# SCREENING KINDERGARTEN CHILDREN FOR COLOR IDENTIFICATION

By

RUTH ELEANOR SHEPHERD

Bachelor of Science of Education

Northeastern State College

Tahlequah, Oklahoma

1970

Submitted to the Faculty of the Graduate College
of the Oklahoma State University
in partial fulfillment of the requirements
for the Degree of
MASTER OF SCIENCE
May, 1974

SCREENING KINDERGARTEN CHILDREN

FOR COLOR IDENTIFICATION

Thesis Approved:

Josephine Hoffer
Thesis Adviser

James Gaertner

Rich Stinnett

N N Durham
Dean of the Graduate College

ACKNOWLEDGMENTS

The writer would like to express her sincere appreciation to her major adviser, Dr. Josephine Hoffer, Associate Professor and Acting Head of the Department of Family Relations and Child Development, for her guidance and assistance. Appreciation is also expressed to Dr. James Walters, Professor of Family Relations and Child Development, and to Dr. Nick Stinnett, Associate Professor of Family Relations and Child Development for their assistance and suggestions.

Appreciation is also given to the Tulsa Public School Research Department and Dr. Paul I. McCloud for permitting the gathering of data from nine Tulsa School Kindergartens. A note of thanks is also given to the principals and teachers of the nine Tulsa kindergartens for allowing me to conduct my study in their schools.

A special note of thanks is given to Dr. Israel Dvorine for supplying me with the information on how to obtain his Dvorine Color Blindness Test.

Finally, special gratitude is expressed to my husband and son for their patience, support, and many sacrifices.

TABLE OF CONTENTS

LIST OF TABLES

# CHAPTER I

## THE PROBLEM AND ITS IMPORTANCE

This study was concerned with the development of a screening test that a classroom teacher may use in identifying kindergarten children's ability to identify colors. Color is one of the areas the kindergarten teacher helps the child investigate. The kindergarten child learns color names through songs, games, associating color in learning about the seasons, through experimenting with paint and crayons and in the differences in color of animals. In working with color in these ways it is assumed that if the child does not know his color names he will be able to learn them.

However, because there are children who cannot associate color with color names, teachers need a tool that will differentiate children who cannot learn colors from those who may not know them. If a teacher can determine that a child is color blind she can then help modify the feeling of anxiety for him by encouraging him to work with the colors he may know. Thus, he can achieve and feel confident in participating in activities with the group (16).

Most kindergarten children begin their first year of public school full of enthusiasm and excitement. They are introduced to many new activities and take pride in being able to accomplish these new tasks. But what about the child who cannot perform a specific task? This study is designed to develop a screening procedure which will assist the

kindergarten teacher in the area of color identification. The investigator anticipates the findings from this study will assist the kindergarten teacher in ultimately identifying children who may be color blind.

Dvorine (8) and Peters (16) have reported that between five and ten per cent of males are color blind. In teaching five year old children their colors this investigator has become very concerned about those children who cannot learn colors. The question is then raised, are these children simply not ready at this stage to associate color names with colors, or is this one of the first signals of a learning disability or are these children unable to see the colors? Are they color blind? If these children are color blind this investigator believes that early detection of this disability is important so that an individual may be guided and taught to accept this personal characteristic. Peters (16) found evidence that strong emotional factors involving self concept in these children were anxiety, fear of being ridiculed and shame at not being able to do what their classmates are doing. If the teacher is aware of this disability she can help to reduce this anxiety.

If color blind children knew early of their color deficiency they could avoid suffering disappointment and the wasted years of study and money in preparing for a field in which they cannot achieve. Examples of these careers are pilots, doctors, chemists, electronic specialists where color codes are very important, color T. V. repairmen, and interior designers. Dvorine (8) stated:

> If one in every ten males is color blind then it would stand to reason that the schools should begin testing children for color vision deficiency early. . . . This would help prevent

> the possibility of a child considering a career that they could not biologically fit in. (p. 100)

Peters (16) advocates testing children for color blindness early in their school years and indicating on their individual records their ability to perceive colors. A counseling session should then be arranged later to discuss the handicap of color blindness with the student and parents and this should be done before any extensive planning for advanced technical training and before a vocation has been decided upon.

## Purpose of the Study

The purpose of this study was to establish a simple procedure by which the kindergarten teacher may identify children who do not know their colors because of color blindness or because they simply may not know their colors. Such a test will be useful in identifying children who would need further examination to test for color blindness.

## Definitions

For this study the following definitions were accepted:

Color: Webster's Dictionary (22) defined color as "a phenomenon of light (red, brown, pink, gray) or visual perception that enables one to differentiate otherwise identical objects" (p. 34).

Color Discrimination: Burnham (3) describes color discrimination as "the awareness or perception of differences among colors" (p. 151).

Quasi Colors: In this study, quasi colors refer to the colorless colors (white, black or gray).

Hue: Refers to the chromatic quality of a color which we indicate

by its name (such as red). In order to change the hue of a color, another color is mixed with it (18).

Brightness: Sargent (18) refers to the relation of a color to black and white. In order to change the value of a color, it is mixed with something lighter or darker than itself.

Saturation: In this study, saturation refers to the strength of a hue when mixed with a colorless color (brilliant blue or dull blue).

Color Spectrum: Another color term utilized in this study is that of color spectrum. The spectrum refers to the series of images formed when a beam of radiant energy is subjected to dispersion and brought to focus so that the component waves are arranged in the order of their wave lengths (22). The colors are arranged from red, the longest wave length to violet, the shortest wave length.

Color Blindness: Total or partial inability to distinguish or recognize chromatic colors (21).

## CHAPTER II

## RELATED LITERATURE

Color is made up of four primal variants or hues, red, yellow, green, and blue. In the spectrum all other colors are a variant of these four hues. Red can mix with yellow to give orange or can mix with blue to give violet or purple; but red cannot mix with green for the two are not compatible and will not blend in any form. Yellow can mix with red to give orange or mix with green to give yellow-green; but yellow will not mix with blue for the two are not compatible. The optical field and the field of painting are in disagreement as to the primal colors. The difference of opinion stems from the artist's use of pigments as contrasted with the focus being on light rays in the optical field. Blue will blend with red and green but will not blend with yellow. Green will blend with yellow and blue, but will not blend with red. Of the four primal variants, each one has a color with which it will not blend (12).

A mixture of a quasi color (colorless color) to the hue determines the saturation or purity of the color. A saturation of white or gray of high brilliance to a color produces a tint of a particular color. For example, the pure color red mixed with the quasi color white, gives us the tint pink. The desaturation of black or gray of low brilliance gives us the shade of a color. For example, the hue of yellow-green desaturated with gray of low brilliance, gives the shade of olive.

Therefore, the four primal variances of color combined with the ones that are compatible give the blend of a color and the mixture of the primal hues or their blends with black, gray, or white gives the shade or tint of a particular hue. The source of color then is determined by hue, saturation, and brightness. The high brilliance color, white, is at the top of the color line, while black is at the bottom and gray somewhere inbetween (12).

## Age at Which Children Differentiate Colors

Stables (19) observed infants ranging in ages from sixty-nine days to twenty-four months and found that the perception of differences in color objects begins at about the age of three months. Parsons (14) found that at an early age children could associate colors with concrete objects, but they are unable to distinguish colors until toward the end of the second year and red is recognized earlier than blue.

Cook (5) found that by the age of two, children could match colors with an accuracy of 45 per cent and could name the four primary colors with an accuracy of 25 per cent, but by the age of six, their accuracy had increased to 97 per cent respectively. Children of the ages ranging from two years to six years match colors better than they can name them. Dale (6) stated that:

> Four year old children generally give single word names to colors when asked to describe them and by the age of six they have a relatively well-developed system of color names and phrases. (p. 1136)

Bateman (2) reported that: "In the fifth year school training increases color naming ability and that recognition and naming of colors

is weakest in the cases of orange and purple" (p. 307).

Pronko (17) found a gradual improvement of color naming and discriminating colored numbers with the increase of age. Color naming showed considerable confusion in the kindergarten group, shade naming becoming somewhat stabilized at the first grade level with tint naming showing a more gradual and continuous growth through the fourth grade level.

Young (24) stated:

> Children are slow to distinguish and name colors. They do learn in time by discriminative action with respect to colors and by naming the differentiating experiences. As late as entrance into the first grade, pupils often confuse red and orange, blue and violet, violet and purple. (p. 162)

## Color Blindness

Peters (15) defined color blindness as "A relative insensitivity to certain portions of the spectrum" (p. 572). The color blind person perceives combinations of colors in portions which are different from the way they are seen by the majority of individuals. Those who are color blind may see red as gray, green as brown, or at times confuse red with orange. Blue is usually confused with purple and the color blind person may not see purple at all. Individuals with normal color vision do not see the infra-red and ultra-violet rays of the spectrum, but these can be seen by bees and other living creatures (9).

Parsons (14) reported that the color blind individual sees fewer hues than the normal person. It is impossible to judge the exact hue another person is seeing. The color blind person may learn to distinguish colors by relating the colors of various objects to objects they see every day. An example of this is a child who is told a cherry is

red, an apple is red and that leaves and grass are green. The color blind child unconsciously associates the color red with a cherry even though the color green to him shows very little variant from red. It is by using these aids that some color blind persons can be color blind and not realize it.

Dvorine (9) describes color vision as:

> Seeing is a visual experience but it is the outgrowth of the summation of stimuli from all the senses. The identification of an object is made possible only because of some previous experience with it or with something that resembles it. . . . The perception and identification of color is a visual experience and therefore a learned skill. (p. 169)

Color blindness is not related to any physical defect as far as seeing clearly or any other functional visual defect. The only relationship with visual defectiveness is when a person has a progressive organic disease of the eye and this is very rare (16).

Color blindness is permanent. The use of drugs and vitamins or even attempts to retrain an individual to improve his perception of colors have met with very little success. Color blindness is hereditary and generally transmitted through the female even though she may not be affected. An affected male will sometimes transmit to his son, but an unaffected male never carries color blindness (16).

Color blindness is either total or partial, congenital or acquired. Total color blindness is extremely rare and is usually associated with some ocular disease. Partial color blindness is usually congenital and the person is not aware of it. Acquired color blindness is usually found in older people and associated with a health problem or with the aging process (8).

De Reuck (7) reports that: "Red-Green blindness is most frequent among Caucasian whites and least frequent among Negroes and Australian

aborigines" (p. 243). De Reuck attributes these findings to the relaxation of natural selection, owing to removal from direct hunting and food gathering of about one hundred and twenty generations since Neolithic times.

## Types of Color Blindness

There are many types of color blindness. Color blindness was once thought to be either red-blindness or green-blindness and many tests were devised simply to measure this deficiency (15). Color specialists have termed color vision as Trichromats, Dichromats and Monochromats.

Trichromats are those individuals whose color vision is judged to be normal to the majority. A subdivision under this heading is the anamalous trichromats who are those individuals who are judged to have normal color vision but need different amounts of red or green in their color mixtures from the majority (20).

Dichromats are those individuals who have a color weakness. There are three types of Dichromats. The first type are the Protanopes who are those individuals who cannot see the color red. Dueteranopes are the second type of Dichromats. Dueteranopes cannot see the color green and of these two types, the Deuteranopes are the most common types of color blindness. The third is the Tritanopes or the blue blind. The Tritanope type is rare and is caused mostly by disease. It is most common in cases of detachment of the retina (20).

Monochromats are those individuals who are totally color blind. Linsky (12) states that "Monochromate is transmitted in an antosomal recessive manner and occurs as often as one case in about 300,000" (p. 180). Monochromats see all parts of the spectrum as gray, the parts

differing only in luminosity. The part which appears to them the brightest is what Trichromats (normals), call green. The condition is congenital and Monochromats usually have very bad central vision (14).

## Effects of Color Blindness

There are eight million persons in the United States who are affected by color blindness in one way or another. These people can never see nature in all its splendor. Aside from the aesthetic pleasure of seeing, there are those who are driving cars. Some of these color blind individuals are endangering their own lives, as well as those of others, because of color blindness of which they are unaware (9). One solution to this problem was the idea of placing the red traffic light above the green at stop signs. At underpasses, the traffic lights should be positioned in a horizontal position with the red light always to the left of the green light (1). There are also advantages of being color blind. During World War II, color-blind men were used to identify camouflaged buildings and other objects and installations.

Our schools are full of color for the young child--beads, puzzles, picture matching cards, even some of the chalkboards are painted green. What is designed to help the normal children learn colors places the defective child in a world of confusion (22). Espinda (10) did a color blind study involving children who were in the third and sixth grades and compared these children to children who were placed in EH (Educationally Handicapped) classes. The results suggested:

> Color vision deficiency was associated with children reflecting known learning disabilities significantly more often than with children with no known learning disorders. Therefore, color vision deficiency might be associated with failure to cope with classroom expectancies in the early grades

> and these perceived inadequacies may result in observable behavioral patterns inimical to the normal learning process. (p. 45)

Thuline (21) reported:

> A higher incidence of referrals of color vision deficient students to the psychologists for behavior problems in kindergarten and first grade children than children with normal color vision. . . . The possibility of using color in teaching techniques places the color deficient child at an unrecognized disadvantage which can result in behavioral patterns warranting referral to the psychologist. (p. 43)

Weddington (23) studied a group of children who were from the deaf, physically handicapped and subnormal schools. Although the sample was small, Weddington concluded that there may be a higher percentage of children with color defects in special schools. She also stated:

> This may be accounted for by the fact that many of the children are in special schools because of blood or circulatory troubles, and internal hemorrhages are recognized as a cause of visual defects. (p. 239)

Weddington (23) has also reported:

> Most of the children with defective color vision succeed in covering up their difficulties in normal life. Probably ridicule brings this about as no little boy who is laughed at for making grass red will willingly make that mistake again. (p. 234)

Therefore, it is important that the teacher should know as soon as possible if a child is color blind. If the teacher is aware of this disability she can help to reduce much of this anxiety for the child.

## Summary

The literature related to this study revealed the following implications:

1. Children begin distinguishing colors at the end of their second year and in their sixth year have developed a relatively good system of

color names and phrases.

2. Perception and identification of color is a visual experience and therefore a learned skill.

3. Color blindness is permanent, hereditary, and either total or partial.

4. Five to ten per cent of our male population is color blind.

# CHAPTER III

## PROCEDURE

To achieve the purpose of this study, which was to establish a simple procedure that a kindergarten teacher may use to identify children who cannot learn their colors because of color blindness and children who may not know their colors, the following steps were followed:

1. A design for this study was submitted to Dr. Paul McCloud, Director of Instructional Research of the Tulsa Public Schools, with the request for permission to obtain data from nine public kindergartens with the public school system (Appendix B). Permission was granted and the kindergarten teachers were instructed on the methods to be used in administration of the color test. Score sheets to record the child's responses may be found in Appendix A. The score sheets were delivered and picked up by the researcher after school hours.
2. Development of a procedure to differentiate between children who know their colors and those who do not.
3. Examination of available color blindness tests. A discussion of these tests follows with a basis for selection of a test to be used in this study.

### Description of Subjects

The subjects for this study were 529 kindergarten children from

the Tulsa Public School Kindergartens. The children came from various socio-economic levels.

## Color Blindness Tests

There are several standardized tests that the classroom teacher can use to screen for color blindness. Many of these tests merely require reading a series of numbers which appear among groups of colored dots. For the kindergarten child the test merely requires the child to trace with his finger the path running through the dots. The time element required to administer the test to each child averages from one to five minutes and the diagnosis is self-evident (4). The disadvantages of available tests is that they are difficult for the classroom teacher to obtain, and in addition they are expensive. Available color blindness tests are described in this section.

### Ishihara Color Blindness Test

This test consists of a series of plates which present digits as the figures. Both the figure and the background consist of smaller and larger discs. The eighteen plates have different color mixtures. The color blind individual will not be able to read the plates in the area he is color blind. The test also contains a section for preschool children and illiterates using a path winding through a series of colored discs. This test was considered unacceptable because the section used to test illiterates and preschool children was not evaluated and Linksz (12) reported the test as being very rigorous.

Hardy, Rand and Rittler Color Blindness Test (H.R.R. Test)

The figures in this test are printed on a gray background. Some of the plates have two figures presented on the gray background with one figure being green and the other figure being a bluish green in color. A person with normal color vision will see both. Other plates present figures of the same two colors but are composed of dots of increasingly greater saturation. The time required to give the test is one to three minutes and the test was designed for those persons four years of age and older. Cost of the test is $20. This investigator could find no data on reliability.

Farnsworth Tritan Test

This test is a series of plates which consist of an array of colored discs. Most of the discs forming the background are violet. Two squares are formed on the plate, one square being composed of faint blue discs, the other square being composed of a more conspicuous green. The red-green defective will see the green square and not the blue, while the tritan (the blue blind) will see the blue square only. The blue square to the tritan appears gray while the green disc fades into the background and the red green defective sees the green square as gray and the blue fades into a background of blue for them (13). This test must be administered and interpreted by a medical doctor.

American Optical Test

This test consists of eighteen plates. Each plate consists of a

crazed pattern of colored dots. The colors of the background on each plate consists of a confusion zone for the color blind. The individual who is color blind sees no number when the background and figures are composed of colors in the area in which they are color blind (13). This test employs the ability of the individual to be able to read a set of numbers camouflaged by a crazed pattern of colored dots. Therefore, this test is unacceptable for testing five year old children since many of these children do not as yet know their numbers.

Freeman Illuminant Stable
Color Vision Test

This test consists of twelve plates using the reciprocal influences of color and form in the perceptual organization of numbers on the plate. The test makes use of the confusion zones of color for the color blind using form factors rather than the crazed pattern of dots as the American Optical does. The Freeman test was devised for those persons four years of age and older and requires one to five minutes to administer (13). This test is unacceptable for five year old children since it employs configural patterns which are unfamiliar to many who take the test, making it more difficult to administer and less reliable when used by untrained personnel.

Dvorine Psuedo-Isochromatic Plates
Color Blindness Test

This test consists of two sections. One section is made up of fourteen plates of eight different colors. The second section is composed of seven plates featuring trails instead of digits. Each of these

plates consists of different color combinations, but similar to the color combinations of the first section. The second section may be used to test preschool age children or as a corroborative test when an individual fails to identify plates of the first section. When testing a child using the second section the child should be furnished with a thin brush or other non-scratching pointer and directed to outline or trace the trail on the demonstration plate and the seven trails that follow it. No more than five seconds are to be allowed for the identification of each plate; and hesitant studied responses, or tilting and turning of the head should be noted and recorded. Behavior of this nature is generally associated with defective color vision. Incorrect response to one plate of the second section of this test is to be considered normal color vision, while incorrect responses to two or more plates is to be considered defective color vision. This test was determined to be acceptable by this investigator in screening five year old children for color blindness since it was developed for persons three years of age and older and requires only three minutes to administer. Linksz (12) referred to the Dvorine Test as "One of the best Psuedo-Isochromatic test systems, with well selected confusion colors" (p. 232).

## Development and Administration of the Kindergarten Color Screening Test

The following method was employed to establish a simple procedure by which the kindergarten teacher can identify those children who know their colors from those who do not. The children were tested at the first of the school year to determine those children who knew their

colors and those who do not know their colors. This was done by placing eight colored balls in a gray box in front of the child. Eight ping pong balls were painted red, brown, yellow, blue, green, purple, orange and black. The color of paint was mixed to correspond to the colors used in the Dvorine color wheel. The tester then asked the child to name the colors of the balls in the box. The tester recorded the correct or incorrect response on the score sheet, Appendix A. After the tester had asked the child to identify all eight colors, the kindergarten teacher then taught colors through games, stories, and songs for two months. At the end of this two month period the kindergarten teacher again used the colored balls to test those children who did not know their colors at the first of school and those who did not know their colors at the end of two months. Those children who still did not know their colors were then given the Dvorine Color Blindness Test. The results were recorded on the score sheet (Appendix A) and data are presented in Chapter IV.

# CHAPTER IV

## ANALYSIS OF DATA

The purpose of this study was to establish a simple procedure by which the kindergarten teacher may identify children who cannot learn their colors because of color blindness and children who may not know their colors. To achieve this purpose, children were tested at the first of the school year to determine those children who knew their colors and those who did not. The sample for this study was 529 children; 271 boys and 258 girls. The results are presented in Tables I and II in terms of frequency and percentages. Table I reflects that of the 529 students tested, 380 (72 per cent) knew their colors at the first of the school year and 194 children (28 per cent) did not. Table II presents the responses according to sex and reveals that of the 380 children in Table I who knew their colors, 174 were boys and 206 were girls. Of the 149 children in Table I who did not know their colors, 97 were boys and 52 were girls.

After the initial testing, the kindergarten teachers then taught colors through games, stories, and songs for a period of two months. At the end of this period, the children who did not know their colors at the first of school were again tested. The results are presented in Tables III and IV. Table III reflects that at the end of the two month teaching period, 88 children (59 per cent) of those children who did not know their colors at the initial test did, and that 61 children

TABLE I

RESULTS OF INITIAL COLOR TESTING ACCORDING TO NUMBER AND PERCENTAGE (N = 529)*

| School | Total Students Tested | Knew Colors | | Did Not Know Colors | |
|---|---|---|---|---|---|
| | | N | % | N | % |
| Irving | 26 | 12 | 46 | 14 | 54 |
| Mayo | 56 | 52 | 93 | 4 | 7 |
| Lee | 49 | 45 | 92 | 4 | 8 |
| Greeley | 75 | 42 | 56 | 33 | 44 |
| Reed | 54 | 47 | 87 | 7 | 13 |
| Lindbergh | 86 | 71 | 83 | 15 | 17 |
| Kendall | 85 | 52 | 61 | 33 | 39 |
| Grimes | 28 | 26 | 93 | 2 | 7 |
| Cherokee | 70 | 33 | 47 | 37 | 53 |
| TOTALS | 529 | 380 | 72 | 149 | 28 |

*N = Number

TABLE II

RESULTS OF INITIAL COLOR TESTING ACCORDING TO SEX
(N = 529)*
(B = 271; G = 258)

| School | BOYS | | | | GIRLS | | | |
|---|---|---|---|---|---|---|---|---|
| | Knew Colors | | Did Not Know Colors | | Knew Colors | | Did Not Know Colors | |
| | N | % | N | % | N | % | N | % |
| Irving | 8 | 47 | 9 | 53 | 4 | 44 | 5 | 56 |
| Mayo | 32 | 94 | 2 | 6 | 21 | 91 | 2 | 9 |
| Lee | 22 | 92 | 2 | 8 | 23 | 92 | 2 | 8 |
| Greeley | 20 | 49 | 21 | 51 | 22 | 65 | 12 | 35 |
| Reed | 21 | 87 | 3 | 13 | 26 | 87 | 4 | 13 |
| Lindbergh | 25 | 74 | 9 | 26 | 46 | 88 | 6 | 12 |
| Kendall | 17 | 41 | 24 | 59 | 35 | 80 | 9 | 20 |
| Grimes | 12 | 86 | 2 | 14 | 14 | 100 | 0 | 0 |
| Cherokee | 18 | 42 | 25 | 58 | 15 | 56 | 12 | 44 |
| TOTALS | 174 | 64 | 97 | 36 | 206 | 80 | 52 | 20 |

*N = Number; B = Boys; G = Girls

TABLE III

RESULTS OF SECOND COLOR TESTING ACCORDING TO FREQUENCY AND PERCENTAGE (N = 149)*

| School | Total Students Tested | Knew Colors | | Did Not Know Colors | |
|---|---|---|---|---|---|
| | | N | % | N | % |
| Irving | 14 | 8 | 57 | 6 | 43 |
| Mayo | 4 | 2 | 50 | 2 | 50 |
| Lee | 4 | 2 | 50 | 2 | 50 |
| Greeley | 33 | 20 | 61 | 13 | 39 |
| Reed | 7 | 4 | 57 | 3 | 43 |
| Lindbergh | 15 | 7 | 47 | 8 | 53 |
| Kendall | 33 | 19 | 58 | 14 | 42 |
| Grimes | 2 | 0 | 0 | 2 | 100 |
| Cherokee | 37 | 26 | 70 | 11 | 30 |
| TOTALS | 149 | 88 | 59 | 61 | 41 |

*N = Number

TABLE IV

RESULTS OF SECOND COLOR TESTING ACCORDING TO SEX
(N = 149)
(B = 99; G = 50)

| School | BOYS | | | | GIRLS | | | |
|---|---|---|---|---|---|---|---|---|
| | Knew Colors | | Did Not Know Colors | | Knew Colors | | Did Not Know Colors | |
| | N | % | N | % | N | % | N | % |
| Irving | 5 | 56 | 4 | 44 | 3 | 60 | 2 | 40 |
| Mayo | 2 | 50 | 2 | 50 | 0 | 0 | 0 | 0 |
| Lee | 1 | 50 | 1 | 50 | 1 | 50 | 1 | 50 |
| Greeley | 13 | 62 | 8 | 38 | 7 | 58 | 5 | 42 |
| Reed | 1 | 33 | 2 | 67 | 3 | 75 | 1 | 25 |
| Lindbergh | 4 | 44 | 5 | 56 | 3 | 50 | 3 | 50 |
| Kendall | 15 | 63 | 9 | 37 | 4 | 44 | 5 | 56 |
| Grimes | 0 | 0 | 2 | 100 | 0 | 0 | 0 | 0 |
| Cherokee | 17 | 68 | 8 | 32 | 9 | 75 | 3 | 25 |
| TOTALS | 58 | 59 | 41 | 41 | 30 | 60 | 20 | 40 |

*N = Number; B = Boys; G = Girls

(41 per cent) still did not. Table IV indicates that of those children who had learned their colors after the two months period, 58 (59 per cent) were boys and 30 (41 per cent) were girls.

The children who did not know their colors were then given the Dvorine Color Blindness Test to determine if those children who had not learned their colors after the two months period were color blind or were unable to learn their colors, but had not because of immaturity or other reasons. The results of the Dvorine Color Blindness Test are presented in Tables V and VI. Table V reflects that of the 61 children who did not know their colors, 33 children (54 per cent) had normal color vision and 28 children (46 per cent) were color blind. Table VI indicates that of the 33 children who had normal color vision, 22 were boys and 11 were girls. Of the 28 children who were color blind, 19 were boys and 9 were girls.

The data reveal that of the 529 children tested, 28 or five per cent of the children were color blind. Of the 271 boys, seven per cent were color blind. Three per cent of 258 girls were color blind. These figures agree with the studies conducted by Dvorine and Peters, indicating that between five and ten per cent of the male population are color blind and a lesser per cent girls are color blind.

TABLE V

RESULTS OF DVORINE COLOR BLINDNESS TEST
ACCORDING TO NUMBER AND PERCENTAGE
(N = 61)*

| School | Total Students Tested | Normal Color Vision | | Color Blind | |
|---|---|---|---|---|---|
| | | N | % | N | % |
| Irving | 6 | 5 | 83 | 1 | 17 |
| Mayo | 2 | 1 | 50 | 1 | 50 |
| Lee | 2 | 0 | 0 | 2 | 100 |
| Greeley | 13 | 5 | 38 | 8 | 62 |
| Reed | 3 | 0 | 0 | 3 | 100 |
| Lindbergh | 8 | 2 | 25 | 6 | 75 |
| Kendall | 14 | 13 | 93 | 1 | 7 |
| Grimes | 2 | 1 | 50 | 1 | 50 |
| Cherokee | 11 | 6 | 55 | 5 | 45 |
| TOTALS | 61 | 33 | 54 | 28 | 46 |

*N = Number

TABLE VI

RESULTS OF DVORINE COLOR BLINDNESS TEST
ACCORDING TO SEX
(N = 61)*
(B = 41; G = 20)

| School | BOYS | | | | GIRLS | | | |
|---|---|---|---|---|---|---|---|---|
| | Knew Colors | | Did Not Know Colors | | Knew Colors | | Did Not Know Colors | |
| | N | % | N | % | N | % | N | % |
| Irving | 3 | 75 | 1 | 25 | 2 | 100 | 0 | 0 |
| Mayo | 1 | 50 | 1 | 50 | 0 | 0 | 0 | 0 |
| Lee | 0 | 0 | 1 | 100 | 0 | 0 | 1 | 100 |
| Greeley | 3 | 38 | 5 | 62 | 2 | 40 | 3 | 60 |
| Reed | 0 | 0 | 2 | 100 | 0 | 0 | 1 | 100 |
| Lindbergh | 1 | 20 | 4 | 80 | 1 | 33 | 2 | 67 |
| Kendall | 8 | 89 | 1 | 11 | 5 | 100 | 0 | 0 |
| Grimes | 1 | 50 | 1 | 50 | 0 | 0 | 0 | 0 |
| Cherokee | 5 | 63 | 3 | 37 | 1 | 33 | 2 | 67 |
| TOTALS | 22 | 54 | 19 | 46 | 11 | 55 | 9 | 45 |

*N = Number; B = Boys; G = Girls

# CHAPTER V

## SUMMARY, FINDINGS, AND RECOMMENDATIONS

The purpose of this study was to establish a simple procedure by which the kindergarten teacher may identify children who cannot learn their colors because of color blindness and children who may not know their colors. To achieve this purpose, kindergarten children were tested at the first of the year to determine those children who knew their colors and those who did not. Colors were then taught for two months and those children who did not know their colors at the first of the school year were again tested. Those children who still did not know their colors were then given the Dvorine Color Blindness Test to determine if the reason for not learning their colors was due to color blindness.

The subjects for this study consisted of 529 children enrolled in nine different kindergartens in the Tulsa Public Schools; 271 boys and 258 girls.

### Major Findings

The results of this study were as follows:

(1) Seventy-two per cent (380 children) knew their colors at the first of the school year.

(2) Twenty-eight per cent (149) of the children did not know their colors at the first of the school year. Thirty-six per cent of

these were boys and twenty per cent were girls.

(3) Of the 149 children who were retested, 88 knew their colors and 61 did not. Of the 88 children who knew their colors, sixty-six per cent were boys and thirty-four per cent were girls.

(4) Forty-one per cent of the 149 children who did not know their colors at the first of the school year still did not know their colors after a two month period of teaching.

(5) Of the 529 children tested, five per cent were color blind. According to sex, seven per cent of the 271 boys and three per cent of the 258 girls were color blind.

From these findings, it may be concluded that the screening technique developed in the present study is a useful device for identifying children who do not know their colors and children who are unable to learn their colors. Thus, it is a valuable tool in identifying those children who may be color blind and who require further testing to ascertain their inability to learn to identify color.

## Recommendations

This investigator believes the findings of this study reveal a need to determine at an early age if a child is color blind and help him recognize his handicap and learn to compensate for it. The following recommendations are based on the findings of this study:

(1) Kindergarten teachers may use a box of Jumbo Primary crayons in place of the colored balls. The colored balls were used in this study to match as closely as possible the colors used in the Dvorine test.

(2) Results of the color blindness test should be indicated on the

cumulative record of the child to alert other teachers to his inability to recognize certain colors.

(3) The child should be retested in a later grade to verify or refute findings at the kindergarten level. If the child is again found to be color blind, counseling should be available to the parents to help them in the future concerning career choices for their child.

(4) All kindergarten children should be screened for color blindness prior to entrance to the public schools or shortly thereafter. This could become the responsibility of the school nurse.

A SELECTED BIBLIOGRAPHY


1. Abarbanel, Albert. "Problems of Color Blind People." Science Digest. Vol. 49 (June, 1961), 69-73.

2. Bateman, W. G. "The Naming of Color by Children." Child Development. Vol. 2 (1931), 303-320.

3. Burnham, Robert W., Randall M. Hanes, and C. James Bartleson. Color: A Guide to Basic Facts and Concepts. New York: John Wiley and Sons Inc., 1963.

4. Buros, Oscar Kristen. The Fifth Mental Measurements Yearbook. New Jersey: The Gryphon Press, 1959.

5. Cook, W. M. "Ability of Children in Color Discrimination." Child Development. Vol. 2 (1931), 303-320.

6. Dale, Phillips S. "Color Matching and Recognition by Preschoolers." Child Development. Vol. 40 (1969).

7. De Reuck, A. V. S., and Julie Knight. Colour Vision. Boston: Little Brown and Company, 1965.

8. Dvorine, Israel. "Color Blindness in the Schools." National Association of Secondary School Principals Bulletin. Vol. 38 (1954), 100-101.

9. Dvorine, Israel. "They Can Never See a Rainbow in the Sky." Education. Vol. 78 (1957), 167-172.

10. Espidia, Stanley D. "Color Vision Deficiency: A Learning Disability?" Journal of Learning Disabilities. Vol. 6 (March, 1973), 164-166.

11. Farnsworth, D. "The Color Blind Also Go to the Play." Quarterly Journal Speech. Vol. 26 (1940), 550-553.

12. Linksz, Arthur, M.D., F.A.C.S. Color Sense: An Essay on Color Vision and Clinical Color Vision Tests. New York: Grune and Stratton, 1964.

13. Mayer, Jack J., and Michael A. Zaccaria. "The Evaluation of a Color-Naming Test for Color Blindness." Journal of Applied Psychology. Vol. 39 (1955), 160-161.

14. Parsons, Sir John Gerbert. An Introduction to the Study of Color Vision. New York: Cambridge at the University Press, 1915.

15. Peters, George A. "A Color Blindness Test for Use in Vocational Guidance." Personnel and Guidance Journal (May, 1956), 572-575.

16. Peters, George A. "Color Blindness." Exceptional Children (March, 1957), 241-245.

17. Pronko, N. H., J. W. Bowles, and F. W. Snyder. "An Experiment in Pursuit of Color Blindness." Journal of Genetic Psychology. Vol. 74 (March, 1949), 125-142.

18. Sargent, Walter. The Enjoyment and Use of Color. New York: Charles Scribner's Sons, 1923.

19. Stables, R. "The Responsiveness of Infants to Color." Journal of Experimental Psychology. Vol. 15 (1932).

20. Teevan, Richard, and Robert C. Birney. Color Vision an Enduring Problem in Psychology. New Jersey: Van Nostrand, 1961.

21. Thuline, H. C. "Color Vision Defects in American School Children." Journal of American Medical Association (May, 1964).

22. Webster's New World Dictionary of the American Language. Cleveland and New York: The World Publishing Co., 1965.

23. Weddington, Mary. "Color Blindness in Young Children." Educational Research. Vol. 7-8 (1965), 234-239.

24. Young, K. Social Psychology. New York: Crofts, 1946.

# APPENDIX A

COLOR IDENTIFICATION SCORE SHEET

NAME_____ M F_____ Age_____ Date_____ No.___

First of School Color Identification Test

| Pass | Fail |
|---|---|
| Red | |
| Green | |
| Yellow | |
| Blue | |
| Orange | |
| Purple | |
| Brown | |
| Black | |

DIAGNOSIS:

Number Missed _____

Knows Colors _____

Does Not Know Colors _____

Remarks:

COLOR BLINDNESS SCORE SHEET

NAME_____ M F_____ Age_____ Date_____ No.___

Dvorine Color
Discrimination Test

| Plate Sequence | Pass | Fail |
|---|---|---|
| 16. Demonstration Plate | | |
| 17. | | |
| 18. | | |
| 19. | | |
| 20. | | |
| 21. | | |
| 22. | | |
| 23. | | |

DIAGNOSIS:

Normal _____

Color Blind _____

Remarks:

August 21, 1973

Dr. Paul McCloud
Director of Instructional Research
Tulsa Public Schools
3027 South New Haven
Tulsa, Oklahoma 74145

Dear Dr. McCloud:

This is to confirm the sponsorship of Mrs. Elinor Shepherd's research on color blindness in kindergarten children, and to thank you for your cooperation in permitting our graduate students to use the public school children to obtain data.

We hope this project will be valuable to teachers who work with young children, as well as to Mrs. Shepherd. Your school system is fortunate to have a person that is so concerned with the needs of young children.

Sincerely yours,

Josephine Hoffer
Adviser and Acting Head
Department of Family Relations
and Child Development

JH:cw

September 4, 1973

Dr. Josephine Hoffer
Department of Family Relations and
Child Development
Oklahoma State University
Stillwater, Oklahoma 74074

Dear Dr. Hoffer:

Your request for permission for Mrs. Elinor Shepherd to test kindergarten children in nine schools for color blindness has been approved, subject to the following conditions:

1. Mrs. Shepherd must contact each principal personally, explain the program to him, and secure his approval to test pupils in his school.

2. Participation by any kindergarten teacher is entirely voluntary.

3. Mrs. Shepherd is to deliver to each building all materials needed for the study. (School mail service cannot be used for this purpose.)

At the conclusion of the study, an abstract of the findings is to be sent to the Superintendent and to the Principal of each participating school.

Sincerely,

Paul I. McCloud, Assistant to Superintendent
Research, Planning and Development

PIM:bjb

cc: Mr. Cecil Benson
Dr. John Dewell
Mr. Johnson Lee
Dr. George Truka
Mrs. Elinor Shepherd
Mr. James McGuire, Principal, Cherokee Elementary School
Mrs. Elsie Rains, Principal, Greeley Elementary School
Mr. Joe Maxfield, Principal, Grimes Elementary School
Mrs. Wilma Burleson, Principal, Irving Elementary School
Mr. John R. Smith, Principal, Kendall Elementary School
Dr. Harry McPhail, Principal, Lee Elementary School
Mr. William T. Voight, Principal, Lindbergh Elementary School
Mr. Howard Fink, Principal, Mayo Elementary School
Mr. Arley U. Garrett, Principal, Reed Elementary School

VITA 2

Ruth Eleanor Shepherd

Candidate for the Degree of

Master of Science

Thesis: SCREENING KINDERGARTEN CHILDREN FOR COLOR IDENTIFICATION

Major Field: Family Relations and Child Development

Biographical:

Personal Data: Born in Sparks, Oklahoma, September 16, 1940, the daughter of Mr. and Mrs. Tommy Troy Cutsinger.

Education: Graduated from Claremore High School, Claremore, Oklahoma, in 1958; received Bachelor of Science degree in Education from Northeastern State College, Tahlequah, Oklahoma, in January, 1970, with a major in Elementary Education; completed requirements for the Master of Science degree in Family Relations and Child Development in May, 1974, from Oklahoma State University at Stillwater, Oklahoma.

Professional Experience: Taught kindergarten four years in the Tulsa Public School System.

Professional Organizations: Oklahoma Educational Association; National Education Association; Tulsa Classroom Teachers Association.