differences between the Skinner and Crowder approaches to teaching machines.

In order to capitalize on the individual errors of the student as sensed by the questions, Crowder allows the student to "branch" off to different frames depending on his answer to the last question. This branching technique uses multiple-choice questions at the ends of the frames, with a different next frame for each of the possible answers. Crowder has coined the phrase "intrinsic programming" to
identify this particular technique.  

Beginning with earliest controlled studies of programmed instruction and its effectiveness in 1958, there has been an ever-increasing body of evidence to support the fact that automated teaching, particularly programmed self-instructional materials, can achieve significant gains in terms of student learning. The accumulation of data has occurred so rapidly that by 1963 Stolurow suggested a moratorium on comparative research for the reason that there was no longer any doubt as to whether programmed instruction worked.

Comparative studies produced more than a simple listing of the relative effectiveness of automated teaching. Blyth found that the motivation of his students was greatly increased as a result of programmed instruction.

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Perhaps the most fundamental effect on the classroom teacher who uses automated teaching materials with his students is a re-evaluation of his own role. There is evidence that certain portions of the academic curriculum can be taught solely by means of self-instructional programs without the aid or intervention of the classroom teacher. At Roanoke, in the research on programmed algebra, certain experimental groups gained mastery of the subject in the absence of any tutoring or group teaching from their instructors.28

It appears that the classroom teacher can work most effectively when he uses the programmed materials as an additional instructional device. Basic concepts, rote learning, and foundation materials are by far the most common kinds of automated teaching materials commercially available today, and the teacher released from developing these kinds of understanding can work in a tutorial way with a number of students. By allowing the students to work at their individual rates, the classroom teacher can counsel and work with learners at the precise point where they experience difficulty.

At the same time, the teacher can become a vital guide to learning for the students who advance very rapidly

through the material. In the Roanoke experiment previously cited, some of the students completed the equivalent of a year's instruction in algebra in three months' time. Harry Broudy\textsuperscript{29} sees in this the true emancipation of the teacher as the catalyst of insights and understandings. The role of the teacher will become all those individualistic behaviors that the teaching machine cannot duplicate.

A second significant change in behavior among classroom teachers using programmed materials lies in the redefinition of success in instruction. Blyth, in his previously cited work, reported that programmed materials had eliminated failure, but there was still work to do in order to raise all students to the criterion level of 100 per cent mastery.

If it can be accepted as a criterion of success that all normal students can achieve mastery of a subject, given time as a variable, then such new organizational arrangements as the ungraded school and flexible scheduling may be used effectively.

One final effect of the use of programmed instructional materials on the teacher is that he now has a more meaningful evaluation of his own effectiveness as a teacher. In a study of programming success, Lysaught reported some

interesting correlations. The classroom teachers who were highly successful in programming tended to be superior in intelligence quotient, in critical thinking ability, in theoretical understanding, and in self-confidence. The classroom teacher did not acquire these characteristics by writing programs, but the ability to develop sound programmed materials and use them effectively reflected the inherent strengths of the instructors. It seems likely that a teacher who cannot construct an effective automated learning program for at least one student very likely cannot provide effective instructional assistance to groups of students.

There are convincing reasons for insisting that all teachers who plan to use automated teaching with their students experience the actual preparation and use of these new methods and materials prior to the application of them in a broad way. Lysaught and Williams, out of extensive experience in preparing teachers as automated programmers, say: "Until a teacher has done some programming and demonstrated to himself that he can control this new pedagogical method, he would be unlikely to use it with his students. If he should use it without previous personal experience, he probably would not do so to best advantage."

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Convincing evidence that programmed instruction is effective for learning has been accumulated over the past decade as a result of extensive research involving a variety of subject areas and extending from the primary grades through adult education. Results of experimentation with programmed learning at the college level, where this research originated, have almost invariably indicated that it is not only effective but also economical as an instructional medium. Coulson and Silberman\textsuperscript{32} have reported success in teaching certain aspects of behavioral psychology to college students using programmed material. Hough and Revisin,\textsuperscript{33} using a programmed course in \textit{The Contemporary Secondary School} for students in teacher education at Temple University, found that learning occurred whether students used mechanical teaching devices or programmed textbooks. The economy of programmed instruction has been described by Ferster and Sapon,\textsuperscript{34} who indicated that subjects who completed a programmed course in German learned in 47.5 hours.


\textsuperscript{33}J. B. Hough and B. Revisin, "Programmed Instruction at the College Level: A Study of Several Factors Influencing Learning," \textit{Phi Delta Kappan}, XLIV, No. 6 (1963), 286-91.

an amount of German comparable to that presented in 145 hours of combined class time and outside preparation.

There can be little doubt that gains in achievement result from the use of programmed instruction at the college level. While research by and for educators has resulted in the development and continuous improvement of an obviously effective instructional medium, the one area in which its potential contributions have been largely ignored is that of teacher education. The insignificant amount of research dealing with the use of programmed instruction in the professional preparation of teachers is difficult to explain or justify, especially at a time when teachers are faced with serious problems created by increasing numbers of students and rapidly expanding curricula.

At the University of Rochester, Lysaught and Williams introduced what may have been the first college level course for teachers in the development and evaluation of programmed learning materials. The original course has been offered each year since its inception in 1961, and an advanced course has been added for those teachers who were field-testing and refining their initial efforts. According to Plattor:

The results of a two year project in the introduction of programmed learning materials on a

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district-wide basis in one area school system indicated that teachers can be helped, through their involvement in curriculum research on programmed learning, to define instructional objectives, to select programmed materials on the basis of their contribution to the achievement of these goals, and to judge the effectiveness of these materials within their own classrooms.36

Research conducted by Lysaught 37 includes the development of an evaluation instrument which distinguishes between highly proficient and minimally proficient programmers and pointed out similarities and differences between the groups. Classroom teachers given proper training were found to be capable of becoming successful writers of programmed materials.

Programmed instruction and teaching machines provide a medium for increasing the efficiency and the effectiveness of teaching and learning in the professional preparation of teachers. There is much concern with individualization in programs of teacher education. The Task Force on New Horizons in Teacher Education and Professional Standards of the N.E.A. has commented:

Those who prepare teachers, and the teachers they


prepare, talk easily about the worth of the individual and the importance of individual fulfillment. The goals are important; their realization is less easily assured and attained. The expanding college population, showing a wide range in human variations within a single college and between colleges, offers a challenge to find new ways to recognize uniqueness and provide for the maximum development of the individual.38

The construction of programmed instructional materials presents to both pre-service and in-service teachers a methodology for the development and evaluation of learning sequences based on specific knowledge about the learner as well as on specific objectives. To organize content for sequencing in small steps requires that initial and terminal behaviors of the learner be defined clearly in measurable, observable terms. The literature on curriculum at all educational levels consistently emphasizes the importance of describing outcomes in behavioral terms. Sowards and Scobey, writing on curriculum development in elementary education, have stated:

Past experience has shown that statements of purpose are most useful when they are expressed in terms of human behaviors. Efforts to express objectives have often in the past resulted in a list of high-sounding generalities, difficult or impossible to follow in providing an educational program. However, if educational goals are expressed according to a definition of education as a change in or modification of human behavior, or in behavioral terms, the

Some concerns of teacher education are the understanding of curriculum content, making decisions concerning curriculum choice, and initiating curriculum change. While the dissemination of information and data is important, the active involvement of teachers in the development and field testing of their own programmed units is necessary as well. Teachers should be prepared, through systematic learning experiences involving programmed instruction, to make sound judgments about this medium and about their role in its development and implementation. To the degree that teachers derive their own styles of teaching behavior from the ways in which they were taught, teaching machines and auto-instructional methods should be an integral part of the preparation of pre-service and in-service teachers. The planning of experiences involving programmed instruction is the joint responsibility of the school of teacher preparation and the school system to which the pre-service teacher is assigned. The essential aspect in the pattern of instruction is the provision of a well-planned program of learning experiences which will meet the teacher's needs in this area. The creative teacher who becomes a capable programmer will be able to communicate with more students under varied conditions of teaching and learning than are

possible at the present time.

The study presented in this dissertation differs from previous research studies in that an attempt had been made to use the programming technique as a means of teacher self-instruction regarding the recognition of the visually inadequate child.
Introduction

The review of related literature has shown that visually related problems are experienced by greater numbers of children as they progress through the school grades. This is attributed to the fact that the human visual mechanism was never designed for lengthy, near-point tasks. Nature designed it for distance seeing, but our present culture demands more and more near-point tasks of an individual.

The child can react or adapt to this increasing stress on his visual system in several ways. He may become a bookworm, reading everything he can acquire. This child places an increasing demand on his visual system. In so doing, it becomes difficult for him to maintain clear and single vision at both near and far distances all the time. He compromises by gradually giving up clear vision at distance in order to retain it at near-point; he becomes myopic or nearsighted. A second alternative is for the child to give up binocular vision through the suppression of one eye. A third alternative is for the child to simply quit, to give up, because it is difficult and painful to adjust his vision for the near-point school tasks demanded of him hours at a time.
day after day. He becomes an underachiever.¹

The review of related literature supplied ample evidence that a child can have 20/20 acuity and still have serious problems in seeing. Acuity or clear sight is only one aspect of vision, however, so other visual areas must be investigated to determine if the child's visual system is functioning properly.

Vision should be considered as a possible reason for poor school work, particularly if other factors have been eliminated. Studious children frequently have headaches from deficient vision because their work and interests demand continuous eye use. They are intent at continuing the near-point tasks even though their efforts result in serious discomfort. But the child who does not achieve due to a functional visual problem takes the easy way out. Either he does as little as possible or he quits doing all near-point tasks. The difficulty in identifying such a child for proper referral in this instance is that the child may not show any obvious visual symptoms, because his eyes cannot hurt when they are not being used intently at near-point tasks.²

An examination of pertinent literature brought out the fact that a major cause of underachievement stems from the

²Ibid., p. 12
factors known as "avoidance"--the urge within the organism to preserve its own operational integrity by escaping from a threat to itself.

In order to create a satisfactory visual climate for learning to occur, a means must be discovered to satisfy the avoidance response of the organism. A convex spherical lens has such a characteristic.\textsuperscript{3} It permits the individual to continue at the near-point visual task. It allows satisfaction of the avoidance urge, that of discontinuing the task at near-point. The individual can now achieve and avoid simultaneously.

No other means, to date, of meeting the response to near-point tasks has been developed except through the application of convex spectacle lenses for all near-point tasks.\textsuperscript{4} These lenses are not being used to correct anything organically wrong with the eyes. They are for classroom use only for the purpose of protecting the individual from developing eye problems and ocular defects. Without the use of such protective lenses, it has been found that eighty percent of the children by the end of grade five will have developed a measurable ocular defect.

A major concept cited previously was the distinction

\textsuperscript{4}Ibid., 1755.
between sight and vision. Among those who have a visual difficulty, there may be no loss of ability to see clearly. It is even possible that there could be a heightening of the sheer acuity process. This apparent contradiction is what caused Betts to conclude that if the boys in the lower third of achievers in any classroom are investigated, it will be found that they have better than average acuity. Theirs are the visual problems that have gone unrecognized. Only recently has the idea come to light that the stress of near-point tasks can cause the child to observe, see, remember, and learn less.

When one reflects on the visual abilities that children must possess for achievement in the classroom, one realizes that children are expected (1) to see clearly at distance and at near-point, (2) to maintain binocular fixation at distance and at near-point, (3) to change fixation easily from one place to another, (4) to maintain focus at far and near, and to change focus easily, (5) to have visual memory, (6) to perceive general configuration, likenesses and differences in form, and (7) to perceive size and space relationships.

It becomes easy for a student to be labeled as an under-

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achiever when deficient visual skills in the above performance areas are really the cause of his underachievement.

An additional factor brought out in the review of related literature was the obvious limitation of the Snellen Test as a screening procedure. Eye defects screened out by it are important to correct, but most of those who fail this test of acuity at distance are not likely to have a problem at near-point tasks unless some other visual skill area is also defective. Those who pass the Snellen Test are the very ones who may be in need of referral because they may be unable to function visually at near-point tasks of less than sixteen inches—the distance at which most learning activities take place.

The visual abilities previously listed are necessary for achievement both in school and out. These abilities are developed after birth through maturation and learning. Children vary in the degree to which they develop these abilities to the extent that Gesell states, "Every child exhibits a distinctive pattern of development of visual performance. . . . Considering the profound intricacy of the visual complex alone, it is not strange that there should be such an amazing range of individual differences in reading performances both before and after the age of six."7

Children with visual disabilities can usually be helped through the use of prescriptive lenses and/or through visual training. Through visual training the primary visual abilities can usually be brought to normal performance.

Vision is a complex process, and it must function with ease and efficiency if the child is to learn through his visual system. If the child's visual system is not operating satisfactorily, there will be interference with his visual performance and school achievement. Because of factors such as these, teachers will have children in class who are underachieving due to vision difficulties. It is imperative that classroom teachers become adept at recognizing children who exhibit symptoms of visual problems so that prompt referral can be made to the appropriate agency for further diagnosis and treatment.

The purpose of this study is the construction, implementation, and evaluation of an effective approach to aid teachers in recognizing students having visual anomalies that could result in the students becoming scholastically disabled. The approach to be used is a self-instructional programmed handbook that is designed to instruct classroom teachers of the differences between sight and vision, of the inadequacy of the usual ten to fifteen minute eye examination to discover all visual problems, of the symptoms which indicate possible visual problems, and of the type of professional eye examiner who is qualified to administer
developmental vision testing and training. Hopefully, this understanding will assure the recognition and prompt referral of those children in need of visual assistance who otherwise may not have been identified.

Development of Programmed Handbook

Literature previously cited indicates the appropriateness of applying programmed instructional materials as a means of individualizing instruction. Teachers especially need to be informed of the visual skills necessary for the child to succeed. It is imperative that teachers become able to distinguish between sight and vision. They need to understand that not all eye examiners are concerned with developmental vision. They need to realize that the usual ten to fifteen minute eye examination is inadequate as a means of diagnosing all possible visual impairments. They need to understand that a child can have his eyes diagnosed as being organically healthy with 20/20 acuity and still not be able to use his visual system effectively or efficiently. How can these ideas best be presented to teachers? Many teachers cannot or will not (1) attend graduate classes, (2) read professional literature in the field of developmental vision, due in some measure to the use of medical terminology that may not be understandable to the layman, and (3) attend conferences or workshops conducted by vision specialists to enlighten educators regarding the function of the visual system. Because of reasons such as these, a
programmed handbook written in layman's terms seemed practicable as a means of transmitting information to teachers regarding the differences between sight and vision.

The writer participated in two graduate courses dealing with programmed learning. One course provided the theory on which programming is based, and the second course involved the construction and evaluation of a programmed handbook that would fit into an existing curriculum sequence. Instruction in these two courses lasted for one school year and was directed by an instructor who is an expert programmer.

Programmed instruction, as well as any other form of teaching, requires the enunciation of educational objectives expressed in measurable terms. Instruction in the area of behavioral objectives stated in measurable terms was a major part of the activities engaged in while the writer was taking graduate courses in programmed learning. Proficiency in writing behavioral objectives which included statements of general objectives followed by specific learning outcomes was required. Based on the objectives, the writer constructed and evaluated a programmed handbook during his year's study of self-instructional materials.

Previously cited research emphasized the importance of teachers acquiring some expertise in the construction, revision, and evaluation of the individual frames which make up a program of study before they attempt to use or construct
programs of their own. Also mentioned was the desirability of stating learning outcomes in behavioral terms which are measurable. Having accomplished this, the writer believed he was prepared to use programmed instruction as the approach to instruct teachers of the differences between sight and vision.

The following general objectives and specific learning outcomes guided the construction and evaluation of the programmed handbook used in this study. The form used to state these instructional objectives followed those of Gronlund. 8

1. Knows basic concepts
   1.1 Explains correctly in writing the differences between sight and vision
   1.2 Lists correctly from memory eight or more symptoms of visual anomalies

2. Recognizes logical fallacies in reasoning
   2.1 Outlines accurately the inadequacies of the Snellen Test as a means of diagnosing visual difficulties
   2.2 Differentiates correctly between the usual ten to fifteen minute eye examination and a developmental vision examination

3. Shows concern for the welfare of others
   3.1 Shares research in developmental vision with colleagues
   3.2 Reads pertinent literature regularly that is related to learning disabilities

---

4. Practices cooperation in group activities

4.1 Listens to colleagues' suggestions to provide a healthy visual environment in the classroom

4.2 Uses school and community referral agencies to aid children in need of a thorough visual diagnosis

5. Judges the adequacy with which conclusions are supported by data

5.1 Concludes that reports indicating that a child has perfect sight (20/20 acuity) are inadequate in assessing the child's visual skills

5.2 Justifies the conclusions using data from professional sources

The content material included in the programmed handbook, Sight ≠ Vision, was based on The Primary Visual Abilities Essential to Academic Achievement,9 the Educator's Guide to Classroom Vision Problems,10 and the Educator's Checklist Observable Clues to Classroom Vision Problems.11

In a personal investigation of the validity of a particular program, various factors are identifiable in a good program. For example, the frame should be concise and clear. The problem to which the learner responds must be clearly stated and answerable on the basis of information that the

9Section on Children's Vision Care and Guidance, "The Primary Visual Abilities Essential to Academic Achievement," pp. 42-50.


11Idem., Educator's Checklist Observable Clues to Classroom Vision Problems, pp. A-B.
Responses should not ordinarily be called for at the beginning of a frame as the learner is likely to go on after making the response without completely reading the frame. A program should include adequate review frames. The sequence must be skillfully designed, with complex concepts built on carefully ordered simple ones. A single frame should not incorporate more than one new idea. It is acceptable, though, to combine review material with one new idea in a frame.

After the writer constructed the individual frames, they were edited for length. This can be measured in three different ways: (1) by the number of words or sentences it contains; (2) by the time needed to work it; (3) by the number of ideas it contains.

The preference is for short frames in a typical Skinnerian constructed-response program. There are several reasons for this preference. First, and most important, the purpose of programming is to divide subject material into small units of work which can be rewarded separately when successfully completed. Also, a learning program should allow the learner to indicate precisely the point that causes difficulty.

Examination of existing programs shows a decided tendency to make use of frames about two sentences in length. One sentence is used to present new material, and a second
sentence is used to form the learner's response to the material.

Next, the frames were edited for readability; this is measured by the vocabulary level, grammatical style, and complexity of the ideas involved. This did not present a difficulty for the writer because of the population for whom the program was intended—college graduates who were certified teachers.

The use of prompts or clues was the third factor considered in the editing process. After studying dozens of programs, the writer believes that if prompts are useful and necessary in the early parts of a program or during the introduction of new material, it still becomes necessary to gradually remove the prompts in order to get the learner to respond to the material on his own. If he cannot, revisions must be made.

A fourth factor considered was the position of a frame within the program. Evans\textsuperscript{12} made a study of the importance of sequential arrangement of frames in a program. He compared programs constructed under the Ruleg system, that is, introduce a rule, give examples, and then present an item which asks the learner to restate the rule, with programs

That were less systematically ordered. Evans concluded that
the advantages of careful arrangement of frames over material
presented in a less orderly fashion is a significant factor
in programming.

When the editing process was completed, the writer
presented the programmed handbook, *Sight * Vision, A
Handbook for Teachers, to a local university instructor who
teaches graduate courses in programmed instruction. The in-
structor suggested that approximately sixteen per cent of the
frames needed to be revised. This was completed to the in-
structor's and the writer's satisfaction.

The program was then submitted to three specialists
in developmental vision for their evaluation of the subject
matter contained in the program. This is detailed in chap-
ter four.

Individual teachers had to be selected on whom to
test the program for one of the key factors of programming,
that of error rate. One of the principles of Skinnerian pro-
gramming states, "By good design of the instruction, and by
repeated tryouts and revisions of the instruction, errors
made by students in responding to frames and in exhibiting
the final desired behavior are held to a minimum."13

Three teachers on separate occasions were asked to
complete the program. Discussions were held afterwards to

13Susan M. Markle, *Good Frames and Bad* (2nd ed.;
determine what difficulties were encountered. The teachers reported that they were not confused or misled on any of the 34 frames in the program. The mean error rate was 12 per cent. The writer considered this to be slightly high from the readings he had studied. The goal was an error rate of 10 per cent or less. Each of the teachers had 2 of the same frames in error. The writer revised those 2 frames, and the program was presented to 4 teachers on separate occasions. The mean error rate was now slightly under 6 per cent, satisfactory in the opinion of the writer and substantiated by others in the field.

The programmed handbook was then presented to a group of 7 teachers after they had first completed the pre-test used in this study. When they had answered the 34 frames in the program, they were given the post-test. The comparison of pre- and post-test scores showed a significant difference from a mean of 8 on the pre-test to a mean of 17 on the post-test.

Copies of the programmed handbook (See Appendix C) were printed and made ready for use in this study to determine its effectiveness in instructing teachers of the differences between sight and vision. Distribution of the programmed handbook, Sight ≠ Vision, A Handbook for Teachers, which was administered to the experimental group, is discussed in chapter four.
CHAPTER IV

PROCEDURE

Testing Instrument

The purpose of the testing instrument was to determine if a random sampling of teachers possessed accurate information regarding visual symptoms that indicated a possible visual problem which could likely impede academic achievement. Since the visual system is the primary information processing system for sighted individuals, it is absolutely necessary that teachers especially be aware of possible visual anomalies in their students. If it can be demonstrated that teachers who have either many or few years of teaching experience and that teachers who have either a graduate or an undergraduate degree show no significant difference in their ability to recognize students with possible visual anomalies, then implications regarding teacher education institutions with the failure to provide essential instructional information for teachers would seem appropriate.

The testing instrument consisted of a pre- and post-

1Section on Optometric Child Care and Guidance, "The Primary Visual Abilities," p. 38.
test, using the same form for both. It incorporated three sections. Section one requested the following data: name, school, room number, the highest degree earned, and the number of years of teaching experience; section two stated the meaning of one term, "student," as it was to be understood in the statements on which the participants were directed to answer either by circling "Y" for yes or by circling "N" for no. The correct replies for the statements numbered 5, 12, and 18 were "N" for no, and the correct replies for the remaining 17 statements were "Y" for yes. The latter mentioned statements included visual performance areas that are related to the academic achievement of students in a classroom.²

In its inception the testing instrument was presented to a primary-grade teacher for completion. Immediately thereafter, each of the twenty statements was discussed with regard to vagueness, inappropriateness, or misleading terminology. Revisions were incorporated and several days later the testing instrument was presented to an intermediate-upper grade teacher. Following this, a discussion of each statement took place with further revisions incorporated into the instrument. After several more days the testing instrument was presented to a secondary school teacher. Additional suggestions resulted in modifications of the statements in the instrument.

²Ibid., p. 42.
A class of educators at a local university agreed to complete the answers to the twenty statements on the instrument. This was followed by group discussion for the purpose of discovering any additional misunderstandings the statements might contain.

The testing instrument was presented to three vision specialists who verified the validity of the statements used to determine the teacher's awareness of visual symptoms that indicated possible visual anomalies. (See Appendix A.)

A different class of educators at the same university mentioned above received the testing instrument and answered the twenty statements. No comments, questions, or answers were discussed. One month later this same class of educators received the testing instrument a second time and completed the answers to the same twenty statements. A reliability study involving test-retest data was conducted. Table 1 presents a summary of this data.

TABLE 1
SUMMARY OF STUDY ON TEST-RETEST RELIABILITY

<table>
<thead>
<tr>
<th></th>
<th>First Testing</th>
<th>Second Testing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>8.7</td>
<td>9.3</td>
</tr>
<tr>
<td>S.D.</td>
<td>2.85</td>
<td>5.3</td>
</tr>
</tbody>
</table>

r = .896

The raw score data for Table 1 on which the test-
Retest reliability study was based is listed in Appendix D.

Table 2 below presents the item analysis data for the testing instrument by comparing the upper and lower twenty-seven per cent of the sample to obtain discriminative power and difficulty of each item. The item discrimination indexes ranged from correlation coefficients of -.46 to .92. The difficulty of the items ranged from 31 to 81 with a mean percentage difficulty of 54.

TABLE 2
ITEM ANALYSIS DATA FOR DISCRIMINATION AND DIFFICULTY INDEXES

<table>
<thead>
<tr>
<th>Item Number</th>
<th>Discrimination Index</th>
<th>Difficulty Index (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>.69</td>
<td>38</td>
</tr>
<tr>
<td>2</td>
<td>.58</td>
<td>63</td>
</tr>
<tr>
<td>3</td>
<td>.62</td>
<td>31</td>
</tr>
<tr>
<td>4</td>
<td>.77</td>
<td>58</td>
</tr>
<tr>
<td>5</td>
<td>-.46</td>
<td>38</td>
</tr>
<tr>
<td>6</td>
<td>.81</td>
<td>52</td>
</tr>
<tr>
<td>7</td>
<td>.73</td>
<td>56</td>
</tr>
<tr>
<td>8</td>
<td>.88</td>
<td>56</td>
</tr>
<tr>
<td>9</td>
<td>.69</td>
<td>35</td>
</tr>
<tr>
<td>10</td>
<td>.73</td>
<td>40</td>
</tr>
<tr>
<td>11</td>
<td>.85</td>
<td>50</td>
</tr>
<tr>
<td>12</td>
<td>.23</td>
<td>77</td>
</tr>
<tr>
<td>13</td>
<td>.38</td>
<td>54</td>
</tr>
<tr>
<td>14</td>
<td>.65</td>
<td>67</td>
</tr>
<tr>
<td>15</td>
<td>.92</td>
<td>54</td>
</tr>
<tr>
<td>16</td>
<td>.85</td>
<td>50</td>
</tr>
<tr>
<td>17</td>
<td>.46</td>
<td>73</td>
</tr>
<tr>
<td>18</td>
<td>-.23</td>
<td>81</td>
</tr>
<tr>
<td>19</td>
<td>.77</td>
<td>58</td>
</tr>
<tr>
<td>20</td>
<td>.81</td>
<td>52</td>
</tr>
</tbody>
</table>

Items 5, 12, and 18 in the above table indicate a relatively high per cent score in the lower twenty-seven
per cent group results. (See Appendix E.) This may be accounted for by the fact that the test subjects in this group appeared to be unable to recognize apparent visual difficulties in most of the items in the testing instrument and proceeded to mark nearly all of the answers "N" for no. Since items 5, 12, and 18 were the only items for which an answer of "N" for no was correct, this group had these three items correct frequently.

Selection of Participants

The faculties from six private, secondary schools received the pre-test. Private schools were selected to expand the sample to include secular and religious order participants in the experiment; this included very experienced teachers and those who are fairly new to the profession. In addition it was hoped that those who would be selected to participate in this study would include as closely as possible a number of teachers with undergraduate degrees as compared to those teachers with graduate degrees. Secondary schools were selected because teacher education institutions historically stressed expertise in a given subject area for those preparing to become high school teachers in contrast to minimum requirements demanded in the area of child development which more than likely neglected the visual development process. This was an attempt to control the teacher variable. The visual development process consists of learned skills, that is,
skills that must be taught to youngsters if they are to use this major information processing system efficiently and effectively.

The locations of the schools whose faculties took part in this study were:

Near northwest area in Chicago--three schools
Mid northwest area in Chicago--one school
Far northwest area in Chicago--one school
Northwest suburb of Chicago--one school

These schools were randomly selected from a list of schools whose principals were contacted by the writer for the purpose of enlisting the cooperation of the principals regarding the distribution of the testing materials to the faculties of the schools.

Three of the schools were composed of a male student body and 3 were composed of a female student body. The total student enrollment taught by the faculties that received the testing instrument amounted to approximately 7,000 students. Three hundred twenty-five teachers at the 6 schools received the pre-test. One hundred thirty-five returned a completed pre-test form. Those who scored 15 or higher on the 20 statement form were eliminated from participating further because it was believed that those teachers were sufficiently aware of visual symptoms leading to possible academic underachievement. Twenty-three
teachers were in this category. That left 112 teachers who were selected to participate further in this study. Fifty-six were assigned to the experimental group and 56 were assigned to the control group. Criteria for placement into the 2 groups were: (1) raw score on the pre-test, (2) degree attained, and (3) years of teaching experience, whenever practicable. For example, if 10 teachers each received a raw score of 6 on the pre-test, then 5 teachers would be placed into each of the 2 groups. If the degrees earned by these 10 teachers amounted to 5 of them having bachelor's degrees and 5 of them having graduate degrees, they were divided as equally as possible into the 2 groups. Consideration was also given to the number of years of teaching experience so that both the experimental and control groups would represent each category. One week after the experimental and control groups received the pre-test, the 56 members in the experimental group received the programmed handbook, \textit{Sight ≠ Vision, A Handbook for Teachers}. The 56 members in the control group received no materials at that time. One week after the experimental group received the above named handbook, both the experimental and the control groups received the post-test. Six of the 56 members in the experimental group failed to return the post-test and were eliminated from the study which meant that the experimental group now consisted of 50 participants. Of the 6 members who were
eliminated from this group, 4 were faculty members at one school, and 2 were faculty members at a second school. Two of the 56 members in the control group failed to return the post-test and were eliminated from the study which meant that the control group now consisted of 54 participants. The 2 members who were eliminated from this group were faculty members at the same school as the above mentioned 4 faculty members who were disqualified from further participation.

Of the original 56 participants in the experimental group, 25 teachers held undergraduate degrees and 31 teachers held graduate degrees. Six members from this group were eliminated from this study for not returning the post-test. Of these, 4 had undergraduate degrees and 2 had graduate degrees. The final experimental group consisted of 21 teachers with undergraduate degrees and 29 teachers with graduate degrees for a total of 50 participants in this group. In the control group, 29 teachers held undergraduate degrees and 27 teachers held graduate degrees. Two members from this group were eliminated from this study for not returning the post-test. Of these, one had an undergraduate degree and one had a graduate degree. The final control group consisted of 28 teachers with undergraduate degrees and 26 teachers with graduate degrees for a total of 54 participants in this group.

The total number of teachers participating in this
Their years of teaching experience were as follows:

Thirty-five teachers have taught less than 6 years;
Sixty-nine teachers have taught 6 years or more.

One of the comparisons made in this study, hypothesis number five, determined whether there was a significant difference in pre-test mean performance between the group of teachers having the least teaching experience compared to those teachers having greater teaching experience to determine whether years of teaching experience had any bearing on knowledge related to visual performance areas.

**Collection of Data**

The principals of the six schools whose faculties participated in this study agreed to permit the writer to deliver the materials used in the experiment to the school office. All the materials were in sealed envelopes, and the envelopes were placed into the mailboxes of the faculty members either by the school clerk or by the writer. On a given day the pre-test was delivered with an accompanying letter enlisting the teachers' participation in this study and including further directions. (See Appendix B, letter #1.) On the following day the writer returned to each school and collected the pre-tests. One week later the writer delivered to each school the programmed handbook, *Sight ≠ Vision, A Handbook for Teachers*, in envelopes
addressed to the teachers in the experimental group. A letter of explanation and direction was included. (See Appendix B, letter #2.) Then, one week later, the post-tests were delivered with an accompanying letter of directions and an expression of the writer's gratitude for the participation of the teachers in this study. (See Appendix B, letter #3.) The writer returned to each school the following day to collect the post-tests. Additional trips were made to the schools to collect the testing instrument from the teachers who were absent on the day the instruments were delivered. Seven teachers had misplaced their copies of the post-tests and were provided with an additional copy of the test. The tests were corrected and the results were made ready for the analysis which is described in the following chapter.
CHAPTER V

ANALYSIS OF RESULTS

Problem Restated

This study is concerned with instructing teachers regarding the differences between sight and vision in order that they may become adept at recognizing students with a visual dysfunction. The problem has been attacked through the construction and implementation of a self-instructional handbook and evaluating its effectiveness. The problem is being restated using the principle of the null hypothesis: no significant difference is expected between pre- and post-test mean performance on the testing instrument. The programme handbook was assumed to have no significant effect on the differences between the means of the pre- and post-test scores unless the t-test of the difference between means was great enough to reject the possibility of chance variations. Significant values have been determined at the .05, .01, and .001 confidence levels in the distributions of t.

The following six hypotheses were to be accepted unless the statistical analysis justified their rejection:

1. There is no significant difference between pre- and post-test mean performance of teachers
on the testing instrument due to the effects of the handbook, *Sight ≠ Vision, A Handbook for Teachers*.

2. There is no significant difference between pre- and post-test mean performance of teachers on the testing instrument of those not receiving the handbook.

3. There is no significant difference between post-test mean performance of those teachers not receiving the handbook and those teachers receiving the handbook, *Sight ≠ Vision, A Handbook for Teachers*.

4. There is no significant difference between pre-test mean performance of teachers with a bachelor's degree and those teachers with a graduate degree.

5. There is no significant difference between pre-test mean performance of teachers with less than six years of teaching experience and those teachers with six or more years of teaching experience.

6. There is no significant difference between experimental and control teachers in the identification of visual problems.

**Results of Statistical Tests**

The first hypothesis compares the pre- and post-test mean performance of the experimental group to determine the effect of the programmed handbook as a method of instruction. The results are presented in Table 3.
TABLE 3
COMPARISON OF PRE- AND POST-TEST RESULTS
EXPERIMENTAL GROUP

<table>
<thead>
<tr>
<th>Test</th>
<th>N</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>t</th>
<th>.05</th>
<th>.01</th>
<th>.001</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-</td>
<td>50</td>
<td>8.66</td>
<td>3.286</td>
<td></td>
<td>10.37</td>
<td>2.00</td>
<td>2.66</td>
</tr>
<tr>
<td>Post-</td>
<td>50</td>
<td>15.00</td>
<td>3.985</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The first hypothesis is rejected. The t score is significant at the .001 confidence level. Based on these results, the use of the programmed handbook was effective in instructing teachers. Significant improvement in the post-test scores cannot be attributed to chance variations.

The second hypothesis compares the pre- and post-test mean performance of the control group which did not receive the programmed handbook as a method of instruction. The results are presented in Table 4.

TABLE 4
COMPARISON OF PRE- AND POST-TEST RESULTS
CONTROL GROUP

<table>
<thead>
<tr>
<th>Test</th>
<th>N</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>t</th>
<th>.05</th>
<th>.01</th>
<th>.001</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-</td>
<td>54</td>
<td>9.19</td>
<td>3.007</td>
<td>.63</td>
<td>2.00</td>
<td>2.66</td>
<td>3.46</td>
</tr>
<tr>
<td>Post-</td>
<td>54</td>
<td>9.48</td>
<td>4.207</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The second hypothesis is not rejected. The t score is not significant even at the .05 confidence level. Not using the programmed handbook resulted in a lack of significant improvement in the control group on their post-test mean performance.

The third hypothesis compares the post-test mean performance of the experimental group and the control group to determine the effect of the programmed handbook. The results are presented in Table 5.

### TABLE 5

**COMPARISON OF POST-TEST RESULTS**

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>t</th>
<th>.05</th>
<th>.01</th>
<th>.001</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>54</td>
<td>9.48</td>
<td>4.207</td>
<td>6.75</td>
<td>1.98</td>
<td>2.62</td>
<td>3.37</td>
</tr>
<tr>
<td>Experimental</td>
<td>50</td>
<td>15.00</td>
<td>3.985</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The third hypothesis is rejected. The t score is significant at the .001 confidence level. Teachers using the handbook, *Sight ≠ Vision, A Handbook for Teachers*, exhibited a significant difference in their post-test mean performance compared to teachers not using the handbook. This cannot be attributed to chance variations.

The fourth hypothesis compares the pre-test mean performance of teachers having a bachelor's degree with those teachers having a graduate degree. The results are
presented in Table 6.

TABLE 6

COMPARISON OF PRE-TEST RESULTS
BACHELOR AND GRADUATE DEGREES

<table>
<thead>
<tr>
<th>Degree</th>
<th>N</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>t</th>
<th>.05</th>
<th>.01</th>
<th>.001</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bachelor</td>
<td>49</td>
<td>9.24</td>
<td>3.12</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Graduate</td>
<td>55</td>
<td>8.65</td>
<td>3.05</td>
<td>.96</td>
<td>1.98</td>
<td>2.62</td>
<td>3.37</td>
</tr>
</tbody>
</table>

The fourth hypothesis is not rejected. The t score is not significant even at the .05 confidence level. Results indicate that teachers having a graduate degree did not score significantly higher on the pre-test compared to the scores received on the pre-test by teachers having a bachelor's degree.

The fifth hypothesis compares the pre-test mean performance of teachers with less than six years of teaching experience with those teachers having six or more years of teaching experience. The results are presented in Table 7.

TABLE 7

COMPARISON OF PRE-TEST RESULTS
INEXPERIENCED AND EXPERIENCED

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>t</th>
<th>.05</th>
<th>.01</th>
<th>.001</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inexper.</td>
<td>35</td>
<td>9.51</td>
<td>3.286</td>
<td>1.40</td>
<td>1.98</td>
<td>2.62</td>
<td>3.37</td>
</tr>
<tr>
<td>Exper.</td>
<td>69</td>
<td>8.64</td>
<td>3.02</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The fifth hypothesis is not rejected. The t score is not significant at the .05 confidence level. Results on the pre-test indicate that teachers with six or more years of teaching experience did not score significantly higher compared to teachers with less than six years of teaching experience.

An analysis of variance was utilized as a more rigorous technique to validate the results of the t-test. Table 8 indicates the analysis of variance summary of pre-test scores involving the factors of: (1) Levels of Education, (2) Levels of Teaching Experience, (3) Levels of Treatment.

Table 8 indicates that no differences existed among the factors listed based on the pre-test scores. The main effect of Factor A allows the assumption of no significant
difference on pre-test mean scores between teachers having bachelor's degrees and teachers having graduate degrees.

Table 8 further indicates no significant difference on pre-test mean scores for the main effect of Factor B which permits the assumption of no difference regarding the effect of this factor; teachers having 0-5 years of teaching experience and teachers having 6 or more years of teaching experience showed no significant difference on their pre-test mean performance. Finally, Table 8 indicates no significant difference for the main effect of Factor C on their pre-test mean performance; neither the experimental nor the control group exhibited a significant difference on their pre-test mean scores.

Table 9 indicates the analysis of variance summary of post-test scores involving the factors of: (1) Levels of Education, (2) Levels of Teaching Experience, (3) Levels of Treatment.

TABLE 9
ANOVA SUMMARY TABLE OF POST-TEST SCORES

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Squares</th>
<th>F</th>
<th>P</th>
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Table 9 indicates no significant difference for the main effect of Factor A on the post-test mean scores. This indicates that, regardless of the types of degrees held by the teachers, their post-test mean performance was not significantly different. The main effect of Factor B indicated no significant difference on their post-test mean performance; this permits the assumption of no difference regarding the effect of few or many years of teaching experience. Table 9, however, does indicate that a significant difference exists due to the main effect of Factor C. The F value of 46.81 and the probability level of <.0001 indicate that there is only one chance out of ten-thousand that the gains made due to the main effect of Factor C could have occurred by chance. Since the summary table of pre-test scores, Table 8, indicated that no significant difference existed between the treatment and control groups on the pre-test, the difference can be reasonably attributed to the "treatment," that is, to the use of the programmed handbook to instruct the teachers who were in the experimental group.

The sixth hypothesis compares the ability of the
experimental teacher with the ability of the control teacher in identifying visual problems in students. To test this hypothesis the writer contacted the principal of a private, secondary school located in the mid-northwest area in Chicago in a manner similar to the selection of the six schools previously mentioned. The principal was asked to randomly select two teachers who instruct the same class of students at different times of the day. The first teacher was asked to observe his class for one week and to make a list of the students, if any, whom the teacher would refer for an eye examination. The reason for the referral was to be listed next to the student's name. This teacher was the control teacher. The second teacher was instructed to read/study the programmed handbook, Sight & Vision, A Handbook for Teachers, and then to observe his class for one week and to make a list as described above. This teacher was the experimental teacher. After one week, the writer collected the lists and two days later, the class of students observed by the two teachers was administered a vision screening test of visual skills (see Appendix F) on the Keystone Telebinocular which is a visual screening instrument designed to test visual skills. The visual skills not only present a picture of the performance ability of the student in terms of magnitude, but perhaps of greater importance, they tell about the quality of his performance. The writer administered the visual
skills tests after being certified to do so by a vision specialist. (See Appendix G.) The results are as follows. The writer, as the vision skills tester, found that 7 out of 25 students (28%) qualified for referral for a complete eye examination. The control teacher did not list any (0%) of the 7 students for referral while the experimental teacher listed 4 (57%) of the 7 students for referral.

Neither teacher was to ask any questions of the students nor to use any school records to help him in compiling his referral list. The control teacher listed 1 student only, and he passed the vision skills tests on the Keystone Telebinocular. The experimental teacher listed a total of 6 students, 2 of whom passed the vision skills tests on the Keystone Telebinocular. These 2 students, in the opinion of the writer as the vision skills tester, did exhibit valid symptoms of visual problems, but the symptoms were precipitated by factors other than visual in nature.

The difference between the 2 teachers in identifying visual problems in students is quite meaningful and, therefore, hypothesis number 6 is rejected. The experimental teacher clearly demonstrated a superior ability over the control teacher in identifying visual problems subsequent to studying the programmed handbook constructed by the writer.
Generalization of Results

The comparison of pre- and post-test mean performance of teachers who received the programmed handbook indicated the effectiveness of the handbook in instructing teachers of the differences between sight and vision. Their improvement was shown to be quite substantial, even at the .001 confidence level. Improved performance did not occur without the use of the handbook by the control group. Having graduated from a teacher training institution does not seem to guarantee that necessary information is possessed by the teacher regarding an individual's visual development. Teacher preparation institutions require course work in child development, but it may be possible that instruction in the development of the visual skills necessary for academic achievement is not included in the curriculum of prospective teachers.

Teachers having graduate degrees did not show any significant difference in their pre-test mean performance compared to teachers having a bachelor's degree only. It appears that the teachers in this study did not receive instruction to any great extent regarding the function of the major information processing system possessed by sighted individuals.

Teachers in this study with six or more years of teaching experience seemed to understand no more regarding the visual symptoms of which to be aware than teachers
with less than six years of teaching experience. Individuals do not seem to acquire this information simply by being classroom teachers. If this information, vital as it appears to be, is not acquired during the years of teacher preparation nor during the years of teaching experience, then some other effective means is necessary.

The comparison of the experimental and the control teachers in identifying visual problems in students appears to indicate positive effectiveness of the programmed handbook in supplying necessary and vital information that teachers ought to possess.
CHAPTER VI

SUMMARY, CONCLUSIONS, AND IMPLICATIONS

Summary of Findings

The purpose of this study was the construction, implementation, and evaluation of an effective approach to aid teachers in recognizing students having visual anomalies that could result in the students becoming scholastically disabled. This required an investigation into (1) the primary visual abilities essential to academic achievement, (2) the visual symptoms exhibited by individuals in need of a thorough vision screening, (3) the research conducted that indicated a significant relationship between inadequate visual performance and scholastic underachievement, and (4) the application of self-instructional materials--their construction, revision, implementation, and evaluation--as an effective means of instruction.

When the materials used in this study were judged to be valid and reliable, the experiment was initiated with a group of 325 teachers at 6 private, secondary schools located in the Chicago area. These teachers received a pre-test which was completed by 135 of them. Based on their raw scores on the pre-test, 112 teachers were selected to
participate further. Of these 112 teachers, 56 were assigned to both the experimental and to the control groups in accordance with the criteria listed in chapter four. Soon thereafter, the experimental group received the programmed handbook, _Sight ≠ Vision, A Handbook for Teachers_; the control group received no materials. Afterwards, an identical post-test was administered to both groups. Eight teachers were disqualified for not completing the testing materials. Six were in the experimental group, and 2 were in the control group. One hundred-four teachers completed the experiment. Later, an experimental and a control teacher who were not part of the group of 104 teachers were asked to list students in their class who exhibited symptoms of visual problems.

The analysis of the results determined that:

1. Regardless of the type of college degree held by the teachers, no significant difference was found to exist in their knowledge of the differences between sight and vision.

2. Regardless of the number of years of teaching experience possessed by the teachers, no significant difference was found to exist in their knowledge of the differences between sight and vision.

3. The programmed handbook, _Sight ≠ Vision, A Handbook for Teachers_, was significantly effective at the .001 confidence level in instructing teachers of the differences between sight and vision.

4. Identification of visual problems in students was effective subsequent to the study of the programmed handbook.

The purpose of this study as stated in chapter one
Conclusion

This experiment included teachers of various backgrounds: lay teachers as well as those belonging to various religious orders; teachers with bachelor's, master's, and doctor's degrees; teachers with experience ranging from one year to more than forty-five years. Of utmost importance, however, is the size of the group that completed this experiment—one hundred-four participants plus two others in a separate experiment—not so large as to be able to draw definitive conclusions but large enough to gain insight into their level of understanding regarding a vital area of concern to educators.

It appears that teachers generally are not well prepared, whether through college course work or through teaching experience, to recognize children exhibiting symptoms of deficient visual development. Schools of teacher preparation might do well to review their curriculum on this matter to discover if their courses on child development include necessary information on the child's visual development. School systems might provide workshops or seminars conducted by a professional optometrist in the capacity of a visual perceptual consultant.

Based on the pre-test performance of teachers in this study, it appears that teachers need assistance in understanding the stages of visual development and the symptoms
suggesting an assortment of visual problems. Without adequate information, teachers will probably not recognize many children with visual anomalies, nor will they understand proper techniques to use in working with children who need special assistance. Unless teachers become adept at recognizing children in need of referral due to a visual difficulty, children may tragically waste their educational lives and suffer the lasting effects of that waste.

It appears that the programmed handbook used in this study provided the means to assist teachers in recognizing students having visual anomalies. The results of the tests conducted substantiate that statement.

It further appears that optometry is an indispensable profession in trying to aid the underachiever. The optometrist often understands both the function and the physiology of sight and vision and their developmental stages. The optometrist who is a specialist in developmental vision is familiar with training techniques and methods that correspond to developmental weaknesses.

The critical need for the future seems to be that of interprofessional cooperation for the benefit of the approximately seventeen million students in the United States who are presently failing to achieve to their

---

potential.² The members of each and every profession should participate in a united effort to aid these children through understanding, cooperation, and efficient therapy.

Implications for Further Study

The importance of a properly functioning visual system, as well as all other bodily systems, cannot be overemphasized in allowing a child to develop his potential to the fullest.

The ability of the classroom teacher to recognize students having visual difficulties so as to make prompt referral is vital. Based on the results of this study, classroom teachers are not well qualified to perform this function. It appears that there is a need to discover whether the results of this study would remain similar for a larger group study, possibly one encompassing an entire school system, since time and resources limited this experiment.

A survey of lists of courses in schools of education could be conducted to determine the extent of course offerings in the area of vision development. Since the visual system appears to be the major information processing system of normal, sighted individuals, it seems obligatory for teacher training institutions to make available, and to

require, preparation in this area.

A study could be conducted using several possible effective approaches to instruct teachers regarding normal visual development such as:

1. cassette tapes for individual and group use
2. closed circuit television in designated schools
3. seminars held by professional consultants in the field of developmental vision, and
4. individualized study packets.

A determination could then be made as to which, if any, of the approaches would have been most successful in imparting the necessary information to teachers.

Since school systems usually have the services of visiting nurses, a study could be conducted to determine their ability at recognizing visual anomalies in children since teachers may rely exclusively on their judgments for further referral of the child.

It is the child about whom we are most concerned and:

It matters little whether the child with vision dysfunctions is detected by more effective screening, by an observant teacher, school nurse, psychologist, or a combined effort of all. The important factor is that he is found promptly and started on an appropriate program of remedial care. 3

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APPENDIX A

Letters from Three Vision Specialists
August 13, 1973

To whom it may concern,

Re: Handbook and questionnaire of Mr. Donald Secha

After having reviewed both the Handbook and questionnaire of Mr. Donald Secha, it is our opinion that all material and information contained therein is factual and accurate.

If there are any questions regarding this, please feel free to call.

Sincerely

Dr. Vito A. Racanelli, Jr. O.D.
Chairman Illinois Optometric Association School Consultants Program

dr/VAR
November, 1972

Loyola University
School of Education

Gentlemen:

I have examined the testing materials to be used in the experiment as part of this research study, and I find the materials to be valid in their presentation of information regarding sight and vision.

Conrad E. Mazeski, O.D.

CEM/ae
August 13, 1973

Loyola University
School of Education

Dear Sir:

I have examined the testing materials used by Donald Socha, and attest to the validity and pertinence of the questions asked concerning visual performances.

Edward L. Kasperek, O.D.
APPENDIX B

Testing Instrument
Letter #1 Accompanying the Pre-test
Letter #2 Accompanying the Programmed Handbook
Letter #3 Accompanying the Post-test
Name (print) ____________________________________________________________

School __________________________________________ Room No. __________

Circle the highest degree earned:

Bachelor's Master's Doctorate

Including this year, how many years have you been teaching?

____________ years

Please study this definition. Your answers to the following statements will be based on your understanding of it.

Student - an individual above seven years of age who is physically, neurologically, mentally, and emotionally healthy.

Do you believe that a possible visual problem is indicated in the following statements? Circle "Y" for yes. Circle "N" for no.

1. Y N The student who recently, within the past week, passed the school system's sight test exhibits a short attention span, about 5 minutes, often during class.

2. Y N It is difficult for the student to walk a straight line while passing through the hallway alone.

3. Y N The student demonstrates 20/20 acuity on Snellen Charts, but he dislikes doing any written work.


1
5. Y N In the classroom the student repeatedly declines to read orally even though he has no speech impediment.

6. Y N The student, whose eyes have a tendency to tear, had an eye examination which revealed that he has 20/20 visual acuity at distance and near-point, and that he has healthy eyes internally and externally.

7. Y N When the teacher is lecturing to the class, the student often tilts his head to the right or to the left while looking at the teacher.

8. Y N The student frequently rubs his eyes, but his health record indicates a recent, within the past week, eye examination reported 20/20 visual acuity at distance and near-point tasks.

9. Y N The student with the ability to do an assignment usually gives-up after working about 5 minutes on the assignment.

10. Y N The student can spell correctly on lists of words but not on written reports.

11. Y N The student is generally clumsy. Time does not improve his problem.

12. Y N Sight and vision are synonymous. (No visual problem is indicated here. Simply make a determination.) Circle "Y" if it is true. Circle "N" if it is false.

13. Y N The student who is underachieving seldom does his assignments.

14. Y N During his gym class, the student caught the ball using either hand separately but dropped the ball using both hands simultaneously.

15. Y N The student lacks the ability to recognize a newly learned word.
16. Y N The student had his eyes examined recently, within the past week, and needed no prescription in the doctor's opinion. The student continues to blink excessively.

17. Y N The student has a well developed speech pattern but continues to have a reading problem.

18. Y N The student holds his head still while reading.

19. Y N The student had the usual eye examination, about 15 minutes in length, by a qualified doctor, was later fitted with prescription lenses but regularly omits small words while reading orally.

20. Y N The student consistently displays postural deviations while working at his desk.
Dear Fellow-Teachers,

I am currently working for a graduate degree at Loyola University while on a sabbatical leave this year. I am hopeful that you will allow me approximately 10 minutes of your time. I am asking you to complete the attached form at home and then to return it to the school office tomorrow morning when you "sign-in." Based on this information, a group of you will be given a brief booklet to read/study. Lastly, a follow-up survey will be made which will take approximately 10 minutes. The information will form the basis for a doctoral dissertation, the purpose of which is to determine the effectiveness of an approach useful to teachers in recognizing students with specific difficulties which, unless discovered and treated, may cause students to become underachievers.

Your responses will be held confidential. The data will not be analyzed on a personal basis, so your name will not be listed in the data nor made public in any manner whatsoever. It will be used by me (and only me) to make sure that there will be no duplication of materials that might distort the findings.

To preserve the reliability of the data, it is important that you do not consult with your colleagues in completing the items on the attached form.

Your consideration and cooperation in assisting me will be greatly appreciated.

Very truly yours,
Dear Fellow-Teachers,

Only a certain sample of teachers received the enclosed handbook in order to test the hypotheses which form the basis of my dissertation. I am grateful to you for this continued cooperation.

It is critical that you do not allow your colleagues to read the handbook if they were not given one as you were and that you do not discuss its contents with them, which would invalidate the results.

You may be familiar with various types of self-instructional materials. One type, a programmed instructional handbook, is the kind you will be using at this time. Simply place the answer shield over the left marginal area to cover the answers on each page of the program. Read each statement, complete the answer in the space provided, and then slide the answer shield downward slowly to check each correct answer against yours.

The types of answers required are fill-ins, multiple choice, sentence completions, and meanings.

After you complete the missing answers, please make an attempt to study the material again during the next four days. Soon thereafter, a follow-up survey will be made to determine the usefulness of the handbook material.

You may keep the handbook.

Very truly yours,
Dear Fellow-Teachers,

This, you will be happy to know, is my final request. Please complete the attached form at home and then return it to the school office tomorrow morning when you "sign-in."

I can readily understand what an additional burden I placed on your busy schedule by requesting your assistance in completing these forms at home.

I would like to express my sincere appreciation for your wonderful assistance.

Very truly yours,
APPENDIX C

Programmed Handbook

SIGHT ≠ VISION,

A HANDBOOK FOR TEACHERS
1. Sight is the ability to see light. One who cannot see light is __________.

2. Vision involves meaning, whereas sight involves the ability to __________.

3. Vision is the ability to interpret and understand the information we receive through our sight. SIGHT and VISION are __________ are not the same thing.

4. A person could have average SIGHT, that is, vision or visual 20/20 acuity, but he may be visually handicapped due to inadequate or undeveloped __________ skills or abilities.

5. SIGHT and __________ are not the same thing.
6. School systems provide for sight screening. The usual basis for screening is that of determining how clearly one sees at a distance of 20 feet by use of the Snellen Test. Passing the Snellen Test means that one can see symbols clearly which are ______ away.

7. Since most school work (reading, writing, drawing, constructing) involves near point tasks, 8 to 10 inches from the eyes, the Snellen Test is a good/poor indicator of visual abilities necessary for success in school.

8. The Snellen Test measures one's ______ acuity. List 2 activities for which a student needs clear vision at a far point in school.

Viewing educational films;
Copying from the chalk board.
9. Do you believe that the Snellen Test is an adequate eye test? yes / no

10. What does the Snellen Test determine?

how clearly one sees at a distance of 20 feet

11. SIGHT, how clearly we SEE an image, obviously vision

is NOT the same as _______ which indicates our understanding of what we see.

12. VISION means the ability to understand (and/or) interpret and/or _______ what we see.
13. Teachers need to become adept at recognizing clues to classroom vision problems. What appears to be a discipline case may in reality be a symptom of inadequate _______ development.

14. Students with good SIGHT who constantly display a short attention span and who otherwise are physically, neurologically, mentally, and emotionally sound, could have a _________ disability.

15. Assuming, as stated above, that the students are sound and have good sight, those who seem clumsy frequently or who have difficulty walking gracefully are showing symptoms of poor _________ skills.

16. Excessive blinking, watery eyes, frequent rubbing of the _____ can be symptoms of _________ problems of which the teacher should be aware.
17. Whenever a student frequently displays a vision problem, may be present that a ________________.

18. List four symptoms of possible visual problems.

frequent blinking, tearing, squinting, rubbing, itching eyes;
short attention span;
general clumsiness;
inability to walk gracefully.

19. SIGHT, the ability to _____ ______, is not the same as __________.
20. A student who has had an eye examination could still have a VISUAL problem that was not located in the usual 10 to 15 minute eye examination. Teachers should keep alert to _________ symptoms exhibited by the student.

21. Many eye examinations check for nearsightedness, farsightedness, muscle control, and diseases of the eye. This is insufficient / sufficient to detect adequate SIGHT, and sufficient / insufficient to detect adequate VISION.

22. Even though a student's eyes are found to be free from disease, the eyes may not be working together as a team. Healthy eyes may still exhibit symptoms of ____________ problems.
23. An optometrist who is also a developmental vision specialist is trained to make definitive tests, diagnose and to remediate visual problems through the use of lenses and vision training.

A student may not need glasses, but he may need __________ ____________.

24. Developmental vision specialists are qualified to administer __________ ____________.

25. An optometrist who is qualified to administer visual training for persons with developmental problems is called a __________ ____________ specialist.

26. Students who wear glasses and those who do not may continuously avoid near-point tasks and suffer frequent headaches.

They may have good SIGHT but very poor ______.
27. If a student cannot form visual images, he will have difficulty in recognizing the proper arrangement of letters in words.

Such a student will / will not develop a good sight vocabulary.

28. Such a student is in need of an eye examination by a developmental vision specialist.

29. An eye examination that takes about 15 minutes could be effective for those with a problem but totally ineffective for those with a problem.
30. Knowing the types of visual symptoms to watch for could salvage a student's academic life.

Some clues or symptoms of poor visual development are: ____________________________,
______________________________, and ____________________________.

31. Teachers should be aware of the limitations of the ________ Test in detecting visual problems.

32. An optometrist who is also a developmental vision specialist is qualified to do what?

Test, diagnose, and to remediate visual problems; prescribe lenses; administer vision training
33. What is sight?

ability
to see
light

34. What is vision?

ability
to
understand
or
interpret
what is
seen
APPENDIX D

Raw Score Data on Test-Read Retest Reliability
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APPENDIX F

Visual Skills Profile
KEYSTONE VISUAL SKILLS PROFILE

For Use with Keystone Ophthalmic Telebinocular

Name_________________________________ Age________ Date________ Wearing Glasses: Yes ________ No_________

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<td><img src="image1" alt="Diagram" /></td>
<td><img src="image2" alt="Diagram" /></td>
<td><img src="image3" alt="Diagram" /></td>
<td><img src="image4" alt="Diagram" /></td>
<td><img src="image5" alt="Diagram" /></td>
<td><img src="image6" alt="Diagram" /></td>
<td><img src="image7" alt="Diagram" /></td>
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<th>Test 2 (DB-8C)</th>
<th>Only</th>
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<tbody>
<tr>
<td>Vertical Fusion (Far Point)</td>
<td><img src="image8" alt="Diagram" /></td>
<td><img src="image9" alt="Diagram" /></td>
<td><img src="image10" alt="Diagram" /></td>
<td><img src="image11" alt="Diagram" /></td>
<td><img src="image12" alt="Diagram" /></td>
<td><img src="image13" alt="Diagram" /></td>
<td><img src="image14" alt="Diagram" /></td>
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<td>Lateral Posture (Far Point)</td>
<td><img src="image15" alt="Diagram" /></td>
<td><img src="image16" alt="Diagram" /></td>
<td><img src="image17" alt="Diagram" /></td>
<td><img src="image18" alt="Diagram" /></td>
<td><img src="image19" alt="Diagram" /></td>
<td><img src="image20" alt="Diagram" /></td>
<td><img src="image21" alt="Diagram" /></td>
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<table>
<thead>
<tr>
<th>Test 4 (DB-4K)</th>
<th>Only</th>
<th>Only</th>
<th></th>
<th>Four, widely separated</th>
<th>Four, near each other</th>
<th>Four, three separated</th>
<th>Four, near each other</th>
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</thead>
<tbody>
<tr>
<td>Fusion (Far Point)</td>
<td><img src="image22" alt="Diagram" /></td>
<td><img src="image23" alt="Diagram" /></td>
<td><img src="image24" alt="Diagram" /></td>
<td><img src="image25" alt="Diagram" /></td>
<td><img src="image26" alt="Diagram" /></td>
<td><img src="image27" alt="Diagram" /></td>
<td><img src="image28" alt="Diagram" /></td>
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<table>
<thead>
<tr>
<th>Test 5 (DB-11)</th>
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<tbody>
<tr>
<td>Color Perception (Far Point)</td>
<td><img src="image29" alt="Diagram" /></td>
<td><img src="image30" alt="Diagram" /></td>
<td><img src="image31" alt="Diagram" /></td>
<td><img src="image32" alt="Diagram" /></td>
<td><img src="image33" alt="Diagram" /></td>
<td><img src="image34" alt="Diagram" /></td>
<td><img src="image35" alt="Diagram" /></td>
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<table>
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<th>Test 6 (DB-2)</th>
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<tbody>
<tr>
<td>Color Perception (Far Point)</td>
<td><img src="image36" alt="Diagram" /></td>
<td><img src="image37" alt="Diagram" /></td>
<td><img src="image38" alt="Diagram" /></td>
<td><img src="image39" alt="Diagram" /></td>
<td><img src="image40" alt="Diagram" /></td>
<td><img src="image41" alt="Diagram" /></td>
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<thead>
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<th>Test 7 (DB-AD)</th>
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<tr>
<td>Stereopsis (Far Point)</td>
<td><img src="image43" alt="Diagram" /></td>
<td><img src="image44" alt="Diagram" /></td>
<td><img src="image45" alt="Diagram" /></td>
<td><img src="image46" alt="Diagram" /></td>
<td><img src="image47" alt="Diagram" /></td>
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<thead>
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<th>Test 8 (DB-2A)</th>
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<tbody>
<tr>
<td>Color Perception (Far Point)</td>
<td><img src="image50" alt="Diagram" /></td>
<td><img src="image51" alt="Diagram" /></td>
<td><img src="image52" alt="Diagram" /></td>
<td><img src="image53" alt="Diagram" /></td>
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<td><img src="image55" alt="Diagram" /></td>
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<table>
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<th>Test 9 (DB-2B)</th>
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<tbody>
<tr>
<td>Lateral Posture (Near Point)</td>
<td><img src="image57" alt="Diagram" /></td>
<td><img src="image58" alt="Diagram" /></td>
<td><img src="image59" alt="Diagram" /></td>
<td><img src="image60" alt="Diagram" /></td>
<td><img src="image61" alt="Diagram" /></td>
<td><img src="image62" alt="Diagram" /></td>
<td><img src="image63" alt="Diagram" /></td>
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<table>
<thead>
<tr>
<th>Test 10 (DB-2A)</th>
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<tbody>
<tr>
<td>Fusion (Near Point)</td>
<td><img src="image64" alt="Diagram" /></td>
<td><img src="image65" alt="Diagram" /></td>
<td><img src="image66" alt="Diagram" /></td>
<td><img src="image67" alt="Diagram" /></td>
<td><img src="image68" alt="Diagram" /></td>
<td><img src="image69" alt="Diagram" /></td>
<td><img src="image70" alt="Diagram" /></td>
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<thead>
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<th>Test 12 (DB-2C)</th>
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<tbody>
<tr>
<td>Vertical Posture (Near Point)</td>
<td><img src="image71" alt="Diagram" /></td>
<td><img src="image72" alt="Diagram" /></td>
<td><img src="image73" alt="Diagram" /></td>
<td><img src="image74" alt="Diagram" /></td>
<td><img src="image75" alt="Diagram" /></td>
<td><img src="image76" alt="Diagram" /></td>
<td><img src="image77" alt="Diagram" /></td>
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<table>
<thead>
<tr>
<th>Test 13 (DB-2D)</th>
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</thead>
<tbody>
<tr>
<td>Color Perception (Near Point)</td>
<td><img src="image78" alt="Diagram" /></td>
<td><img src="image79" alt="Diagram" /></td>
<td><img src="image80" alt="Diagram" /></td>
<td><img src="image81" alt="Diagram" /></td>
<td><img src="image82" alt="Diagram" /></td>
<td><img src="image83" alt="Diagram" /></td>
<td><img src="image84" alt="Diagram" /></td>
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<table>
<thead>
<tr>
<th>Test 14 (DB-2E)</th>
<th>Only</th>
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</thead>
<tbody>
<tr>
<td>Left Eye (Near Point)</td>
<td><img src="image85" alt="Diagram" /></td>
<td><img src="image86" alt="Diagram" /></td>
<td><img src="image87" alt="Diagram" /></td>
<td><img src="image88" alt="Diagram" /></td>
<td><img src="image89" alt="Diagram" /></td>
<td><img src="image90" alt="Diagram" /></td>
<td><img src="image91" alt="Diagram" /></td>
</tr>
</tbody>
</table>

NOTES:
APPENDIX G

Letter Stating the Writer's Qualifications to Perform Vision Screening Tests
June 22, 1973

Dear Sir:

Donald E. Socha has attended a workshop for educators regarding the topic "Sight and Vision" which was conducted by optometric vision specialists. He has done extensive research for his doctoral dissertation pertaining to the visual abilities necessary for academic achievement. He has also received instruction in performing visual screening tests using the Keystone Telebinocular and is qualified to perform vision screening tests with that instrument.

Sincerely,

[Signature]

Dr. Conrad E. Mazeski
BIBLIOGRAPHY

A. Books


B. Journals


Silbiger, Francene, and Woolf, Daniel. "Fixation Disparity and Reading Achievement at the College Level." American Journal of Optometry, XLV, No. 11 (1968), 734-42.


C. Magazines


D. Publications of Learned Societies


E. Unpublished Materials


APPROVAL SHEET

The dissertation submitted by Donald E. Socha has been read and approved by members of the School of Education.

The final copies have been examined by the director of the dissertation, and the signature which appears below verifies the fact that any necessary changes have been incorporated with reference to content and to form.

The dissertation is therefore accepted in partial fulfillment of the requirements for the degree of Doctor of Education.

August 13, 1973

Sister Mary Constantine
Signature of Advisor