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The Effect of the Frostig Program for the Development of Visual Perception on Readiness Skills

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THE EFFECT OF THE FROSTIG PROGRAM FOR THE DEVELOPMENT OF VISUAL PERCEPTION ON READINESS SKILLS

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CHAPTER I

INTRODUCTION

Research on the relationship between young children's visual perception and academic success, especially in the reading area, is pertinent to this study. Although such research is abundant, the investigator believed there was a need to establish whether a specific visual perception training program, such as the Frostig Program for the Development of Visual Perception, would significantly improve readiness skills for kindergarten children.

I. PURPOSE OF THE STUDY

The purpose of this investigation was to evaluate what effect use of the Frostig Program for the Development of Visual Perception would have on readiness skills for kindergarten children. The results of this study would appear to have meaning for elementary school teachers, administrators and school counselors.

II. HYPOTHESIS

Specifically, the following hypothesis was tested: There will be no significant difference in readiness level reflected by the Metropolitan Readiness Test between kindergarten students who received Frostig Visual Perception training and those who received no special visual perception training.

Gesell and his collaborators stress the organismic nature and take the position that visual perception involves the body as a whole. The hypothesis of this study was formulated on the premise that visual perception develops out of the sensory-receptor mechanisms of actual contact in infancy and childhood. Another underlying theory in this study is Piaget's contention that perceptual ability progresses through regular developmental stages, with maximum development between the ages of 4 and 7. There is less growth after the age of approximately 7½, when cognitive functions begin to predominate (Frostig & Horne, 1964). Research confirms the contention that the development of visual-perceptual processes is the major function of the growing child between the ages of 3 and 7. At this age level, perceptual development becomes a most sensitive indicator of the developmental status of the child as a whole, as well as reading ability in particular (Frostig & Horne, 1964).

The results of studies in the Review of Related Literature suggest the need to test visual perception and provide visual perception training at the early grade levels, particularly kindergarten and grade one, in addition to administering tests of intelligence and reading readiness.

III. DEFINITIONS

Perception

For the purposes of this study, perception is defined as:

> The ability to recognize stimuli. This ability includes not only the reception of sensory impressions from the outside world and from one's own body, but the capacity to interpret and identify the sensory impressions by correlating them with previous experiences. The recognition and integration of stimuli is a process that occurs in the brain, not in the receiving organ, such as the ear or the eye (Frostig & Horne, 1964, p. 7).

Visual Perception

> Visual perception (which should become the supreme skill for more complete and adequate concepts of our world of people, objects, words, pictures, direction, distance, size, shape, color and texture) develops out of the sensory-receptor mechanisms of actual contact. . . . The child's ability to perceive the details of similarities and differences, relationships and individualities within his world provides him with his 'working concepts' (Getman, 1962, p. 31).

Readiness

Readiness in a very general sense is the "preparedness to respond or react" (English & English, 1958, p. 441). More specifically, it refers to:

> A state or condition of the person that makes it possible for him to engage profitably in a given learning activity. It depends on (a) maturity, (b) relevant preparatory training, and (c) an aroused interest or motive. While readiness is sometimes spoken of as if it were a trait or entity, there is no single condition of readiness; it is a composite of many personal qualities and conditions and differs from one learning task to another (English & English, 1958, p. 441).

CHAPTER II

REVIEW OF LITERATURE

An abundance of research has been completed in the field of visual perception. The results indicate that the visual perceptual process is extremely complex. Of particular interest in this paper is research which has been written on the relationship between young children's visual perception and academic success, particularly in the area of reading.

Following is the general outline of this review of literature: (1) General Background of Perception; (2) General Background of Visual Perception, in Particular; (3) The Development of Visual Perception in Young Children and Experiences Which Affect This Development; (4) The Relationship of Visual Perception to Reading; (5) Causes of Disabilities in Visual Perception and Their Effect on Reading Growth; (6) Description and Use of the Frostig Developmental Test of Visual Perception for Diagnosing Visual Perception Problems; (7) Description and Use of the Frostig Program for the Development of Visual Perception for Training and Remedial Measures.

General Background of Perception

Perception is one of the prime psychological functions. It is the bridge between the human being and his environment.

"The concept of perception, like other psychological concepts, is fuzzy at the boundaries. It melts into the concept of sensation on the one hand, and of concept formation or cognition, on the other." Frostig concluded that the definition of perception, like that of intelligence, must at the present time be an operational one. In posing the question, "What role does perception play in the life of the individual?", she stated that she agreed with Ittelson's view that whatever the exact definition of perception may be, it is undebatably "a crucial process intimately involved in the effective functioning of the individual" (Frostig, 1963 b).

An awareness of an existing relationship between perception and learning is not novel. Quintillian began to explore this relationship and to develop teaching programs designed to assist the pupils' learning processes about 70 A.D. In about 1880 Froebel incorporated some of this type of programming in the first training program he developed. Materials designed for training of the senses were utilized by Maria Montessori in her educational experiments in the early 1900's (Mould, 1965).

General Background of Visual Perception

Of the two pre-eminent senses, hearing and vision, the latter appears to be of greater importance for perception of the environment (Frostig and Horne, 1963, p. 7). Visual perception is involved in nearly every action we take.

Gates commented that "There does not appear to be any such thing as general as visual perception. Rather there are abilities to perceive words, digits, geometrical figures, etc.; each of which is relatively independent of other perceptual abilities" (Gates, 1922). As stated earlier and emphasized by Robinson, "Visual perception involves far more than receiving clear impressions" (Robinson, 1946, p. 224). Diack states that "It is not possible for the conscious visual perception of an object to take place without (2) the involvement of past experience and (b) the involvement of other centres besides the visual" (Diack, 1960, p. 36).

Harris (1956, p. 29) observes:

> Even if the eyes are normal, the child may have immature visual perception. Seeing a thing does not always mean noticing its details. Many young children pay attention only to the main characteristics of visual stimuli--the size, shape and color--and ignore the details.

Gesell and his collaborators take the position that vision involves the body as a whole. They stress the organismic nature of vision and insist that people not restrict their attention too sharply to the eyes. A publication of the American Optometric Association states:

> Participating in the visual act is the visceral component regulating the focusing of the eye which allows clear vision at the various distances, the skeletal component, regulating the change in position of the eye, which allows a single vision at the various distances, and with all of this there must be cortical participation for unification of the resulting visual impressions and for interpretation of the objects received (Dechant, 1961).

The Development of Visual Perception in Young Children and Experiences Which Affect This Development

Perceptual ability progresses through regular developmental stages. Flavell has summarized Piaget's developmental periods as follows:

> (1) The period of sensory-motor intelligence (0-2 years). . . .
>
> (2) The period of preparation for and organization of concrete operations (2-11). This period commences with the first crude symbolization late in the sensory-motor period and concludes with the beginning of formal thought in early adolescence. There are two important subperiods. The first, that of pre-operational representations (2-7), is the referent of the term preparation for in the title above. It is that period in early childhood in which the individual makes his first relatively unorganized and fumbling attempts to come to grips with the new and strange world of symbols. Piaget sometimes distinguishes three stages in this first subperiod: (1) beginning of representational thought (2-4); (2) simple representations or intuitions (4-5); (3) articulated representations or intuitions (5½-7). The labor of this preparatory era comes to fruition in the next subperiod, that of concrete operations (7-11). Here, the child's conceptual organization of the surrounding environment slowly takes on stability and coherence by virtue of the formation of a series of cognitive structures called groupings. In this subperiod particularly, the child first begins to 'look' rational and well-organized in his adaptations; he appears to have a fairly stable and orderly conceptual framework which he systematically brings to bear on the world of objects around him.
>
> (3) The period of formal operations (11-15) (Flavell, 1963).

Getman listed six main processes of childhood which are sequential and interrelated areas of total ability development. These steps were listed as follows:

1. The development of general movement patterns for action. . . .

2. The development of special movement patterns of action. . . .

3. The development of eye movement patterns to reduce action. . . .

4. The development of communication patterns to replace action. . . .

5. The development of visualization patterns to substitute for action, speech, and time. . . .

6. The development of visual perception organizations. . . .

He concluded by saying, "It is very important to understand one aspect of this elaborate perceptual development sequence. Most perceptions of our world and its contents are all learned from self outward in infancy and childhood" (Getman, 1962, p. 31).

In kindergarten, children's eyes are still somewhat undeveloped and largely untrained (Lamoreaux, 1943, p. 53). Children must learn through experience to interpret more and more of what is focused on the retina of the eye, for only through experience do the various components and aspects of the world become related to one another in new ways and in new integrations (Mussen, 1963, p. 32).

The Relationship of Visual Perception to Reading

When the child goes to school, accurate visual perceptual abilities enable him to learn to read, write, spell, do arithmetic, and undertake any other work involving the

accurate recognition and reproduction of visual symbols. These are all visual tasks, at least in part, and a child's success in mastering them depends upon his visual perceptual proficiency. Foremost among such tasks is learning to read.

Smith and Dechant pointed out the physical aspect of visual perception. They said,

> A child must have attained certain levels of visual maturation before he is ready to begin reading. He should have become able to focus at twenty feet or more. He should have acquired some skill in depth perception, binocular coordination, ability to center, and ability to change fixation at will (Dechant, 1961, p. 121).

Goins contributes the interest in the nature of visual perception in reading to the following:

> Since the turn of the century, when experimental investigations revealed that the unit of recognition in reading was the word and groups of words rather than individual letters comprising words, there has been considerable interest in the nature of visual perception in reading (Goins, 1958).

Based on the evidence of his study, Goins has postulated the relationship of visual perception to reading thus:

> Efficient reading involves ability not only to hold in mind the 'wholeness' of a word, phrase, or sentence, but also to attend to individual words and, at times, to parts of words (Goins, 1958a, p. 45).

DeHirsch complements Goins' viewpoint when he states that the differences of small details and the understanding of the essential relationships between the parts and the whole are a "sine qua non" in reading (DeHirsch, 1957, p. 568). Also in agreement with Goins is Mooney (Mooney, 1959).

Vernon has emphasized the importance of the development of shape and color perception in children prior to the acquisition of reading ability. In a discussion of the beginning reading instruction she pointed out the necessity of visual perception ability, not only in terms of interpreting the reading symbols but the importance of understanding reading. She stated:

> But we have also seen that young children have much difficulty in perceiving the essential characteristics of meaning--less shapes drawn on paper. Therefore it is not surprising that the process of teaching them to recognize the important features of printed letters and words may be protracted. In pursuance of the idea that children perceive 'wholes' rather than parts or details, the teaching of reading is often begun by presenting whole words rather than isolated letters for recognition. This method also has the advantage that the words can be spoken, and that these spoken words have meanings which are immediately familiar to the child; whereas letters by themselves are meaningless to him. But the characteristics of whole words are not at all clear and obvious and thus it is difficult for him to remember them apart. The tendency is for the child to recognize words partly by means of their general outline and length, and partly by means of characteristic letters, such as the first and last letters, or letters of peculiar shape such as 'g' and 'y.' In this way, he learns to recognize a few whole words at a glance. But sooner or later, in order to perceive the essential structure of words, he has to learn the characteristics of isolated letters and the manner in which they are combined in different words. This necessitates differentiating letters which are often similar in shape, particularly the reversed letters 'b' and 'd' and 'p' and 'q' and the inverted letters 'n' and 'u.' He then has to learn that each of the letters has one or more associated sounds; and that the sound of the whole word is made up of the appropriate letter sounds in the correct order. When, and only when, he has achieved the total word sound, he will know its meaning, given by its meaning in speech (Vernon, 1962).

Much evidence has accrued that visual skills are related to school achievement. Kephart, for example, tested 2,200 children in grades 3 through 12 and concluded that four of ten had visual skills below those required for good school work. He also found a positive relationship between visual skill and school achievement (Kephart, 1960). In a follow-up study, Lowder gave a test of ability to copy seven simple geometric forms (circle, square, horizontal and vertical diamond, cross, divided rectangle, and triangle) to 1,510 first, second and third graders in Winter Haven, Florida. Lowder concluded that performance on this test was more closely related to school achievement than were scores on an intelligence test. Kephart and Lowder have concluded that visual perception skills can be improved and that such improvement should lead to better school achievement (Lowder, 1956).

McQuarrie and McQuarrie, analyzing the work of Lowder, adduced evidence that skill in form perception is necessary for successful achievement in reading (McQuarrie, 1957).

Kloppitz, Sullivan, Blyth and Sherlton conclude: "Studies have shown that achievement in first grade is closely related to visual motor coordination and perception" (Russell, 1956), and Hildreth and Griffiths (1949) conclude that reading readiness tests should involve visual and motor perceptual tasks as a function necessary for assessing reading accomplishment.

Another study which demonstrates that a child's ability to learn to read is affected by his visual perceptual development is the University Elementary School Study (Frostig & Maslow, 1964). It was found that no children with a visual perceptual quotient below 90 on the Frostig Developmental Test of Visual Perception had begun to read. Research in other beginning reading situations in which the children were required to read, showed a correlation of between .4 and .5 between the Frostig Test of Visual Perception and reading scores (Frostig & Maslow, 1964). These findings are in agreement with those of Goins (mentioned previously).

Of the various measurement devices used in Williams' study, "The Rutger's Perceptual Drawing Test proved to be of most diagnostic value, lending weight to those who feel visual-motor perceptual processes are quite important in the acquiring of reading skills" (Williams, 1966, p. 59).

Results reported in a study by Bryan (1964) indicate that visual perception, as measured by the Frostig Developmental Test of Visual Perception, may be applied as a predicator of reading success.

> Results indicated that visual perception correlates more highly with reading readiness in kindergarten than does intelligence. In the first grade, visual perception appears to correlate more closely with reading success than do intelligence and readiness. In the second grade, visual perception correlates more highly with reading comprehension and intelligence with

> reading vocabulary. In third grade, intelligence appears to be a better predicator of reading success for both reading vocabulary and reading comprehension.

Beneveniste (1962) in her master's thesis, reported information consistent with the findings reported in the above study.

In a general report of research at the Marianne Frostig School of Education Therapy, Frostig stated that:

> . . . There is a medium-high correlation between visual perceptual ability and reading achievement at the first grade level in the usual public school setting. However, this correlation diminishes at higher grade levels, because some children either have a late spurt in perceptual growth or learn to master visual perceptual tasks by means of cognitive abilities, the development of which usually reaches a peak at about 7½ years of age (Frostig & Horne, 1961).

These results suggest the need to test visual perception at these grade levels, particularly kindergarten and grade one, in addition to tests of intelligence and reading readiness.

Causes of Disabilities in Visual Perception and Their Effect on Reading Growth

It is often extremely difficult to discover the factors contributing to a child's disabilities in visual perception. The disability may be physical in origin (particularly visual); pathological, such as minimal brain dysfunction; a result of developmental lag; or even multiple causation.

Harris points out that of the visual defects, poor

near-point acruity and poor eye-muscle balance are most significantly relative to reading problems (Harris, 1956). Smith and Dechant commented that:

> In searching for possible relativity between visual defects and reading achievement, we must consider the likelihood of multiple causation. In many cases an eye defect alone might not reduce reading efficiency, yet the same defect combined with other factors might do so. And it is quite possible that certain eye defects affect reading performance only when their severity is beyond certain critical points (Dechant and Smith, 1961, p. 132).

One of the major causes of perceptual disabilities in children is undoubtedly brain damage. An impressive correlation between perceptual disabilities and neurological handicaps has been shown in every study, whether of children with confirmed brain damage or of children with so-called minimal brain damage in which diagnoses were made on the basis of behavioral disturbances, learning difficulties, and postural changes (Frostig, 1963b). DeHirsch (1957, p. 570) states that brain injury, and in fact any lowering of integrative efficiency, brings about an impairment in figure-background relationships and consequently impairs reading activities. Monroe studied quantitatively 415 children who had special reading defects that varied from mild retardation in reading to extreme disabilities. In a discussion of causative factors in reading defects she concluded that,

> The perception of visual patterns involves more of the nervous system and brain than simply the sensory apparatus. Patterns vary in complexity,

> and a child who can discriminate simple patterns such as letters may not be able to discriminate complex patterns such as words. The literature on aphasias and word-blindness gives many records of cases who, after brain injury, were still able to read letters although they could not read words composed of the letters (Monroe, 1937).

Harris (1961), at the International Reading Association Conference in 1961, emphasized the Gestalt characteristics of perception and the developmental sequence of visual perception abilities. He also stressed the importance of accurate perception of similarities and differences, figure-background as well as the importance of adequate development of laterality and directionality in learning to read. He concluded by saying:

> Perception is awareness of objects, relations or qualities which is primarily controlled by sensory excitation but influenced also by past experience and immediate set. Adequate perception of printed symbols is essential in the reading process, since appropriate meaningful response is based upon it. Sensory handicaps can interfere with perception, but are less important than difficulties in the perceptual organization of sensory data.
>
> In reading disability cases that involve neurological defects or delayed maturation there is difficulty with the Gestalt aspects of visual and auditory perception. The whole-part relationship is inadequate. Wholes tend to be perceived in a vague and global, undifferentiated way. Parts tend to be perceived as separate unrelated units rather than in the whole-part relationship, so that visual closure and auditory blending are deficient. There is likely to be some figure-background difficulty. Laterality and directional orientation tend to be delayed in development and there is likely to be orientation difficulty particularly with the left-right sequence and with diagonals. The child's body image as projected in his drawings of the human figure is

> likely to be immature, undifferentiated and somewhat distorted (Harris, 1961, p. 289).

The cause may be simply a lag in perceptual development without readily discernible causes. Kephart (1960, p. 120) explained that,

> In many children the developmental process has broken down; at one of the earlier stages, the child either failed to develop further or developed in an atypical or distorted manner. Such breakdowns in the developmental sequence may be the result of environmental deprivations, injuries, or defects in the organism, or emotional pressures with which the child has been unable to cope. Many of these breakdowns reveal themselves in the early elementary grades through difficulty in learning and low academic achievement.

A child with such a lag is indeed handicapped. He has difficulty in recognizing objects and their relationships to each other in space, and since his world is perceived in a distorted fashion, it appears to him unstable and unpredictable. Further learning may therefore be adversely affected.

A trend indicated in a study by Coleman (1953) was that:

> Perceptual retardation is cumulative through the childhood age group; that is, the older the children get chronologically, the more retarded they become in relation to their ages. However, this trend doesn't appear to carry through into adulthood. Although formal evidence as to what conditions bring about retardation in perceptual development is scanty, there are certain clinical impressions which may serve as helpful hints for further research. This study has implications that a majority of the reading disability cases could profit from remedial instruction directed toward the better differentiation and integration of perceptual experiences.

Sometimes the problem may result from an emotional disturbance severe enough to cause the child to pay more attention to his inner feelings and fantasies than to the stimuli of his outer environment. Conversely, emotional disturbance can also be the result of disabilities rather than the cause. A child with disabilities in visual perception is subject to emotional disturbances. For example, Frostig commented that,

> The child with disturbances of visual perception may be excluded from games because he is clumsy, derided because he seems ill-mannered at the dinner table, scolded because his writing is a mere scribble, or treated with visible worry or anger by his parents because he cannot read. Such a child soon feels himself excluded and rejected. He comes to regard himself as inadequate, and his disturbed self-concept results in aggressive or depressive reactions, which in turn provoke counter-aggression in persons in his environment. His 'effective functioning' indeed becomes disrupted (Frostig, 1963b).

Whatever the etiology, it is important to the mental health of the child that his difficulties be diagnosed and remedial measures instituted as early as possible.

Description and Use of the Frostig Developmental Test of Visual Perception for Diagnosing Visual Perception Problems

The Frostig Test can serve as the diagnostic tool and the Frostig Program can serve as the training and remedial measures. Following is a discussion of the Frostig Test. In the next section the Frostig Program will be discussed.

A new test has been published recently by Marianne

Frostig, Ph.D., (1961) in collaboration with Welty Lefever, Ph.D., and John Whittlesey, M.S.--Developmental Test of Visual Perception. Standardization norms of 1963 are based on 2,100 nursery school and public school children between the ages of 3 and 9 years. Normative curves drawn from the standardization sample support Piaget's contention that the peak of perceptual development is between the ages of 4 and 7. The instructions for administering the test have been translated into German, and norms are now being obtained in England, Austria, and Australia.

Frostig, Lefever, and Whittlesey described the test thus:

> In the test, the child is required to attempt carefully graded tasks in five areas of visual perception. These five areas were chosen because defects in these abilities were observed in clinical work with children with learning difficulties. (1) The first of these is eye-hand coordination. The child's task here is to draw straight and curved lines between increasingly narrow boundaries. (2) The second function tested is figure-ground perception. Here the child is asked to discriminate between intersecting figures. (3) The third function is the perception of form constancy, and here the task is to detect squares and circles among other shapes on the page. (4) Then follows perception of position in space, tested by requiring the child to detect a reversed or rotated figure in a sequence. (5) The last subtest explores the perception of spatial relationships. The task is to copy patterns by linking dots (Frostig, Lefever & Whittlesey, 1964).

It is a paper-and-pencil test which may be easily administered either individually or to groups. The time required for group administration is less than one hour;

individual administration takes about 45 minutes. Administration and scoring are described in the accompanying manuals. Scoring is objective, and requires 5-10 minutes. The child's raw score for each subtest is converted into a perceptual age equivalent (representing the age at which the average child achieves this score). A perceptual quotient (P.Q.) can then be derived in a manner similar to that used for determining an intelligence quotient (I.Q.).

The test has proven useful as a screening tool with groups of kindergarten and first grade children, since it permits identification of those children who need special perceptual training. By indicating the areas of visual perceptual disability, it also provides the basis for instituting remedial programs.

A significant correlation has been found between scores on the perceptual test for kindergarten and first grade children and ratings for classroom adjustment assigned by their teachers. "Children who deviate from the norm can be identified and the range and severity of perceptual disabilities measured (by the test), regardless of the etiology, be it brain injury, developmental lag, or emotional disturbance" (Frostig, 1963a). A single test of perceptual ability cannot establish the causes of disturbances; etiology can only be assessed by a battery of tests, medical as well as psychological. At present, the test is intended to assess

perceptual difficulties and the level of perceptual maturation. A complete discussion of this test can be found in Perceptual and Motor Skills (Frostig, Lefever & Whittlesey, 1961; Frostig & Maslow, 1964).

Description and Use of the Frostig Program for the Development of Visual Perception for Training and Remedial Measures

The Frostig Program focuses on the same five visual perceptual abilities as does the Frostig Developmental Test. Worksheets along with numerous activities (which are suggested in the Teacher's Guide) are provided during the training program. Descriptions and purposes of the Frostig Program can be found in Chapter I of the Teacher's Guide. Chapters 2-6 offer specific directions and suggestions for employing training for the five visual perceptual abilities.

The worksheet exercises together with kinesthetic (muscle sense) and tactile training described in the Teacher's Guide, can be integrated into regular kindergarten and first grade programs. These should be augmented by language training.

The worksheets are divided into five categories:

1. Perception of Position in Space: These exercises are designed to develop the child's recognition of the formation and directionality of figures and characters. This ability relates to reading and writing skills in such areas as distinguishing "3" from "E," "p" from "q," or "on" from "no."

2. Perception of Spatial Relationships: The object of these exercises is to develop the child's ability to perceive positional relationships between various objects or points of reference--for example, the order of letters in a word or of digits in a number, or the arrangement of material on a page.

3. Perceptual Constancy: Exercises in this category develop the child's perception and identification of forms, regardless of differences in size, color, texture, position, background, or angle of viewing.

4. Visual-Motor Coordination: These exercises help to develop printing, writing, and drawing skills through practice in such specific areas as tracing, drawing from point to point, completing patterns, and duplicating patterns and figures. Visual and kinesthetic methods are employed and eye-hand coordination is significant.

5. Figure-Ground Perception: Isolation and identification of overlapping, intercepting, or hidden figures help to develop the child's ability to correctly identify a word or a letter on a printed page. The object of these exercises is to develop the child's facility in reading without running words together, or seeing words distinctly without confusing them with other words around them (Frostig & Horne, 1964).

In summary, it would seem that the findings, as discussed throughout this paper, confirm the impression that

the development of visual-perceptual processes is the major function of the growing child between the ages of 3 and 7. Perceptual development at this age level becomes a most sensitive indicator of the developmental status of the child as a whole, as well as reading ability in particular. Regardless of the etiology of the perceptually disturbed child, an effective remedial program can be devised, provided his perceptual difficulty is detected and its precise nature made known. The major task is to gain this information, and this can be obtained most usefully at the preschool and early school ages, when perceptual development appears to be at its maximum. The Frostig Test of Visual Perception was designed to measure independent areas of visual perception at different age levels in order to obtain that information. The Frostig Program for the Development of Visual Perception provides the training and remedial measures.

CHAPTER III

PROCEDURES

I. POPULATION AND SAMPLE

This study was conducted during the 1965-1966 school term. Of the original 56 children attending two classes at Central Lutheran Kindergarten in Yakima, Washington, 50 subjects remained in class through May and are included in this study. The experimenter's morning class of 25 children composed the experimental group, and the afternoon group of 25 children, taught by another teacher, was the control group. The control group continued to follow the regular kindergarten schedule; the experimental group received visual perception training according to the procedures described in Chapter II of this study.

The children ranged in age, at the beginning of the study, from 61 months to 78 months. The rounded median ages for experimental and control groups are 66 and 67 months respectively. A comparison age table between experimental and control groups is shown in Appendix A.

Following the procedures of standardization used by Wechsler, an examination was made of parental occupations of both the experimental and control groups compared with the 1960 census figures obtained from the County of Yakima at large (Hodges, 1960). The purpose of this procedure was twofold: first, to provide a measure of initial standing

between the two groups and secondly, to compare the total sample group with the City of Yakima as a whole with respect to parental occupation. Table I indicates the number of persons in each of 12 occupation groups for the parents of both groups of children used in the sample. The percentage of each occupational group is provided for inspection also. Using parental occupations as an index of socio-economic standing, the sample does not appear to represent a truly cross-sectional picture of the County of Yakima. Inspection of Table I seems to indicate that there is a greater number of parents representing the white color, middle class group, than is found in the county at large. Within the limited context of this study, however, this finding does not affect the usefulness or purpose of this research.

II. RESEARCH INSTRUMENTS

A. Marianne Frostig Developmental Test of Visual Perception

In the FDT, the child is required to attempt carefully graded tasks in five areas of visual perception. These five areas include: (1) eye-hand coordination, (2) figure-ground perception, (3) form constancy, (4) position in space, and (5) spacial relations. For a complete test description, refer back to Chapter II of this paper, Part VI, entitled "Description and use of the Frostig Developmental Test of Visual Perception for diagnosing visual perception problems."

TABLE I

PARENT OCCUPATIONS:
NUMBER AND PERCENTAGE OF EACH GROUP
FOR SAMPLE AND COUNTY

Occupation	Exp. #	Cont. #	Total Sample	Yakima Co.%	Exp. %	Cont. %	Total Sample %
Professional	12	7	19	6.6	48	28	38
Farmers	0	0	0	11.8	0	0	0
Managers	6	5	11	12.1	24	20	22
Clerical & Kindred	1	5	6	3.4	4	20	12
Sales Workers	3	3	6	5.8	12	12	12
Craftsmen	2	4	6	15.0	8	16	12
Operatives & Kindred	1	1	2	13.1	4	4	4
Private Hsh. Workers	0	0	0	.09	0	0	0
Service Workers	0	0	0	4.6	0	0	0
Farm Laborers	0	0	0	18.9	0	0	0
Laborers	0	0	0	6.5	0	0	0
Occup. not reported	0	0	0	1.7	0	0	0

B. Metropolitan Readiness Test: Form R-pre-test; Form S-post-test (MRT)

Anderson, in Buros, 3rd Yearbook, stated that "The MRT continues to be among the most widely used of the readiness tests" (Buros, 1949, p. 578). Gardner in Buros, 4th Yearbook, stated: "Two alternate forms, R and S, have replaced the single older form. . . . Several improvements in test format, related materials, and procedures have been introduced. . . ." He reported research findings that "Analysis of the data from an experiment showed the two forms to be completely comparable throughout the range of scores in each subtest" (Buros, 1953, p. 570).

The test measures Word Meaning, Sentence Meaning, Information, Visual Perception (Matching), Number Knowledge, and Visual Perception and Motor Control (Copying). Tables are provided which permit translation of the total readiness score (total raw score) into a percentile rank, and the reading readiness, number readiness, and the total readiness scores into letter ratings with verbal description. "The reported reliability of Tests 1-4 is .83; of the Numbers Test (5), .84; and of the total score, .89. The corresponding standard errors of measurement are 3.7, 1.9 and 4.6" (Buros, 1953, p. 570). "The norms show that there is a significant relationship between scores on the test and achievement in first grade. High correlations exist between

scores on the Metropolitan Readiness Tests and scores on intelligence tests" (Buros, 1949, p. 518).

Some additional evidence has also been reported and relationships are perceived more as moderate than high. Although Anastasi (Anastasi, 1954) includes the MRT among the best known reading readiness tests, she reports validation studies against subsequent achievement test scores in reading. Such studies show the validity coefficients ranging from the .50's to the .80's. Correlations within the same range have been found between the reading tests and tests of general intelligence for primary grades.

Williams reports that the MRT proved to be of value in predicting reading achievement. "Although there were positive relationships between the three subscores from the MRT, the numerical subtest seemed the most useful of the scores selected from that instrument" (Williams, 1966, p. 57). These findings generally support the investigations of Abbott (1963) and Petrone (1963).

C. Draw-A-Person Test (DAPT)

The writer used a combination of Goodenough's Draw-A-Man Test and Machover's Draw-A-Person Test. The Draw-A-Man Test, as developed and standardized by Goodenough, is primarily a measure of intelligence, although it has possibilities of being utilized for the study of personality. "A scoring system of 51 points was developed, in which credit

is given for the inclusion of individual body parts, clothing details, proportion, perspective, and similar features" (Anastasi, 1961, p. 264). The raw score, which gives the number of points out of the possible total of 51 on which a given drawing has received credit, is not ordinarily used directly. Raw scores are converted into "mental ages," and the ratio between the subject's mental age and his chronological age is then taken as his Goodenough I.Q. The table for converting raw scores into mental age equivalents derives from the norms for ages 3-13 published by Goodenough in 1926.

> The Goodenough Draw-A-Man Test is undoubtedly a most valuable instrument. During the 25 years the test has been in existence, a number of studies have confirmed that it compares favorably in test-retest reliability with most group tests of intelligence applicable in the same age range (Buros, 1953, p. 392).

In the Machover Draw-A-Person Test, the subject is told simply to "draw a person." Upon completion of the first drawing, the subject is asked to draw a person of the opposite sex from that of the first figure. Scoring of this differs from Goodenough scoring as "Machover's is essentially qualitative" (Anastasi, 1961, p. 586).

The writer used a combination of instructions in asking each child to make the drawing, saying, "I'd like you to draw a person. Take your time and do the very best you can."

The scoring procedures used by the investigator will be discussed in Part III of this chapter.

D. The Frostig Program for the Development of Visual Perception

The Frostig Program focuses on the same five visual perceptual abilities as does the FDT and includes worksheets and numerous activities. For a description of the training program, see Chapter II, Part 7. The experimental group received five months' training, consisting of approximately five 15-minute sessions weekly.

III. PROCEDURES

1. Pre-tests: Before the beginning of visual perception training for the experimental group, all the children in both groups were administered pre-tests; namely, (a) MRT, Form R, (b) FDT, and (c) the DAPT. These were to obtain a measure of each child's level of readiness, visual perception, and intelligence, respectively.

(a) The MRT was administered by the investigator with the assistance of a proctor. A mother in the experimental group and the afternoon teacher in the control group acted as proctors. Standard procedures in testing were followed. There were no more than fourteen children tested during one period. There were three testing sessions as recommended: I, Tests 1 and 2; II, Tests 3 and 4; III, Tests 5 and 6.

The total working time for each session did not exceed 20 minutes. Test materials included the test booklet and a large crayon. All tests were scored by the experimenter. Raw scores were obtained for Tests 1-4, Test 5, and total Tests 1-6.

(b) The FDT was administered one week following the administration of Metropolitan Readiness Test by a school psychologist with the experimenter and a proctor assisting. The administration time was approximately 60 minutes, with short rest intervals included. The experimenter scored the FDT with the assistance of a school psychologist. Raw scores for each of the five areas were obtained and converted to Perceptual Quotients.

(c) The DAPT was administered following the last testing session of the MRT. Each child was given a sheet of 8½ x 11 inch white paper and a large crayon. Each group was given instructions as follows: "I'd like you to draw a person. Take your time and do the very best you can." The experimenter and proctor supervised the drawing activity so that the children were not able to get assistance from others. No time limit was set, but the task usually required from 5-8 minutes.

Two scoring systems were utilized with the DAPT. First, the drawings were scored on the 51-point system developed by Goodenough. The purpose was to obtain a measure

of intelligence for each child for initial standing analysis and comparisons in changes made between the two groups. Secondly, the experimenter and a second scorer (a kindergarten teacher in a Master's Degree Program) evaluated each drawing by Glenn Easley's scaled scoring method (Easley, 1964). Easley's scale comparison method has age drawing score norms for the age range of 5 years, 6 months to six years, eight months.

2. The experimental group received training in visual perception from the first of November to early May through the use of the Frostig Program. This training included Frostig Program worksheet exercises designed for kindergarten level, together with kinesthetic (muscle sense) and tactile training as described in the Teacher's Guide to the Frostig Program (Frostig & Horne, 1964).

3. Post-tests; namely, Form S of the MRT, the FDT and the DAPT, which had been given in October were readministered to both groups in May to determine what effect, if any, the Frostig Program had on the experimental group's level of readiness skills. All administration and scoring procedures were similar to the pre-testing situation in October.

IV. METHODS USED IN ANALYZING DATA

All the statistical analyses were made by an IBM 1620 computor. The statistical analyses by IBM 1620 computer

were made under the direction of Dr. Bernard Martin, Associate Professor of Mathematics at Central Washington State College in Ellensburg, Washington. The following analyses were computed:

1. Analysis of variance between the experimental and control groups upon the initial standing was computed for the following two variables: (a) age and (b) parental occupation. Following the analysis of variance, t-tests of significance were computed, and only t-tests' results are reported since differences between the two groups was the only concern.

2. On the basis of pre-tests' results, analysis of variance between the two groups were made to determine initial between-group variability of (a) readiness (measured by MRT, Form R, Tests 1-4, 5 and 1-6, (b) visual perception skills (measured by FDT, and (c) intelligence (measured by DAPT).

3. Comparisons between the two scores were made of Easley's scaled scoring method of the DAPT to reflect reliability.

4. Analysis of variance was made on the basis of the post-tests' results. These difference comparisons (labeled t-test on the difference) were arrived at by taking the pre- and post-scores for each of the tests involved (seven variables listed below), calculating the difference

and then calculating the t-test on these differences. These values are indicative of any change that may have taken place (particularly as a result of visual perception training in the experimental group) between the pre-test and the post-test in the case of every variable tested. These seven variables on differences include:

(a) MRT 1-4
(b) MRT 5
(c) MRT 1-6 (total test)
(d) FDT
(e) DAPT (Easley scoring-experimenter)
(f) DAPT (Goodenough scoring)
(g) DAPT (Easley-second scorer)

5. Analysis of covariance was made, with the Frostig difference as a control variable, to indicate whether the variable of visual perception training was associated with score changes for the two groups.

It was decided that all computations in this research must reach the five per cent level of confidence to be considered significant.

CHAPTER IV

RESULTS

The results will be discussed in the same order that the methods used in analysis were presented in the previous chapter.

1. t-tests of significance between the experimental and control groups upon the initial standing for the two variables, (a) age and (b) parental occupation is shown in the table below

TABLE II

COMPARISON BETWEEN THE EXPERIMENTAL AND CONTROL GROUPS FOR CHILDREN'S AGE AND PARENTAL OCCUPATION

Variable	N	df	t	p*
(a) Age	50	48	-1.3474	n.s.
(b) Occupation	50	48	-1.4475	n.s.

*p= .05 for t = 2.010, with 48 df.

Table II indicates that there was no significant difference between the two groups upon initial standing in regard to age of subjects and parental occupations. The experimental group was younger but not significantly different.

2. t-tests of pre-tests' results between the two

groups determined whether the two groups were functionally equivalent at the beginning of the experiment on the basis of the following variables: (a) MRT 1-4, Test 5 and Tests 1-6; (b) FDT and (c) DAPT. Table III presents the results of the analysis of initial standing. It indicates that the two groups were functionally equivalent at the onset of the study as to the variables of (a) readiness skills, (b) visual perception skills and (c) intelligence.

3. DAPT scoring by the Easley method comparing experimenter's results with a second scorer's results indicates significant inter-scorer reliability of this scaled scoring method. Table IV shows that there was no significant difference on either the pre-testing or post-testing inter-scorer results.

4. t-tests of significance measuring change between pre- and post-testing was calculated for seven variables. Table V indicates no significant differences between those students who received visual perception training (experimental group) and those who received no special training (control group) on the following criterion:

1. Reading readiness skills (MRT 1-4).
2. Number readiness skills (MRT 5).
3. Total readiness skills (MRT 1-6).
4. DAPT scored by Easley method.
5. DAPT scored by Goodenough method.
6. DAPT scored by Easley method--2nd scorer.

The only variable which did show significant difference between the two groups was the Frostig Test. This result

TABLE III

t-TESTS BETWEEN THE EXPERIMENTAL AND CONTROL GROUPS ON INITIAL STANDING ON PRE-TESTS OF MRT, FDT, AND DAPT

Variable	N	df	t	p*
MRT Pre (1-4)	50	48	.60402	n.s.
MRT Pre (5)	50	48	-.34748	n.s.
MRT Pre (1-6)	50	48	.62229	n.s.
FDT Pre	50	48	1.30129	n.s.
DAPT (Easley) Pre	50	48	.28843	n.s.
DAPT (Goodenough) Pre	50	48	-.15307	n.s.

*p= .05 for t=2.010, with 48 df.

TABLE IV

DAPT (EASLEY SCORING) PRE- AND POST-TESTING COMPARING EXPERIMENTER'S RESULTS WITH SECOND SCORERS' RESULTS

Group	Test	N	df	t	p*
Experimental	Pre	25	24	.04999	n.s.
Experimental	Post	25	24	.08036	n.s.
Control	Pre	25	24	-.33344	n.s.
Control	Post	25	24	.08061	n.s.

*p= .05 for t= 2.064, with 24 df.

TABLE V

t-TESTS ON DIFFERENCES BETWEEN PRE- AND POST-TESTING OF ALL EXPERIMENTAL VS. ALL CONTROL ON SEVEN VARIABLES

Variable	N	df	t	p*
MRT 1-4	50	48	.05171	n.s.
MRT 5	50	48	.75344	n.s.
MRT 1-6	50	48	.46653	n.s.
FDT	50	48	3.63945	n.s.
DAPT (Easley)	50	48	.74680	n.s.
DAPT (Goodenough)	50	48	1.97364	n.s.

*p= .05 for t= 2.010, with 48 df.

was significant at the .01 level of confidence, indicating that the experimental group did significantly improve visual perception skills through the training program.

Although there was no significant difference between the two total groups on post-test readiness skills, there were some interesting results of sex breakdown combinations, e.g., experimental female vs. control male, experimental female vs. control female, experimental male vs. control female, experimental male vs. control female, and experimental male vs. control male. t-tests showed significant differences for the following criteria and sex combinations:

1. MRT Post-test, 1-4 for:
   a. Exp. female vs. control male (.05 level)
   b. Exp. male vs. control male (.05 level)

2. MRT Post-test, 5 for:
   a. Exp. female vs. control male (.01+ level)
   b. Exp. male vs. control female (.01+ level)
   c. Exp. male vs. control male (.01+ level)
   d. Exp. female vs. control female (.05 level)

3. MRT Post-test, 1-6 for:
   a. Exp. female vs. control male (.01+ level)
   b. Exp. male vs. control male (.01+ level)

4. DAP (Easley) Post-test for:
   a. Exp. female vs. control male (.05 level)

It is interesting to note that in the four possible combinations on Post-subtest 5 (numbers) that the experimental groupings did perform significantly better than the control. According to research cited earlier, the numerical subtest seems the most useful in predicting reading achievement.

5. Analysis of covariance, with the Frostig difference being the control variable, indicated that the visual perception training was associated with any score changes which occurred. Table VI shows that on the same variables as in t-test the results were significant at the .01 level of confidence on all the variables. The Frostig training would apparently be responsible for score changes in the experimental group.

TABLE VI

ANALYSIS OF COVARIANCE WITH FROSTIG DIFFERENCE AS CONTROL VARIABLE FOR EXPERIMENTAL VS. CONTROL

Variable	N	df	F	p*
Met. Read. 1-4	50	47	48.2066	s. (.01 level)
Met. Read. 5	50	47	32.0279	s. (.01 level)
Met. Read. 1-6	50	47	38.1034	s. (.01 level)
DAP (Easley)	50	47	61.6627	s. (.01 level)
DAP (Goodenough)	50	47	53.4764	s. (.01 level)
DAP (Easley) (2nd scorer)	50	47	54.2431	s. (.01 level)

*p= .01 for F= 7.31.

CHAPTER V

DISCUSSION AND RECOMMENDATIONS

I. DISCUSSION OF THE RESULTS

The t-test differences relative to the criteria (1) age, (2) parental occupation, (3) readiness skills as measured by MRT, (4) visual perception skills as measured by the FDT and (5) intelligence as measured by the DAPT, indicated that the experimental and control groups were functionally equivalent at the beginning of the experimental study.

Following the visual perception training for the experimental group from November to May, however, analysis showed no significant difference between the two groups on the criteria included. Therefore, the null hypothesis which was stated in Chapter I cannot be rejected. There was no significant difference in readiness level reflected by Metropolitan Readiness Test between kindergarten students who received Frostig Visual Perception training and those who received no special visual perception training.

Analysis did indicate, however, that there was a significant difference between the visual perception skills of the two groups. Analysis of covariance indicated that the Frostig Program was associated with the score changes which occurred.

The scorer reliability of the Easley system for scoring DAPT appears to have been upheld as acceptable for this study, as it was in the original work of Easley (1964) and the follow-up study of Williams (1966).

Several factors may have accounted for the failure to find any significant differences in readiness skills between the two groups. One important variable which contributed to an unknown degree is the teacher variable. The control group had a different teacher and there were no curriculum guidelines for the experimental and control teachers to follow. It is possible, therefore, that the two programs may have differed basically, even beyond the variable of the Frostig training program used with the experimental group.

The selection of research instruments also poses some questions. Easley, for example, stated that:

> The stability of the DAP Test is not expected to be great in young children except, perhaps, for certain features peculiar to a given child. The passage of a 5-7 month time interval before retest with the DAP Test in the case of young children usually produces considerable change as the children grow and develop (Easley, 1964, p. 42).

II. RECOMMENDATIONS

The writer would make several suggestions and recommendations to another researcher who might like to pursue such a study as this one. First of all, a larger, more random sample upon which to perform a study of similar

design would be desirable. The same teacher for both experimental and control groups would help eliminate the teacher variable. Another possibility would be to include several kindergarten classes which were being taught by a similar curriculum guide.

The individual characteristics of these children would be a most useful study. It would perhaps have been profitable to have taken the score in the lowest quartile on the FDT for both groups to determine amount and direction of change. The researcher would hypothesize that the amount of improvement in readiness skills from pre-testing to post-testing of those in lowest quartile would have been significant, especially for the children in the experimental training group. Another interesting study might be to provide the Frostig training to only the lowest quartile of an experimental group.

A follow-up study of these children through the first grade was desirable but not possible due to a large percentage of them enrolling in a parochial school in the area.

Considering the limitations of this study, further suggestions would include that the visual perception training program last for longer than a five-month period to allow for more emphasis on tactile and kinesthetic training, along with the worksheet exercises.

CHAPTER VI

SUMMARY

The purpose of this study was to evaluate what effect use of the Frostig Program for the Development of Visual Perception would have on readiness skills for kindergarten children. The experimental method employing one experimental class and one control class was the research technique used.

The experiment was carried on at the kindergarten grade level in the Central Lutheran Church Kindergarten in Yakima, Washington during the 1965-1966 school term. There were 25 pupils in each of the two groups. In October, both groups were administered pre-tests; namely, (a) The Metropolitan Readiness Test, Form R, (b) The Frostig Developmental Test of Visual Perception, and (c) The Draw-A-Person Test. These were to obtain a measure of each child's level of readiness, visual perception, and intelligence, respectively. These tests were administered and scored according to standardized procedures. The Draw-A-Person Test was scored by two methods, namely, (a) Goodenough's 51-point system and (b) Easley's scaled scoring system.

The experimental group received visual perception training according to the Frostig Program for the Development of Visual Perception from early November to early May. At

the conclusion of the experimental teaching, a second form (Form S) of the Metropolitan Readiness Test, The Frostig Test and the Draw-A-Person Test were again administered to both classes. The results of the pre- and post-test scores for all the students were submitted to a comprehensive statistical analysis by an IBM 1620 computer.

The following analyses were computed:

1. The first series of t-tests were performed to determine whether or not the experimental group and the control group were functionally equivalent at the onset of the experiment on the basis of (a) age, (b) parental occupation, (c) readiness skills (measured by MRT), (d) visual perception skills (measured by FDT), and (e) intelligence (measured by DAPT).

2. The inter-scorer reliability of Easley's scaled scoring system for the DAPT was determined by statistical analysis of the comparisons between two scorers.

3. t-tests of significance were made also to determine whether or not a significant statistical difference existed between (a) the experimental group and control group's post-tests using seven variables, (b) the difference between pre- and post-tests of both groups using the same seven variables.

4. Analysis of covariance was made, with the Frostig difference as a control variable, to indicate whether the variable of visual perception training was associated with score changes for the two groups.

Results of the t-tests revealed that:

1. The difference between the experimental groups and the control group at the beginning of the experiment was not significant and that the two groups were functionally equivalent on the basis of the following criteria: (a) age, (b) parental occupation, (c) readiness skills, (d) visual perception skills and (e) intelligence.

2. The difference between the first and second scorer's results using Easley's method was not statistically significant and thus supports substantial reliability.

3. The differences between the experimental and control group's post-tests was not significant, although there were some significant differences when different intra-group combinations on the post-Metropolitan were examined. On subtest 5 of the post-MPT, for example, the experimental female and male groups did perform significantly better when compared with control male and control female in separate groupings. The experimental female and male also did significantly better than the control male only on post-tests 1-4 and 1-6.

4. The difference between pre- and post-tests of both groups on the same seven criteria was not significant for the readiness and intelligence measures, but was significant for visual perception measures (FDT). This indicates that the experimental group did not show a significant improvement in readiness beyond the level of the control group, but did

improve significantly in visual perception skills following the training program.

5. Analysis of covariance indicated that the visual perception training was associated with score changes on the seven variables listed earlier.

On the basis of these results, the null hypothesis could not be rejected. There was no significant difference in readiness level, reflected by Metropolitan Readiness Test, between kindergarten students who received visual perception training and those who received no special visual perception training.

This study supports, in part, previous research with implications that visual perception diagnosis and training is needed at the early childhood age for the development of perception, per se, but not necessarily for improvement of other readiness skills. The Frostig Developmental Test of Visual Perception and the Frostig Program for the Development of Visual Perception can be especially useful for these purposes.

The importance of such diagnosis and training is summarized by Dr. Frostig, "If a child with perceptual disabilities can be detected and specific perceptual training instituted, he [might] (parentheses researcher's) be expected to benefit 'in toto,' rather than in perception alone" (Frostig, 1963, p. 665).

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APPENDIX A

APPENDIX A

AGES OF BOTH EXPERIMENTAL AND CONTROL GROUPS FROM OLDEST TO YOUNGEST BY 2 MONTHS AT TIME OF PRE-TESTING

Age in Months	Exp. Group	Control Group
77-78	0	1
75-76	0	0
73-74	0	1
71-72	1	1
69-70	8	7
67-68	2	5
65-66	7	7
63-64	3	2
61-62	4	1
Total Exp.	25	Total C. 25

APPENDIX B

Experimental

Subj.	Met. Read. Pre			Met. Read. Post			Frostig Pre	Frostig Post	DAP Easley Pre	DAP Easley Post	Ages Years	Ages Months	Occup.	DAP Gooden. Pre	DAP Gooden. Post	Sex	DAP 2nd Scorer Easley Pre	DAP 2nd Scorer Easley Post
	1-4	1-6	5	1-4	1-6	5												
A	48	67	14	60	92	23	50	69	1.45	1.45	5-5	65	3	111	127	0	1.45	1.45
B	45	56	8	62	88	16	35	63	1.28	1.64	5-5	65	1	111	114	1	1.11	1.64
C	43	64	15	63	94	22	55	73	.89	2.19	5-5	65	1	92	169	1	.89	2.01
D	61	87	17	64	93	21	53	67	1.83	2.95	5-7	67	1	134	168	0	2.01	2.55
E	55	81	17	63	95	23	54	76	.89	1.45	5-2	62	1	97	132	0	1.11	1.45
F	45	54	9	53	73	16	37	59	.67	.89	5-6	66	3	91	96	0	.67	.89
G	33	53	13	59	92	23	53	66	1.45	1.64	5-10	70	1	116	114	1	1.45	1.83
H	47	65	15	61	93	23	45	72	1.64	1.83	5-6	66	1	100	125	0	1.45	1.83
I	47	60	12	61	89	23	45	69	1.28	1.28	5-3	63	1	110	117	1	1.11	1.28
J	52	67	15	57	87	21	41	61	1.45	1.28	5-10	70	5	107	103	1	1.45	1.45
K	37	46	8	61	86	18	28	65	1.45	1.45	5-4	64	6	98	103	0	1.45	1.45
L	31	48	4	59	84	18	19	57	.67	1.11	5-2	62	5	97	97	0	.67	1.11
M	46	65	13	62	93	22	36	66	1.11	1.83	5-7	67	6	107	125	1	1.11	1.83
N	61	86	15	65	97	23	64	69	2.01	2.55	5-6	66	3	163	125	0	2.19	2.19
O	40	63	18	64	96	22	46	64	.89	1.45	5-10	70	1	73	99	1	.89	1.45
P	40	58	14	61	94	24	33	64	1.11	1.28	5-9	69	1	91	100	1	1.11	1.45
Q	53	68	11	63	91	22	44	62	1.45	1.83	5-9	69	3	113	124	0	1.45	1.83
R	55	71	14	64	98	24	47	62	1.64	1.83	6-0	72	1	121	127	1	1.45	1.83
S	54	79	16	63	95	23	54	74	1.11	2.01	5-2	62	5	121	137	0	1.11	2.01
T	35	49	12	62	92	20	49	68	.67	1.45	5-9	69	7	83	108	1	.67	1.45
U	41	50	9	60	84	21	25	64	.67	.67	5-4	64	3	75	73	1	.67	.67
V	34	49	14	56	86	23	36	64	1.28	1.11	5-10	70	3	111	87	1	1.28	1.28
W	60	87	19	64	94	21	58	72	1.45	1.64	5-9	69	1	122	108	0	1.45	1.45
X	42	53	11	62	81	19	35	54	.89	1.11	5-2	62	4	82	101	1	.89	1.28
Y	35	45	10	60	87	22	38	58	.67	1.28	5-5	65	1	74	89	0	.67	1.28

Control

Subj.	Met. Read. Pre			Post			Frostig Pre	Frostig Post	DAP Easley Pre	DAP Easley Post	Age Years	Age Months	Occup.	DAP Gooden. Pre	DAP Gooden. Post	Sex	DAP Easley 2nd Scorer Pre	DAP Easley 2nd Scorer Post
	1-4	1-6	5	1-4	1-6	5												
A	43	63	15	48	71	16	44	48	1.28	1.64	5-7	67	5	112	136	0	1.45	1.64
B	56	72	11	62	86	16	50	57	1.45	1.83	5-7	67	1	121	95	1	1.45	1.64
C	50	73	19	59	87	21	52	57	1.11	1.11	5-8	68	3	97	85	1	1.11	1.11
D	38	53	9	61	84	16	46	53	.89	1.28	5-11	71	1	72	97	1	.89	1.28
E	35	53	11	50	74	17	33	46	1.11	1.45	5-2	62	6	111	110	0	1.28	1.45
F	56	77	15	59	86	19	57	58	1.11	1.45	5-9	69	6	113	100	1	1.11	1.64
G	58	84	16	65	90	16	65	63	1.64	2.01	5-5	65	5	120	135	0	1.45	1.83
H	29	45	10	54	79	17	34	48	1.45	1.45	5-3	63	1	133	113	0	1.45	1.64
I	43	53	9	56	77	15	45	52	.33	1.11	5-6	66	7	64	96	1	.33	1.28
J	38	45	6	53	73	16	39	52	1.28	1.45	5-7	67	4	112	90	1	1.45	1.45
K	39	57	13	63	89	21	47	47	1.11	1.11	5-9	69	4	87	92	1	1.11	1.11
L	56	78	13	57	84	19	54	61	2.19	1.83	5-6	66	1	168	150	0	2.19	1.83
M	52	69	10	61	81	11	49	58	1.11	1.11	6-5	77	5	78	72	1	1.28	1.11
N	60	83	16	65	97	22	52	59	1.45	2.19	5-5	65	3	106	128	0	1.45	1.83
O	44	61	13	52	79	20	36	53	1.28	1.64	5-7	67	4	99	111	0	1.45	1.64
P	45	61	13	58	83	17	43	53	.67	1.11	5-9	69	4	78	96	1	.89	1.11
Q	30	38	7	57	79	17	30	42	1.11	.67	5-6	66	6	109	79	1	1.11	.67
R	52	59	7	59	80	13	44	47	.89	1.11	5-3	63	6	86	78	0	.89	.67
S	35	45	7	46	65	16	42	46	.67	.33	5-5	65	1	83	59	1	.67	.33
T	53	77	15	58	86	20	57	62	1.11	1.45	6-1	73	1	103	95	0	1.28	1.45
U	50	75	16	59	88	20	48	64	1.45	1.45	5-9	69	1	122	112	1	1.45	1.45
V	55	78	14	64	93	24	46	57	1.45	1.64	5-10	70	4	107	114	0	1.45	1.83
W	42	59	14	59	83	18	45	43	1.45	1.45	5-6	66	3	109	113	0	1.45	1.64
X	59	83	15	65	91	17	56	64	1.45	1.83	5-10	70	3	107	103	0	1.45	1.83
Y	62	91	20	65	97	22	56	66	1.64	2.01	5-9	69	3	126	121	0	1.45	2.01

APPENDIX C

Table 84.—OCCUPATION GROUP AND CLASS OF WORKER OF EMPLOYED PERSONS, BY SEX, FOR COUNTIES: 1960—Con.

[See text for source of data]

SUBJECT	SNOHOMISH	SPOKANE	STEVENS	THURSTON	WAHKIAKUM	WALLA WALLA	WHATCOM	WHITMAN	YAKIMA
OCCUPATION									
MALE, EMPLOYED	40 589	60 491	4 376	12 865	944	10 494	16 382	8 641	34 103
1 PROFESSIONAL, TECHNICAL, AND KINDRED WORKERS	3 826	6 423	312	1 601	61	1 165	1 382	1 522	2 256
ENGINEERS, TECHNICAL	599	855	12	327	13	255	112	27	212
MEDICAL & OTHER HEALTH WORKERS: SALARIED	144	393	13	53	...	81	41	51	107
SELF-EMPL	281	548	28	90	4	84	107	52	206
TEACHERS, ELEMENTARY & SECONDARY SCHOOLS	670	800	69	270	21	96	284	111	475
OTHER PROFESSIONAL, ETC.: SALARIED	1 874	3 271	163	786	16	574	735	1 233	1 061
SELF-EMPLOYED	258	556	27	75	7	75	103	48	195
2 FARMERS AND FARM MANAGERS	1 044	1 582	989	378	136	845	1 496	1 497	4 058
3 MANAGERS, OFFICIALS, & PROPR'S, EXC. FARM	4 892	9 280	415	1 912	87	1 367	2 010	760	4 140
SALARIED	2 817	5 817	173	1 174	28	875	1 104	468	2 272
SELF EMPLOYED: RETAIL TRADE	892	1 390	95	268	27	259	450	142	883
OTHER THAN RETAIL TRADE	1 183	2 073	147	470	32	233	456	150	985
4 CLERICAL AND KINDRED WORKERS	1 973	4 491	134	863	15	544	713	331	1 175
5 SALES WORKERS	2 804	5 955	156	664	16	610	1 023	328	2 006
RETAIL TRADE	1 155	2 170	111	328	12	295	537	192	845
OTHER THAN RETAIL TRADE	1 649	3 785	45	336	4	315	486	136	1 161
6 CRAFTSMEN, FOREMEN, AND KINDRED WORKERS	9 675	12 455	594	2 565	155	1 921	3 285	951	5 130
CONSTRUCTION CRAFTSMEN	3 123	3 461	198	783	46	648	1 256	268	1 658
FOREMEN (N.E.C.[1])	1 032	1 543	68	313	22	212	364	116	714
MECHANICS AND REPAIRMEN	2 303	3 582	186	711	35	606	740	346	1 590
METAL CRAFTSMEN, EXCEPT MECHANICS	1 302	855	40	100	4	112	279	23	347
OTHER CRAFTSMEN	1 915	3 014	102	658	48	343	646	198	821
7 OPERATIVES AND KINDRED WORKERS	8 639	10 178	783	2 216	97	1 240	3 053	702	4 462
DRIVERS AND DELIVERYMEN	2 149	3 383	257	490	62	504	833	250	1 780
OTHER OPERATIVES, ETC.: DUR. GOODS MFG.	3 107	2 719	336	860	15	142	602	66	520
NONDUR. GOODS MFG	1 523	969	5	324	...	171	750	63	732
NONMFG. INDUSTRIES	1 860	3 107	185	542	20	423	868	323	1 430
8 PRIVATE HOUSEHOLD WORKERS	44	45	3	4	...	9	44	9	34
9 SERVICE WORKERS, EXCEPT PRIVATE HOUSEHOLD	1 830	3 814	147	582	28	982	967	639	1 562
PROTECTIVE SERVICE WORKERS	549	781	37	146	14	348	185	57	332
WAITERS, BARTENDERS, COOKS, & COUNTER WKRS.	338	566	19	83	...	118	208	117	268
OTHER SERVICE WORKERS	943	2 467	91	353	14	516	574	465	962
10 FARM LABORERS AND FARM FOREMEN	705	777	320	365	42	731	645	1 035	6 469
11 LABORERS, EXCEPT FARM AND MINE	4 133	4 088	488	1 318	271	719	1 543	584	2 228
CONSTRUCTION	548	663	51	148	11	118	307	110	512
MANUFACTURING	2 029	1 153	308	667	204	134	470	95	547
OTHER INDUSTRIES	1 556	2 272	129	503	56	467	766	379	1 169
12 OCCUPATION NOT REPORTED	1 024	1 403	35	397	36	361	221	283	583
FEMALE, EMPLOYED	16 610	32 239	1 514	6 613	317	5 493	7 520	3 571	14 911
PROFESSIONAL, TECHNICAL, AND KINDRED WORKERS	2 250	4 837	226	907	41	797	1 243	733	2 009
MEDICAL & OTHER HEALTH WORKERS: SALARIED	593	1 628	58	182	...	259	350	140	550
SELF-EMPL	15	131	...	15	...	24	...	4	16
TEACHERS, ELEMENTARY & SECONDARY SCHOOLS	923	1 603	116	368	17	231	462	197	882
OTHER PROFESSIONAL, ETC.: SALARIED	584	1 233	44	297	20	253	361	351	453
SELF-EMPLOYED	135	242	8	45	4	30	70	41	108
FARMERS AND FARM MANAGERS	147	71	64	65	56	39	138	20	195
MANAGERS, OFFICIALS, & PROPR'S, EXC. FARM	723	1 664	46	358	22	276	398	103	710
SALARIED	358	1 052	19	202	19	198	203	72	360
SELF-EMPLOYED: RETAIL TRADE	214	281	16	104	3	59	123	19	208
OTHER THAN RETAIL TRADE	151	331	11	52	...	19	72	12	142
CLERICAL AND KINDRED WORKERS	4 878	10 710	277	2 654	44	1 719	1 943	979	3 429
SECRETARIES, STENOGRAPHERS, AND TYPISTS	1 292	3 392	46	1 065	24	488	569	369	834
OTHER CLERICAL WORKERS	3 586	7 318	231	1 589	20	1 231	1 374	610	2 595
SALES WORKERS	1 579	2 746	139	381	32	353	655	235	1 145
RETAIL TRADE	1 349	2 316	124	326	32	278	583	214	1 009
OTHER THAN RETAIL TRADE	230	430	15	55	...	75	72	21	136
CRAFTSMEN, FOREMEN, AND KINDRED WORKERS	205	301	24	43	8	63	86	29	146
OPERATIVES AND KINDRED WORKERS	1 473	1 715	73	280	...	431	574	172	2 596
DURABLE GOODS MANUFACTURING	202	183	8	20	...	15	12	...	33
NONDURABLE GOODS MANUFACTURING	664	415	15	72	...	200	295	45	970
NONMANUFACTURING INDUSTRIES	607	1 117	50	188	...	216	267	127	1 593
PRIVATE HOUSEHOLD WORKERS	1 509	2 731	151	534	21	466	682	340	1 186
SERVICE WORKERS, EXCEPT PRIVATE HOUSEHOLD	2 882	6 056	247	909	31	1 080	1 407	805	2 164
WAITERS, BARTENDERS, COOKS, & COUNTER WKRS.	1 479	2 578	131	434	12	444	718	449	993
OTHER SERVICE WORKERS	1 403	3 478	116	475	19	636	689	356	1 171
FARM LABORERS AND FARM FOREMEN	284	184	180	186	46	45	189	39	878
LABORERS, EXCEPT FARM AND MINE	44	122	16	52	...	20	23	8	96
OCCUPATION NOT REPORTED	636	1 102	71	244	16	204	182	108	357
CLASS OF WORKER									
MALE, EMPLOYED IN AGRICULTURE	2 011	2 615	1 337	814	178	1 721	2 291	2 614	10 948
PRIVATE WAGE AND SALARY WORKERS	787	839	199	389	31	833	649	957	6 586
GOVERNMENT WORKERS	27	59	4	7	...	...	5	49	28
SELF-EMPLOYED WORKERS	1 132	1 669	1 004	389	136	867	1 536	1 501	4 092
UNPAID FAMILY WORKERS	65	48	130	29	11	21	101	107	242
FEMALE, EMPLOYED IN AGRICULTURE	512	351	256	299	102	129	379	79	1 207
PRIVATE WAGE AND SALARY WORKERS	245	183	22	152	8	78	173	55	898
GOVERNMENT WORKERS	...	...	...	4	...	...	...	...	...
SELF-EMPLOYED WORKERS	147	85	64	69	56	39	146	20	199
UNPAID FAMILY WORKERS	120	83	170	74	38	12	60	4	110
MALE, EMPLOYED IN NONAGRICULTURAL INDUSTRIES	38 578	57 876	3 039	12 051	766	8 773	14 091	6 027	23 155
PRIVATE WAGE AND SALARY WORKERS	29 635	43 309	1 865	7 338	493	5 861	10 039	2 809	16 680
GOVERNMENT WORKERS	3 931	7 554	571	3 295	118	1 817	1 963	2 538	2 970
SELF-EMPLOYED WORKERS	4 993	6 935	599	1 391	152	1 083	2 085	667	3 471
UNPAID FAMILY WORKERS	19	78	4	27	3	12	4	13	34
FEMALE, EMPLOYED IN NONAGRICULTURAL INDUS	16 098	31 888	1 258	6 314	215	5 364	7 141	3 492	13 704
PRIVATE WAGE AND SALARY WORKERS	12 471	24 854	789	3 180	132	4 088	5 230	1 782	10 618
GOVERNMENT WORKERS	2 396	4 756	277	2 690	64	852	1 303	1 490	1 916
SELF-EMPLOYED WORKERS	929	1 880	110	314	19	294	479	176	814
UNPAID FAMILY WORKERS	302	398	82	130	...	130	129	44	356

[1] "N.E.C." MEANS NOT ELSEWHERE CLASSIFIED.

were developed in consultation with many individuals, private organizations, government agencies, and, in particular, the Interagency Occupations Classification Committee of the United States Bureau of the Budget.

Occupation Statistics

Classification system.—The occupational classification system developed for the 1960 Census of Population consists of 479 items, 297 of which are specific occupation categories; the remainder are subgroupings (mainly on the basis of industry) of 13 of the occupation categories. The 479 detailed items are classified into 12 major occupation groups and selected condensed groups for which the occupation data are presented in this report.

For each group with a title that may not adequately indicate the inclusion of certain important components, a listing of such selected components is given. More complete information on the composition of the major groups is given in the publication, U.S. Bureau of the Census, 1960 Census of Population, *Classified Index of Occupations and Industries*, U.S. Government Printing Office, Washington.

Professional, technical, and kindred workers.

Engineers, technical.—Includes aeronautical, chemical, civil, electrical, industrial, mechanical, metallurgical, mining, and sales engineers, and metallurgists.

Medical and other health workers.—Includes chiropractors, dentists, dietitians, healers, medical and dental technicians, nutritionists, optometrists, osteopaths, pharmacists, physicians and surgeons, professional nurses, student professional nurses, psychologists, therapists, veterinarians.

Teachers, elementary and secondary schools.—Includes principals and supervisors of elementary and secondary schools.

Other professional, technical, and kindred workers.—Includes accountants and auditors, actors, airplane pilots and navigators, architects, artists and art teachers, athletes, authors, clergymen, college presidents, professors, and instructors, dancers, dancing teachers, designers, draftsmen, editors, electrical, electronic, and other engineering and physical science technicians, entertainers, farm and home management advisors, foresters and conservationists, funeral directors and embalmers, judges, lawyers, librarians, musicians and music teachers, natural scientists, reporters, sports instructors and officials, surveyors, teachers (except elementary and secondary).

Farmers and farm managers.

Includes owner operators, tenant farmers, and share croppers.

Managers, officials, and proprietors, except farm.

Includes buyers, building managers and superintendents, credit men, lodge, society, and union officials, postmasters, public administration inspectors and officials, purchasing agents and buyers, railroad conductors, ship officers, pilots, pursers, and engineers.

Clerical and kindred workers.

Secretaries, stenographers, and typists.—Includes clerk-typists, public stenographers, typing-pool supervisors.

Other clerical workers.—Includes baggagemen, bank tellers, bill and account collectors, bookkeepers, cashiers, dispatchers and starters of vehicles, express messengers, file clerks, insurance adjusters, insurance examiners and investigators, library attendants and assistants, mail carriers, messengers and office boys, office machine operators, payroll and timekeeping clerks, postal clerks, physician's and dentist's office attendants, railway mail clerks, receptionists, shipping and receiving clerks, stock clerks, storekeepers, telegraph messengers, telegraph operators, telephone operators, ticket, station, and express agents.

Sales workers.

Includes advertising agents and salesmen, auctioneers, demonstrators, hucksters, insurance agents and brokers, insurance underwriters, newsboys, peddlers, real estate agents and brokers, stock and bond salesmen, salesmen and sales clerks in retail trade.

Craftsmen, foremen, and kindred workers.

Construction craftsmen.—Includes brickmasons, carpenters, cement and concrete finishers, electricians, excavating, grading, and road machinery operators, painters (construction and maintenance), paperhangers, pipefitters, plasterers, plumbers, roofers and slaters, stone masons, structural metal workers, tile setters.

Mechanics and repairmen.—Includes repairers of airconditioning, heating, and refrigeration equipment, airplanes, automobiles, office machines, radios and television, railroad cars.

Metal craftsmen, except mechanics.—Includes blacksmiths, boilermakers, coppersmiths, die makers and setters, forgemen and hammermen, heat treaters, machinists, metal jobsetters and molders, metal rollers and roll hands, millwrights, pattern and model makers (except paper), sheet metal workers, tinsmiths, toolmakers.

Other craftsmen.—Includes bakers, bookbinders, cabinetmakers, compositors, cranemen, derrickmen, electrotypers, engravers, furriers, glaziers, goldsmiths, inspectors, jewelers, lens grinders and polishers, lithographers, locomotive engineers, locomotive firemen, log and lumber scalers and graders, loom fixers, millers, motion picture projectionists, opticians, piano and organ tuners and repairmen, plate printers, printing pressmen, shoemakers (except in factories), silversmiths, stereotypers, stationary engineers, stone carvers, stone cutters, tailors, telegraph and telephone linemen and servicemen, typesetters, upholsterers, watchmakers, window dressers.

Operatives and kindred workers.

Drivers and deliverymen.—Includes bus drivers, chauffeurs, deliverymen, routemen, taxicab drivers, truck and tractor drivers.

Other operatives and kindred workers.—Includes apprentices, asbestos and insulation workers, assemblers, auto service and parking attendants, blasters, boatmen, bus and street railway conductors, canalmen, dressmakers, furnacemen, graders and sorters in manufacturing, laundry and dry cleaning operatives, lockkeepers, meat cutters, metal heaters, milliners, mine operatives and laborers, motormen, oilers and greasers, packers, painters (except construction and maintenance), photographic process workers, powdermen, power station operators, railroad brakemen and switchmen, sailors, sawyers, sewers and stitchers in manufacturing, smeltermen, stationary firemen, surveying chainmen, rodmen, and axmen, textile knitters, textile spinners, textile weavers, welders, and flame cutters, wrappers.

Private household workers.

Includes baby sitters, housekeepers, and laundresses in private household.

Service workers except private household.

Protective service workers.—Includes bailiffs, bridge tenders, constables, detectives, firemen (fire protection), guards, marshals, policemen, sheriffs, watchmen.

Waiters, cooks, and bartenders.—Includes cooks (except in private households) and counter and fountain workers.

Other service workers.—Includes attendants and ushers in amusement places, barbers, bootblacks, boarding and lodginghouse keepers, chambermaids and maids (except in private household), charwomen, elevator operators, hairdressers, housekeepers and stewards (except in private household), janitors, kitchen workers (except in private household), midwives, porters, practical nurses, sextons.

Farm laborers and farm foremen.

Unpaid family workers.—Includes unpaid family farm laborers.

Except unpaid family workers.—Includes self-employed farm service laborers.

Laborers, except farm and mine.

Includes carpenters' helpers, car washers, fishermen, garage laborers, gardeners, longshoremen, lumbermen, oystermen, raftsmen, stevedores, teamsters, truck drivers' helpers, warehousemen, woodchoppers.

Relation to DOT classification.—The Population Census occupational classification is generally comparable with the system used in the *Dictionary of Occupational Titles* (DOT).[1] The two systems, however, are designed to meet different needs and to be used under different circumstances. The DOT system is much more detailed than the system of the Bureau of the Census, and it also calls for many types of distinctions which cannot be made from census information.

[1] See U.S. Department of Labor, Bureau of Employment Security, *Dictionary of Occupational Titles*, Second Edition, Vols. I and II, Washington, 1949.

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"General Social and Economic Characteristics" - Washingto

U. S. Dept. of Commerce ; Luther H. Hodges, Sec.
Bureau of the Census ; c. 1960.

APPENDIX D

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Frostig, Marianne and Horne, David. "Teacher's Guide". *The Frostig Program for the Development of Visual Perception*, Spirit Masters, VM: Exercise 12, FG: Exercise 1, PC: Exercise 1, PS: Exercise 1, SR: Exercise 1, Follet Pub. Co., 1964, Chicago.