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The effects of perceptual and Piagetian training on the reading achievement of first grade pupils

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THE EFFECTS OF PERCEPTUAL AND PIAGETIAN COGNITIVE TRAINING ON THE READING ACHIEVEMENT OF FIRST GRADE PUPILS

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Abstract of Dissertation

Purpose: This study was designed to investigate the effect of pairing cognitive training, developed from Piaget's theory, with perceptual training on reading achievement. Also investigated was the effect of cognitive and perceptual training by themselves, as well as that of a control group on reading achievement. A second purpose of this study was to investigate whether or not perceptual errors would be reduced by pairing perceptual and cognitive training as opposed to perceptual, cognitive or control training alone.

Procedures: Four first grades, with their 87 pupils, were used to represent the four conditions of training. These first grades were part of a three school elementary district with 1600 pupils. Each first grade was assigned one of four training programs: (1) Combined cognitive and perceptual training, (2) Cognitive, (3) Perceptual, (4) Control. The cognitive training consisted of a program developed from Piaget's theory of cognition. The perceptual training was a progressive paper-pencil program. The four programs were started at the beginning of the school year and ended in May.

Pretesting and posttesting was done nine months apart, with the Wide Range Achievement Test and the Slingerland Test of Learning Disability. Each hypothesis was restated in the null form. Statistical analysis included homogeneity of regression, analysis of covariance and planned contract comparison among treatment means. There was also a post hoc analysis done to see if gender was a factor in determining differences among the group means.

Findings: (1) There was found to be a statistically significant difference between the combined treatment group and the other three groups on the dependent variables of reading achievement grade placements and perceptual error scores. Inspection of the adjusted posttest means suggested that the combined training was the most successful of the treatments. (2) There was a significant interaction indicated between treatment effect of cognitive training and gender on the dependent variable of reading achievements with females scoring higher than males.

Conclusions: The combining of a cognitive and visual perceptual training program produced a training effect that significantly and positively affected the reading vocabulary scores and perceptual error rate of first grade children. The cognitive treatment was also found to have had a positive effect on reading scores. An interaction was present in that girls achieved better reading scores than boys as a result of cognitive training. Gender had no effect for the other three groups.

Recommendation: The gains made by the children in the combined training program would suggest that a Piaget-based cognitive training program, combined with visual perception training should be included in the first grade curriculum as a means of acquiring higher levels of reading and visual skills. This study should be replicated with teacher variability controlled by having one teacher train the different groups of first grade pupils in the three treatments.

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GENERAL STATEMENT

This study was undertaken to investigate the controversy surrounding the role of perceptual motor training programs in the school curriculum. Much of the controversy centers on the question of the generalizability of training in perceptual motor skills to performance in reading. Proponents of perceptual motor training programs maintain that the training develops underlying neurological and sensori-motor organizations or integration, which is essential to the acquisition of reading skills. Various rationales are given for different systems of training, but the activities suggested by these systems are similar in that they involve the use of motor and non-verbal perceptual training as a means of facilitating reading skills in children (Barsch, 1967; Delacato, 1966; Frostig and Horne, 1964; Getman, 1962; Kephart, 1960).

Unfortunately, the limited research material on the problem presents conflicting evidence. Studies supporting the positive effects of perceptual motor training consist primarily of case study materials of individual children (Delacato, 1966; Kephart, 1960). Other studies confound variables by combining perceptual motor training with traditional education methods.

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Chapter I

THE PROBLEM, HYPOTHESES, AND DEFINITION OF TERMS

Introduction

During the 1960's perceptual training was introduced into the schools as one of the necessary components of remedial reading programs. Such training was also regarded as an essential part of the early primary programs of reading skill development (Harris and Smith, 1972).

The advent of perceptual training in the primary school programs of reading was accompanied by a rush to try to demonstrate experimentally that such training would actually improve reading. The results have been largely inconclusive (Duncan, 1971; Halliwell and Solan, 1972). Some experimenters have reported success through increased reading achievement (Faustman, 1968; Bosworth, 1967; Gibson, 1967). Other researchers have been unable to find positive results (Cohen, 1969; Rosen, 1966).

One aspect of these perceptual training programs has been the basic isolation of these sequences from any integrated approach to child growth (Anheim, 1969).

Teachers, particularly in the primary grades, are pressured by external and internal needs to make their students learn to read. Any procedure or method that holds out a promise to help is eagerly sought and used--often without question. Now that some time has elapsed since the initial onslaught of perceptual training techniques and materials, it seems appropriate to explore and integrate what we know about perception into the recent areas of knowledge in child growth and development.

Piaget has developed a theory describing how children develop in the cognitive area. Perception is included within this theory as an important aspect of cognitive growth. His theory indicates that to isolate perceptual training from cognitive training would negate the former (Flavell, 1963). Piaget's theory suggests that students could be taught perceptual skills within the framework of cognitive training (Furth, 1960). It would then appear possible to investigate the effect of various training combinations of perception and cognition programs upon reading achievement.

Statement of the Problem

Some students are having difficulty reading.

There are indications from Piaget's work that a combination of cognitive and perceptual training might be helpful. As cited earlier, the effectiveness of isolated visual perception training is inconclusive. Despite this, the schools have continued to use such training as a continuing part of their K-3 programs.

Purpose of the Study

This study seeks to investigate the effect of pairing cognitive training, developed from Piaget's theory, with perceptual training on reading achievement. Also investigated will be the effect of cognitive and perceptual training by themselves, as well as that of a control group, on reading achievement.

Since reading is both a cognitive and visual perception skill (Gibson, 1967; Harris and Smith, 1972; Werner, 1957), the researcher expected to see a significant increase in reading achievement as a result of the paired training, as compared to either perception or cognition training or no training at all.

Theoretical Background

Piaget's theory of intelligence offers a framework within which to understand the interrelationship of

perception and cognition. He suggests that perception must be understood as part of the total cognitive growth process (Piaget, 1969). Other authors have done extensive work with perception (Anheim, 1969; Werner, 1948), however, the work of Piaget places perception and cognition into a unified, mutually interacting system that has given rise to considerable experimental work (Almy, Chittenden and Miller, 1966; Furth, 1969; Piaget, 1967).

Piaget states (Furth, 1969) that when an organism reacts there is not only the response to outside stimuli, but also "the response of the underlying structure within the organism". When the young child experiences external stimuli, the underlying intrinsic cognitive structure determines, to a large degree, what is perceived.

The process of perceiving involves assimilation and accommodation. "Assimilation is when an organism incorporates into his own mental framework the data from an experience" (Lavatelli, 1970). Therefore, in order for a child to respond there must be an inner sameness between the cognitive structure within the organism and the environmental phenomenon. A higher cognitive process is that of accommodation, where there is a modification of an existing framework of thought. There is a modifying and redefining of the cognitive framework so as to incor-

porate the data that was assimilated. Initiative and choice are present as the child "takes a stand" on the presented data and as a process of accommodation is undertaken, i.e., there must be an effort made by the child.

In regard to the perceptual process, Piaget states that perception is a subordinate process of the cognitive operation/system and that it, therefore, develops in conjunction with the developmental framework of intelligence (Lavatelli, 1970; Flavell, 1963). Perceptual training alone will not lead to the transformation of data that is necessary to logical thinking. Many primary programs emphasize perceptual training as a prerequisite to reading, but if this training has little to do with transforming data (as in reading) then the perceptual training contributes little to the expected goal. The child must, through a cognitive process, change what he perceives.

Lavatelli, of the University of Illinois, has done extensive work with Piaget's theory of childhood development and, as a result of her work, developed a cognitive training program. This program is designed for the grade placement years of kindergarten and first grade. With the development of this program, an investigation

can be made in the possibility of improving the effect of perceptual training on reading skill.

Hypotheses

This study is based upon the following hypotheses:

H_1: Children who have training in both perceptual and cognitive skills have better reading skills, as measured by the Reading Subtest of the Wide Range Achievement Test, than those receiving only perceptual training.

H_2: Children who have training in both perceptual and cognitive skills have better reading skills, as measured by the Reading Subtest of the Wide Range Achievement Test, than those receiving only cognitive training.

H_3: Children who have training in both perceptual and cognitive skills have better reading skills, as measured by the Reading Subtest of the Wide Range Achievement Test, than those in the control group who have neither cognitive nor perceptual training.

H_4: Children who have training in both perceptual and cognitive skills achieve lower perceptual error scores, as measured by the Slingerland Test of

Learning Disability, than those having only perceptual training.

H_5: Children who have training in both perceptual and cognitive skills achieve lower perceptual error scores, as measured by the Slingerland Test of Learning Disability, than those who have only cognitive training.

H_6: Children who have training in both perceptual and cognitive skills will achieve significantly lower perceptual error scores, as measured by the Slingerland Test of Learning Disability, than those in the control group who receive neither cognitive nor perceptual training.

Limitation

The students are not truly representative of the cross-section of the nation's school population in regard to large city and urban populations. However, Piaget's theory has stated that regardless of the cultural, intellectual, and experience factors, the cognitive processes and structures are the same for all children. Some children will mature earlier, some will be delayed (Lavatelli, 1970), due to environmental and genetic factors, but the essential processes and structures are still

present and show their effect in the child's cognitive and perceptual development.

The variable of teacher difference could not be completely controlled. This difference involved such variables as teacher effort, skill in personal interaction with children, and experience. The latter element was felt to be somewhat controlled, as none of the teachers had less than five years experience.

The selection of the children cannot be considered random sampling. As Keppel (1973) stated, however, most subjects are selected from convenience rather than at random.

Statistically, the extension of the results of this experiment cannot be extended beyond its boundaries. However, Keppel makes the point that there are statistical and non-statistical generalizations. The former cannot extend beyond the statistics for the sample, but the latter, based upon knowledge of the subject matter, permits extension of the findings.

Definitions

For the purpose of this study, the following terms are defined:

Visual Perception Training. Visual Perception

Training is described as visual thinking (Anheim, 1969). It is a process of learning to understand sensory data through the modality of the eyes. Training in this sensory area means to instruct the student to perceive his world in such a way that visual stability is present (Harris and Smith, 1972). Many such programs are available, e.g., Winterhaven's Perceptual Training Program (Winterhaven Lions Research Foundation, Inc., 1969), Frostig Program for Individualized Training and Remediation in Visual Perception (Kephart, 1971), POINT System, developed by Fresno City Schools.

The visual perception training used in this study was the program of eight units from the Continental Press, Inc., which included skills in Visual Readiness, Seeing Likenesses and Differences, and Visual Discrimination.

The Piaget Cognitive Training Program. Lavatelli, working with American Science and Engineering, Inc., developed in 1972 a cognitive training program, using Piaget's developmental theory as a framework. The program trains children, ages 4-6, in those areas of intellectual growth that are predominant at the aforementioned ages, as defined by Piaget (American Science and Engineering, Inc., 1972).

Summary

The first chapter of this dissertation has presented an introduction to the problem, stated the problem, discussed the significance of the study, stated the hypotheses, specified the assumptions and limitations of this research project, and defined the technical terms used in the report.

There are four additional chapters to complete this dissertation: Chapter II is a review of the relevant literature; Chapter III describes the design and procedures of the study; Chapter IV gives a presentation of the data obtained from this investigation; and Chapter V states conclusions based upon the study and offers some recommendations for further study.

Chapter II

CURRENT RESEARCH

This chapter is concerned with the theoretical and research foundations of the question investigated by this research project. Central to the research done were two areas of interest: The first one was the role of perceptual training in the acquisition of reading skills, and second was the interrelationship of cognitive operations and perceptual functions as applied to reading.

Certainly, as noted by Spache (1976), there are a multitude of issues involved with learning to read, as well as in the remediation of reading disabilities. As indicated, however, this study attends specifically to the problem of whether an interdependency exists between perceptual and cognitive functions that can be used to enhance reading skills.

Introduction

With the advent of Frostig's visual perception training programs in the mid-sixties, a tremendous interest for this type of training as an answer for read-

ing problems developed within the educational system. There had been other authors and investigators interested in visual perception training, such as Kephart (1971), who had published his theory in 1960, but Frostig provided a program which included a test and a remediation package of materials. Since the time of the publication of the Frostig materials, the various companies that sell educational materials and programs have become involved with producing many different visual perception training packages. Implied in these remediation and training activities is the assumption that these programs will somehow increase reading levels both on the readiness and on the remediation levels.

There appears to be a division made between visual perception training by itself and visual perception training done to increase reading skills, i.e., vocabulary reading skill. This paper deals with visual perception training and reading, but it seems appropriate to mention a few studies dealing with basic visual perception training as an introduction to the subject before going ahead and applying it to reading success.

The studies reviewed here concerning perceptual training for perceptual skill increase, as well as reading enhancement, seem to illustrate the tremendous con-

fusion present regarding whether or not perception training helps a student in his acquisition of reading skills.

The general studies grouped together here are kept at a minimum due to the constant repetition of results that are present. As one reads the hundreds of reports, it is apparent that certain major points are being repeated.

During the 1960's many investigators were interested in the Frostig tests and training materials as a means of increasing perceptual skills. One investigator of the Frostig materials was Coralie (1969), who demonstrated that the Frostig Developmental Program in Visual Perception (FPDVP) significantly improved perception, as reflected on the Metropolitan Readiness Test.

Another study by Wiederholt and Hammer (1971), substantiated this improvement of perceptual skills by the use of the Frostig materials. Unfortunately, the authors used Frostig's own test as a pre- and post-measure. The training materials reflect much of the test in their training sequence, thus preparing the student to better take the test. A similar type of experiment was conducted by Bishop (1972), who also found that the FPDVP would improve perceptual scores on the Frostig test.

In opposition to these studies, Buckland, (1969), Pumfrey and Anthony (1972), and Sheck (1967), found no significant perceptual skill increase with the use of Frostig materials, nor did Church (1970), who in two separate studies, also found no gain in visual perception skills through the use of Frostig materials. He also raised the question as to the value of any perceptual training. Conversely, other studies, such as those by Muehl (1966), Rose (1974), Turner and Fisher (1970), Williams (1969), and King (1964), using a variety of training materials and tests, showed significant gains in perceptual skills.

Collectively, there does appear to be evidence that it is possible to increase or stimulate perceptual skills using perceptual training programs, although there has been little done to show that the gains are permanent.

Even though the majority of the studies are in support of perceptual training, the varied studies are also not always fully positive in their findings. One apparent problem that is present in many of the studies surveyed is that the authors do not give a rationale for their choice of specific perceptual training programs. They imply that visual perception training is essentially

the same whether it is a paper-pencil task, manipulation of geometric shapes, colored puzzles, etc. On the other hand, examination of the many published training tasks seems to clearly indicate that many factors are involved. There is also, as with the Frostig test, a use of items that are related directly to the training materials, which then contaminates the results through teaching to the test.

The second issue that is more important to this study is that of the relationship of perception enhancement to reading achievement. As will be noted, the studies are more controversial than those dealing only with perceptual improvement.

Reading and Perceptual Training

The studies that favor perceptual training as a means of helping increase reading achievement are minimal. One that did support such preparedness for reading was done by Benensen (1972), who isolated out the factor of visual memory from the gross category of visual perception, and found that this was positively correlated with reading at the readiness level. This is one of the more interesting investigations, due to the specificity of factors dealt with instead of a global approach.

Halliwell (1972) found that Perceptual training helped reading achievement of boys, but only in conjunction with a regular reading program. Developmental differences, specifically boys', show that their visual perceptual skills mature slower than girls'. From Halliwell's work it would appear that he has again demonstrated this in regard to perception. One study by Gamsky and Lloyd (1971) noted improved word recognition skills through the use of the Frostig training program in kindergarten.

Rouch (1968) trained first graders in visual discrimination skills and tested whether there was improved reading. He found no significant reading achievement increase, even though there was a significant increase in visual-motor skills. Other authors, such as Hedges (1974), Lapray and Ross (1965), Fortenburg (1969), Seaton (1972), Thomas (1971), found negative results in trying to increase reading achievement by means of perceptual training.

Several authors, such as Fortenburg (1969), surveyed a large number of studies and stated that reading skills were not improved by perceptual training, but that there was a significant increase, in most cases, of visual motor-skills.

There were, besides the positive and negative studies, several that pointed toward other factors which tended to illustrate some of the multi-factors present in the subject areas of perception and reading. Newman (1972) found that perceptual training resulted in greater reading achievement. However, the results also demonstrated that older children having reading problems improved more than did younger children. This brought in question the age factor of the perceptually delayed child. This agrees with a study by Andersen and Stern (1972).

A study by Holovka (1971) showed a significant increase in reading skill, but when he followed the children over a two-year period there was a regression of skills. No explanation was given,. except to consider the factor of individual attention given by the teacher and its decreased effect when taken away. One factor the author might have considered is that the original training was not assimilated, but rather was a short term "memory task" forgotten over time.

Several authors have mentioned the state of developmental readiness for perceptual tasks, including Klesius (1971), who suggested that the various research projects studying visual perception and reading have been moving toward identifying conditions under which

the training procedures for visual perceptual skills tend to improve reading. The point has yet to be reached, but he points toward the multitude of available experiments to be studied for an integration.

It appears from the many and varied studies that many perceptual training programs do tend to increase measured visual perception skills. Many authors, however, seem to have made the error of teaching to the test, as with the Frostig test and training programs. Following perception training success, many studies have attempted to prove a positive effect between perceptual training and reading success. There has been less demonstrated in this area. Results tend to be negative. The successes seem to point toward an age factor, where the older child may respond to visual perception training due to a delay in development. In contrast, the younger child would possibly be maturing at a normal rate and not be amenable to remediation, since he does not need it (Anderson and Stern, 1972).

There are many factors not yet brought together in regard to the visual perception training field, not the least of which is the training method. Visual perception training takes many forms and methods. The first training materials tended toward simple drawing of

geometric forms. As educators and curriculum specialists became more sophisticated, the types of programs increased to include manipulation of geometric material as well as basic letters and numbers. With time there appeared training involving drawing such as developed by the Westinghouse Corporation and packaged under the title of CHILD. This is a developmentally based visual perception program progressing from readiness to the first grade level. Other training programs, such as the one used in this study, followed the same type of format. Materials with color cues, tactile stimuli, and gross physical training, have also appeared. Rationalizations for the particular method used are often not given, or they are mentioned briefly without further explanation.

The topic of cognition in reading is not addressed here as there is no current relevant research that seems to directly deal with the question of conceptual skills and reading development. Many authors address themselves to the role of cognition in reading, but not until the student has learned to read short sentences and paragraphs at the primer level. As a consequence, the author felt that an overview of Piaget's view of perception would seem to introduce the reader to cognition as it fits within this study. The author would also refer the reader to Werner's

(1957) study in comparative psychology, where a detailed analysis is made of the formation of syncretic thought in primitive man as it parallels the perceptive and conceptive development in children of our society. Werner makes the point that the primitive mentality fuses or syncretically organizes perception/imagery and the real world, and so also does the child of our society in the early years of his life. This illustrates an interdependency of the visual stimuli and the conceptual structure that develops to understand or decode environmental stimuli.

Piaget's Theoretical Framework Regarding the Interrelationship of Perception and Cognitive Development

In light of the previous discussion, it would appear that the best conditions for enhancing reading through visual perception training would be with older children who show perception deficiency, and then linking remedial reading techniques with the visual perception training.

Piaget's theory of cognitive development has yet to be researched, much less linked to reading enhancement and perception. Certainly, Piaget's observations over the past forty years offer considerable validity but for the purpose of this study there is a dearth of

research. For the clarity of this study, it was felt that a brief statement should be made regarding Piaget's theory in regard to perception and cognition.

Some Preliminary Distinctions

Visual space has been and continues to be an area of investigation favored by educational psychologists interested in the learning process. It is Piaget who deserves the credit for having introduced the fundamental distinctions and interrelationships that seem to exist, first between perceptual space and intellectual space, and second between sensori-motor and representational space (Laurendeau-Pinard, 1970).

Perceptual Space and Cognitive Space

In his work in the perceptual mechanisms (1961), Piaget states that there is a distinction between the figurative and the operative aspects of knowledge; a distinction which appears to be critical at all stages of development. When an individual "knows" an object, he is constructing or reconstructing it. Piaget states that the knowledge of this operation must include two aspects: First, an aspect which is essentially operative, related to the operation by which the individual submits

the object to the transformation necessary for its reconstruction; and second, a figurative aspect related to the direct or pictorial perception of the successive states between which the transformational activities must be interposed. The operative aspect is dependent upon intelligence at all levels. The figurative aspect is dependent upon perception (or on the mental image).

Piaget emphasizes the crucial fact that intelligence and visual perceptions have a reciprocal influence upon each other. The information provided by perception serves as raw material for the intellectual action or operation, and reciprocally, the intellectual activities exert an influence on perception.

Representational Space

The understanding of representational space begins to develop around the age of two years with the emergence of the symbolic function. This is a developmental phenomenon which requires that the achievements attained at the earlier sensori-motor level of motor activity reassert themselves on the symbolic and conceptual levels (Piaget and Inhelder, 1948). Spatial representation then derives from sensori-motor activity, to which it is added when the appearance of the symbolic function enables the

child to act not only on objects which are real and physically present in his perceptual field, but also on objects which are symbolized or mentally represented. A critical facet of this process is the fact that the mental representation is not simply the mental recollection of the objects, nor even of the action exerted on them. It is still an action, but an action which has been internalized--that is, an implicit action which is carried out in thought on the symbolized object.

This is phrased differently by Laurendeau and Pinaud (1972), in that they state that to recall an object mentally is to reproduce or to sketch this object in thought, and that this mental activity is not limited to representing an external action or the result of this action, but it actively reconstructs it and extends it to the symbolic level.

A final critical point is noted by Piaget when he states that the internalized actions of symbolic thought are static and irreversible through about age seven, and are modified through the conditioning of perceptual activity.

Knowing and Perceiving

Having discussed the concept of space as viewed

by Piaget, it is now important to look at some broader, yet specific, processes of how children acquire "knowing" and to relate this to perceptual-space awareness.

When a child looks at the world around him, the underlying respective structures of intelligent behavior dictate or explain what the child perceives. The stimulus can be said to be that part of the world to which the child is responding, and the main factor of response is the underlying structure of the organism (Furth, 1969; Piaget, 1973). The stimulus received is also viewed as intrinsically related to the structure--it is able to be assimilated by the internal structure. The concept of assimilation is very critical to Piaget. There is assimilation each time an individual incorporates into his mental framework the data from an experience (Lavatelli, 1970). Or, as described by Furth (1969), "Assimilation is a technical term for the psychological relation of a stimulus to a reacting organism and expresses an inner correspondence or sameness between an environmental phenomenon and the structure within the organism."

If the incoming stimulus is not understood or cannot be assimilated, then for the child it does not constitute a stimulus--the stimulus would not exist for the child. This would be true of all learning, whether it is perceptual--space, language, or value systems. Piaget

(Furth, 1969) states that structuring occurs at all levels of behavior and is equivalent to knowing. Knowing is defined as being synonymous with assimilation to the child's internal structure. This process is not considered to be conscious. To restate this view it is proposed that an organism cannot respond to a stimulus unless the stimulus is, at least in some rudimentary way, meaningful or known to the child. Furth (1969) states:

> "The main point for Piaget is that behavior at all levels demonstrates aspects of construction, which derive at least partly from the behaving organism's intrinsic structure, and that this structuring aspect is identical with meaningful knowing behavior."

In order for knowing and assimilation to take place there must be self-activity (Lavatelli, 1970). The obtainment of knowledge comes from the child who has to do for himself. Self-activity is crucial for the child, as he must transform the data. The elements to be assimilated may be present in an experience, or the child may be told of the error in his performance or thinking, but unless the child is actively engaged in dealing with or struggling with the data, no learning takes place. Like adults, children are not easily convinced by being verbally corrected. They have to act upon the data and transform it. As indicated by Piaget, knowledge is not

a copy of reality. To know something one must modify one's conception of reality (Lavatelli, 1970).

In regard to the perceptual process, which is the concern of this study, Piaget's theory makes it quite clear that this process is not the same as that of operational thought. Perceptual skills develop parallel with cognition and provide basic data for the growth of intellect. Through the process of assimilation a child must change the data so it makes logical sense. It would then appear that perceptual skill is not only a function of maturation, but a measure of how well the data is understood at any given maturation level. Teaching children by rote drill about spatial judgments may be either a waste of effort or a process that could be greatly enhanced through cognitive training.

Summary

An overview of the field of visual perception training was given, which tended to indicate that such skill building could take place.

The next major review was in regard to the effect of visual perception training on reading achievement. The majority of studies were not supportive of the hypo-

thesis that perceptual training helps reading. There were several investigators, however, who did report significant results in reading gains.

It is not argued that children do not need visual perceptive skills. It is obvious that an understanding of visual stimuli is needed to be able to correctly perceive the form of written language. What is apparent in evaluating many of the studies is that there is not sufficient control of many of the factors such as ability, developmental maturity, and sex differences. Perhaps it is best stated that many of the studies are of the basic pre- and post-test form with a reading test followed by visual perceptual training, followed by the same reading test. The visual perceptual training program is often chosen without sufficient rationalization given for the particular form of training used.

A short statement regarding the Piaget cognitive theory and how it incorporates perception as a major factor was presented. There were several vital points to be considered: One, that perception is an important aspect of knowing, and two, that without assimilation there is no learning, i.e., one has to understand what the incoming stimuli means. Finally, there has to be participation of the learner in an act of learning.

Chapter III

METHOD OF STUDY

This chapter describes the methodology for testing the effects of administering cognitive training, developed from Piagetian theory in conjunction with perceptual training, as opposed to the training of perceptual skills and cognitive skills in isolation from each other. The differences will be measured in reading achievement and perceptual skills.

Analysis of covariance procedures were used to determine whether there were significant treatment effects among the four groups on the dependent variables of achievement and perceptual error scores. It was also possible to determine if gender as a variable was relevant, or if there was an interaction between gender and the variables of achievement and perceptual scores.

Sampling

The subjects for this study were eighty-seven first grade children attending school in an elementary district of approximately 1500 students. Economically, the state of California rates this school district in

the upper 25% of all districts in the state.*

The majority of parents work in Auburn, Roseville and Sacramento, thus making this a predominantly suburban area, with the majority of people commuting. Racially, there are only a few minority children who are Japanese or Spanish, from old, long-established families.

Procedure

Experimental Groups. There were four first grades in the district. Three of these classes were assigned to the three experimental conditions, while a fourth one was designated as a control group. Assignment to the various conditions of treatment was done randomly. The treatment groups were designated in the following manner:

1. Experimental Group A--24 pupils; 14 male, 10 female. This group was given only the Piaget cognitive training program.

2. Experimental Group B--18 pupils; 10 male, 8 female. This group was given only the visual perception training programs of the Developmental Learning

* State Testing Report--Grades 2, 3, 6, April, 1977. State of California, Department of Education.

Materials Company.

3. Experimental Group C--26 pupils; 12 male, 14 female. This group received cognitive training program and the visual perceptual training program.

4. Control Group--19 pupils; 10 male, 9 female. This group received no training.

Teachers of each group

Group A: This teacher is quiet, rather introverted, with fourteen years of teaching experience in the primary grades. She does not pressure her children, and occasionally has discipline problems.

Group B: This teacher is a very motherly person, who worries a great deal about her pupils and is often overly concerned that they might not be ready for the next grade. Her teaching experience consists of fifteen years in the primary grades.

Group C: This is the youngest of the four teachers. She has a structured classroom, tends to be very verbal, and is somewhat demanding of her students. Her teaching experience is six years.

Group D: This is a very warm and motherly teacher, who is well-liked by her students. Her teaching time in the primary grades has been eighteen years.

Testing Instruments

Slingerland Test of Learning Disability: This is a visual perception test which contains a series of subtests that are representative of visual perception skills. These include copying of geometric forms, spatial awareness, close and distant copying of letters and words, and visual memory. A total score of errors is obtained. Reliability measures have been reported between .57 and .65 (Oliphant, 1969).

Wide Range Achievement Test: This is an easily administered achievement test, with a vocabulary list that extends from alphabet recognition through a fourteenth grade level vocabulary. Scores are reported as grade level scores. Reliability coefficients are reported by the authors ranging from .981 to .993, while validity studies correlations have been reported ranging from .68 to .91.

Training Materials

Cognitive Training Program: Lavatelli, University of Illinois, working with American Science and Engineering, Inc., developed, in 1972, a cognitive training program* using Piaget's developmental theory as a

* See Appendix

framework. The program trains primary children, ages four through seven, in the areas of intellectual growth (American Science and Engineering, Inc., 1972). Those areas trained were: (a) Classification Operations, (b) Number, Measurement and Space Operations, and (c) Seriation Operations. As stated by Lavatelli (1970), the program is one designed to train children to acquire logical ways of thinking.

The materials for the program come in a packaged sequential form that leads the teacher and student through the three operations at a pace set by the teacher, although it is recommended that at least twenty minutes a day, three days a week, be considered as the norm. Each operation has its own materials for the child to manipulate. It is imperative that the teacher never tell the child what to do, but merely guide the training, seeking to understand the child's reasoning process.

Perceptual Training Program. After consultation with the two teachers using the perceptual training material, it was decided to use the perceptual training material in the form of worksheets from the Continental Press, Inc. The teachers had a number of programs to choose from regarding visual perception training.

Among these were manipulative material such as fitting together puzzles, paper-pencil puzzles, Frostig program, and Winterhaven material.

The Continental Press worksheets were chosen due to their progression from simple to complex materials, their approximation of task to school work, in that they were similar to many other curriculum materials in the language arts area, and finally, their use of letters and words as part of the training activities.

These worksheets are made from Liquid Duplicator Masters, with 24 lessons per book unit. The units used were:

Visual Readiness Skills	Levels 1, 2
Seeing Likenesses and Differences	Levels 1, 2, 3
Visual Discrimination	Levels A, B, C

Testing and Training Program

Each child in each of the four first grades was administered the Slingerland Test--Form A and the Wide Range Achievement Test-Reading Vocabulary Test during the fourth week of September. The author administered and scored the Slingerland Test in groups of four, with the teachers' and teacher-aides' help. The Wide

Range Achievement Test-Reading Vocabulary was given individually by the author and teachers.

At the end of the experiment, during the third week of May, the same tests were given again by the same personnel.

Training of the two teachers and their aides, using the Piaget material, was done starting the week before school and extending through several follow-up sessions just prior to use. Observation of the use of these materials was done by the author to ensure that the procedures of administration were followed correctly.

The perception material was quite easy to use and entailed no pretraining.

Procedure for Use of Training Material

Group A: This class received cognitive training twice a week, approximately twenty minutes each session. The teacher and teacher-aide divided the class in half between them and worked with groups of four to six children at a time.

Group B: This group initially received two worksheets per day to complete. As it became apparent in late February that there were not enough days left to

the end of the training time to complete the worksheets, the number given per day was increased to three.

The order of presentation of the worksheets progressed from figures to simple words to complex words. This order was similar to the normal presentation within the classroom of visual-based curriculum. Children first achieved mastery of geometric forms with pencil-paper tasks, as well as manipulation of three-dimensional objects. They then moved to writing letters and small words, which includes visual-motor-perceptual skills. The worksheets parallel this developmental and classroom sequence and were given in the following order through the school year:

1. Visual Readiness Skills
   Level 1
2. Visual Discrimination
   Level A
3. Visual Discrimination
   Level B
4. Visual Readiness Skills
   Level 2
5. Seeing Likenesses and Differences
   Level 1
6. Seeing Likenesses and Differences
   Level 2

7. Seeing Likenesses and Differences

Level 3

8. Visual Discrimination

Level C

Group C: This group received both cognitive and perceptual training. The training time and presentation was that of the two groups A and B combined.

Group D: This was the control group and maintained the regular classroom teaching procedures.

Statistical Procedures

Each of the hypotheses stated in Chapter I was restated in the null form and tested by appropriate statistical methods. These included testing for homogeneity of regression, analysis of covariance, followed by planned contrast comparisons among treatment means (Keppel p. 85-103). The level of significance for rejecting the null hypothesis was established at .05.

Null Hypotheses

H_1: There is no difference in the mean reading level, as measured by the Wide Range Achievement Test, between children who have had training in both perceptual and cognitive skills and those who have had only cogni-

tive training.

H_2: There is no difference in the mean reading level, as measured by the Wide Range Achievement Test, between children who have had training in both perceptual and cognitive skills and those who have had only perceptual training.

H_3: There is no difference in the mean reading level, as measured by the Wide Range Achievement Test, between children who have had training in both perceptual and cognitive skills and those in the control group having neither cognitive nor perceptual training.

H_4: There is no difference in the mean reading level, as measured by the Slingerland Test of Learning Disability, between children who have had training in both perceptual and cognitive skills and those having only cognitive training.

H_5: There is no difference in the mean reading level, as measured by the Slingerland Test of Learning Disability, between children who have had training in both perceptual and cognitive skills and those having only perceptual training.

H_6: There is no difference in the mean reading level, as measured by the Slingerland Test of Learning Disability, between children who have had training

in both perceptual and cognitive skills and those having neither cognitive nor perceptual training.

Statistical Analysis

A test of homogeneity of regression was first conducted. Following this, an analysis of covariance was done to determine if any treatment effects were present. Finally, in order to accept or reject the hypotheses of this study, provided treatment effects were present, a series of planned a priori contrast comparisons among treatment means was done (Keppel, p. 85-103). The adopted level of significance was set at .05. The computer service used was the Burroughs 6700 at the University of Pacific, with Fortran Program-ANCOVA analysis. Dr. Aiken of the University of Pacific, School of Education was the referring resource for the computer service and program.

Model for Analysis

	Cog.	Percep.	Sex	Test Pre-	Test Post-
Group C	With Cog.	With Percep.	M		
			F		
Group A		Without Percep.	M		
			F		
Group B	Without Cog.	With Percep.	M		
			F		
Group D		Without Percep.	M		
			F		

Summary

Chapter III has discussed the method of the study. The population of the study was described as were the testing instruments, treatment and statistical procedures.

Chapter IV

STUDY FINDINGS

The previous chapters have dealt with the problem of whether perception and cognition skills could interrelate to improve reading vocabulary scores and also reduce perceptual errors. The basis for this study came from Piaget's Theory of Cognitive Growth.

Preliminary Analysis

Before an analysis could be done, it was necessary to establish that the individual within-group regression coefficients for the data of both reading and perceptual error scores were homogeneous.

Tables 1 and 2 show that the individual within-group regression coefficients for the data of both reading and perceptual error scores are homogeneous. This permitted the analysis of covariance to be done.

Table 1

Test of the Homogeneity of Regression Coefficients for Reading Grade Placement Scores

Source	SS	df	MS	F
Between regression	2.16	7	.31	1.10*
Within regression	19.81	71	.28	

*p > .05

Table 2

Test of the Assumption of Homogeneity of Regression Coefficients for Perceptual Error Scores

Source	SS	df	MS	F
Between regression	90.76	7	12.97	.80*
Within regression	1149.63	71	16.19	

*p > .05

The first analysis of covariance study was done to determine if there was a treatment effect among the

groups in reading achievement grade placement scores using the Wide Range Achievement Test posttest scores. Table 3 shows that there was a significant treatment effect and that nonchance differences were noted between the groups.

Having determined that there was a treatment effect, it was then necessary to investigate where the treatment effect occurred among the various group means by use of a priori or planned contrast comparisons among treatment means. A summary of the Comparison F ratios is shown in Table 4, along with the hypothesis associated with each F ratio comparison. This summary or overview shows that all of the contrast comparisons exceeded the level of .05 set for this study. Each of the hypotheses is presented separately within the following pages.

Table 3

An Analysis of Covariance Summary Using the Post Reading Grade Placement Scores from the Wide Range Achievement Test as the Dependent Variable and the Pre-test Scores as the Covariate

Source	SS_{adj}	df	MS_{adj}	F
Method	20.32	3	6.77	24.06*
Gender	.17	1	.17	.61
Method & Gender	2.44	3	.81	2.89*
Error	21.97	78	.28	
Total	44.90	85		

*$p < .001$

**$p < .05$

Table 4

Summary of Planned Comparison F Ratios for Reading Grade Placement and Perceptual Error Scores Used to Test the Six Reading Hypotheses

Visual Perception	Cognitive	Perceptual	Combined	Control
Cognitive			Reading H_1 F=13.81***	
Perceptual			Reading H_2 F=33.75***	
Combined	Perceptual H_4 F= 9.34**	Perceptual H_5 F= 6.04*		Perceptual - H_6 F= 6.16*
Control			Reading H_4 F=66.25***	

*p $<$ .025

**p $<$ .01

***p $<$ .001

Statistical Treatment of the Hypotheses

The six hypotheses stated in Chapter 3 in null form were each tested as follows, with the first three hypotheses being concerned with the effect of the various treatment programs upon reading vocabulary scores.

H_1: There is no difference in the mean reading level, as measured by the Wide Range Achievement Test,

between children who have had training in both perceptual and cognitive skills and those who have had only cognitive training.

The first planned comparison shown in Table 5 indicates that there was a significant difference between the perceptual and cognitive groups beyond the adopted level of significance. This, therefore, suggests that H_1 is false.

Table 5

Planned Comparison Among the Treatment Means for the Cognitive Treatment vs the Combined Treatment Groups Using Reading Achievement Scores

Analysis of Variance

Source	SS	df	MS	F
Comparison 1	3.89	1	3.89	13.81*
Error	21.97	78	.28	

*$p < .001$

H_2: There is no difference in the mean reading level, as measured by the Wide Range Achievement Test, between children who have had training in both perceptual and cognitive skills and those who have had only perceptual training.

Results shown on Table 6 indicate that there was a significant difference between the combined and perceptual groups beyond theadopted level of significance. This then suggested that H_2 is false.

Table 6

Planned Comparison Among the Treatment Means for the Perceptual Treatment vs the Combined Treatment Group Using the Reading Achievement Scores

Analysis of Variance

Source	SS	df	MS	F
Comparison 2	9.51	1	9.51	33.75*
Error	21.97	78	.28	

*$p < .001$

H_3: There is no difference in the mean reading level, as measured by the Wide Range Achievement Test, between children who have had training in both perceptual and cognitive skills and those in the control group having neither cognitive nor perceptual training.

Table 7 indicates that there was a significant difference between the combined and control groups beyond the adopted level of significance. This, then, suggests that H_3 is false.

Table 7

Planned Comparison Among the Treatment Means for the Control Group vs the Combined Treatment Group Using Reading Achievement Scores

Analysis of Variance

Source	SS	df	MS	F
Comparison 3	18.55	1	18.55	64.32*
Error	21.97	78	.28	

*p $<$ .001

Table 8, containing the adjusted post-test means for reading achievement scores, shows that the combined treatment group is the best of the treatments in increasing reading achievement scores.

Table 8

Pretest and Posttest Means of Reading Achievement Scores for the Treatment and Control Groups

Groups	Pretest Mean	Posttest Mean
Cognitive	1.13	2.68
Perceptual	1.18	2.33
Combined	1.12	3.22
Control	1.27	2.06

Table 9 contains the second analysis of co-variance, which was done to determine if there was a treatment effect among the four groups or a significant difference between the means on the dependent variable of perceptual error scores. The results show that there was a significant difference present between the means of the group.

Table 9

An Analysis of Covariance Summary Using the Post Reading Grade Placement Score from the Slingerland Test of Learning Disability as the Dependent Variable and the Pre-Test Scores as the Covariate

Source	SS_{adj}	df	MS_{adj}	F
Method	183.14	3	61.05	3.84*
Gender	1.06	1	1.06	.07
Method & Gender	57.42	3	19.14	1.20
Error	1240.39	78	15.90	
Total	1482.02	85		

*$p < .05$

The next three hypotheses deal with the effect of the treatment and control groups in regard to changing perceptual error scores. As with the first three

hypotheses, planned contrast comparisons were made to determine whether or not the null form of each of the study's six hypotheses was to be accepted or rejected.

H_4: There is no difference in the mean reading level, as measured by the Slingerland Test of Learning Disability, between children who have had training in both perceptual and cognitive skills and those having only cognitive training.

Results from Table 10 indicate that there was a significant difference between the cognitive and combined beyond the adopted level of significance. This, therefore, suggests that H_4 is false.

Table 10

Planned Comparison Among the Treatment Means for the Cognitive Treatment vs the Combined Treatment Group Using Perceptual Error Scores

Analysis of Variance

Source	SS	df	MS	F
Comparison 4	148.50	1	148.50	9.34*
Error	1240.39	78	15.90	

*$p < .01$

H_5: There is no difference in the mean reading

level, as measured by the Slingerland Test of Learning Disability, between children who have had training in both perceptual and cognitive skills and those having only perceptual training.

Table 11 results show that there was a significant difference between the perceptual and combined groups beyond the adopted level of significance. This, therefore, suggests that H_5 is false.

Table 11

Planned Comparison Among the Treatment Means for the Perceptual Treatment vs the Combined Treatment Group Using Perceptual Error Scores

Analysis of Variance

Source	SS	df	MS	F
Comparison 5	96.13	1	96.13	6.04*
Error	1240.39	78	15.90	

*$p < .025$

H_6: There is no difference in the mean reading level, as measured by the Slingerland Test of Learning Disability, between children who have had training in both perceptual and cognitive skills and those having neither

cognitive nor perceptual training.

Table 12 results show that there was a significant difference between the combined and control groups beyond the adopted level of significance. This, therefore, suggests that H_6 is false.

Table 12

Planned Comparison Among the Treatment Means for the Control Group vs the Combined Treatment Group Using Perceptual Error Scores

Analysis of Variance

Source	SS	df	MS	F
Comparison 6	97.95	1	97.95	6.16*
Error	1240.39	78	15.90	

*$p < .025$

The adjusted posttest means for perceptual error shown in Table 13 suggest that the combined treatment is the best training method to use to reduce perceptual errors.

Table 13

Pretest and Posttest Means of Perceptual Error Scores for the Treatment and Control Groups

Groups	Pretest Mean	Posttest Mean
Cognitive	25.63	10.95
Perceptual	25.11	10.03
Combined	21.73	6.11
Control	19.68	8.58

An additional variable was included in the factorial analysis of covariance which was that of gender. A post hoc decision was made to use that information to see if gender was a factor in determining differences among the group means, and also to see if there was an interaction effect between the treatments and gender.

Table 3 indicates that there was a significant interaction taking place between the treatments and gender with regard to WRAT reading data. Gender, as a main effect, however, showed no significant difference.

Table 9 shows no significant effect of gender as a main effect or in interaction with the treatments.

It, therefore, appears that gender is a factor that influenced the effect of the treatment in terms of reading achievement, but not in regard to perceptual error scores.

The reading achievement means for the eight treatment-by-gender combinations are presented in Table 14. In order to examine the interaction, the cell means were plotted in Figure 1. The row and column marginal means are representative of the effects of the treatment and gender effects. However, the simple main effect of the cognitive treatment, plotted in Figure 1, shows an interaction with females doing better than males. The combined, perceptual, and control treatments showed no difference between boys and girls.

Table 14

Adjusted Grade Placement Reading Means of Treatment Groups and Gender Combinations

	Treatments				
Gender	Cognitive	Perceptual	Combined	Control	Mean
Male	2.47	2.36	3.45	1.96	2.59
Female	3.04	2.27	3.12	1.98	2.68
Mean	2.71	2.32	3.27	1.97	

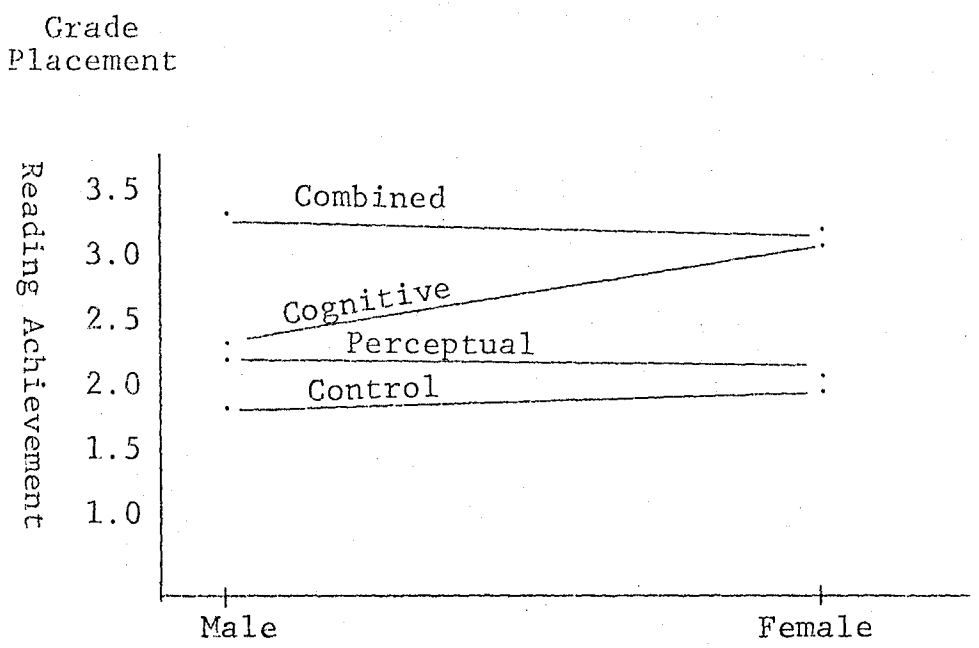

Figure 1

Plot of Data Presented in Table 14
Showing Interaction Between
Treatment Effect and Gender

Summary

The results have indicated that there was a significant treatment effect present between the four treatment groups on the dependent variables of reading achievement grade placement scores and perceptual error scores. It was noted that gender did not show a significant effect. However, there was a significant interaction indicated between the treatment effect and gender on the dependent variable of reading achievement. Under the cogni-

tive training, females scored higher than the males. No other gender differences were observed.

The six hypotheses of this study, in the null form, were tested by planned comparison studies with all being found to be false. From the adjusted post-test means, it was shown that the combined treatment was the best of the three treatments and better than the control group in improving reading achievement scores and lowering perceptual errors.

Chapter V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

This chapter is divided into three sections: (1) A summary of the research project, (2) The conclusions that can be made from the analysis of the data presented in Chapter IV, and (3) Recommendations relative to the conclusions of the study and recommendations for further study.

Summary

The purpose of this research was to determine if visual perception training, in conjunction with a cognitive training program developed from Piaget's theory of cognitive growth, would increase reading achievement skills and reduce perceptual error scores better than cognitive, perceptual or no training approaches. Also studied, post hoc, was whether gender had an effect or interacted with the type of treatment in regard to the reading scores or perceptual error scores.

Analysis of the data was done through analysis of covariance and planned contrast comparisons among

treatment means. There was one post hoc comparison to determine if there were interactive effects between gender and the treatment variable.

Method

The subjects in this study were eighty-seven students from four first grade classes from the Loomis Union Elementary School District. Three of those first grade classes were used as the experimental groups, and the fourth one as a control. Three treatment methods were used which included cognitive, perceptual, and combined cognitive/perceptual training. Only one training method was given to a class or group of children. The training of the children took place for the entire school year. Pre and post testing were done with the Wide Range Achievement Test and the Slingerland Test of Learning Disability.

Results

The results of this study suggest that the combined treatment of cognitive/perceptual training produced the best results in increasing the reading achievement scores and lowering perceptual errors. An interaction was noted between gender and the cognitive treatment in

relation to reading scores, in that girls achieved higher scores than boys when given that particular training. In contrast, the perceptual, combined, and control groups showed no gender differential effect.

One confounding variable should be identified which might have produced differences among the four groups, namely of teacher differences. The teachers used were different in their age, experience, and personalities. In support of teacher similarity, the teachers were experienced, having had at least five years of teaching, and were considered to be excellent teachers by each principal. They were instructed and observed throughout the school year by the author of this study, and were all apparently equally interested in the project.

The teacher variability does produce an element of tentativeness into the interpretation of the results. However, the posttest results in every case were as predicted. It, therefore, seems that this result does suggest that some benefits may be derived from the combined cognitive/perceptual approach, although further replications are required to firmly establish this finding.

Discussion

Reading and the Three Treatment Groups

Combined Treatment. Of the three treatment groups, the combined treatment was hypothesized to be the most effective method of increasing reading achievement vocabulary scores. A planned comparison of the posttest means showed that the combined treatment was the best method of increasing the reading scores. It is suggested that Piaget's formulation of the relationship between cognitive function and perception is tentatively supported, namely that cognitive function and visual perception have a positive influence upon each other.

The combining of cognitive and perceptual training parallels the interrelationship that Piaget speaks of when he says that there is no demarcation between perception and intelligence (Furth, 1969). He contends that knowledge is the result of the organism constructing such knowing from its interaction with sensory data.

Cognitive Treatment. The Cognitive Treatment, although not as powerful as the combined program, did have a group mean eight months above that of the control

group. Cognitive training, therefore, seems to have a positive effect in improving reading achievement scores. Piaget has not addressed himself to the question of how to improve or increase cognitive skills, however, Lavatelli's attempt to translate Piaget's formulations into a cognitive training program would appear to be somewhat successful.

Perceptual Training. The gain in reading achievement through perceptual training alone was approximately three months, compared to the control group. This lack of more substantive gain in reading achievement resulting from perceptual training is consistent with the general negative results found in the literature by Fortenburg (1969).

The minimal increase noted could be accounted for by the type of perceptual training used in this study, which used alphabet and word discrimination tasks as part of the advanced program. By using these word "stimuli", the youngster received some direct training in working with words, which in turn may have helped in the reading vocabulary task.

Perceptual Skills and the Three Group Treatments

Combined Treatment. The Combined Treatment was

the most successful of the treatment methods in reducing perceptual errors. As with the reading scores, the combination of cognition and perception appeared to produce a significant drop in perceptual errors.

This gain from the combined treatment program reflects Piaget's contention regarding the interdependency of knowing and perceiving that was also demonstrated in the reading aspect of this study. By giving the child training in verbalizing and symbolizing his world, using basic familiar objects and color, paired with perceptual training, the child is more able to make accommodations (Furth, 1969)(Lavatelli, 1970), which then allow assimilation of new material, i.e., the cognitive level changes in depth and maturity, which enhances the rate of learning.

Cognitive and Perceptual Training. From Table 13, it is seen that the reduction of perceptual errors for either the cognitive or perceptual treatments was no better than that of the control group. One possible reason for this lack of difference in treatment effect is that the perceptual training method used was not a powerful enough technique for the first grade student to lower perceptual errors more than cognitive or control group treatments. These two latter groups had had visual

perceptual experience built into their usual curriculum, which may have equalled the effect of the perceptual training group.

Gender. An unplanned, or post hoc comparison was made regarding whether or not there was a difference between the responses of the boys and girls to the different treatments. From Figure 1, it appears that cognitive training is more effective in improving reading achievement scores for girls than it is for boys. One possible reason for this effect, as noted by Kennedy (1971), would be that girls develop language faster than boys in the American culture, thus also acquiring a base for conceptual-symbol growth at an earlier age.

Conclusions

This study has indicated that by combining a cognitive and visual perceptual training program, there is a transfer effect that significantly and positively affects the reading vocabulary scores and perceptual error rate of first grade children. Inspection of the post-test means also indicates that the cognitive treatment had a positive effect on reading scores, although not to the level of the combined program. Gender difference was studied post hoc, and showed that there was a treat-

ment effect present in that girls achieved better reading scores than boys as a result of cognitive training. The results for the other three groups indicated that gender had no effect.

It would, therefore, be suggested that girls may not need the more time-consuming combined training, but could benefit as much from the cognitive program. This seems to support the general observation by teachers in the primary grades that girls are more mature than boys during the early school years. They, therefore, respond earlier to cognitive training.

Recommendations

The gains made by the children within the combined treatment class would suggest the inclusion of a Piaget-based cognitive training program, combined with visual perception training, for first grade students in acquiring higher levels of reading and visual skill. Because the girls did almost as well on the cognitive program alone it would, possibly, save some time to give the girls the cognitive treatment alone.

There was a question of teacher variability influencing the results. This was answered to some degree by identifying commonalities of experience, principal

judgment, and strict supervision of the treatment programs by the experimenter. Nevertheless, a follow-up study should be done controlling teacher variability. One means of doing this would be to have one teacher train three different groups of first graders. It would also be suggested that the study be done with minority children and with children from other socioeconomic levels.

As indicated by previous research, this study seems to support the research that states visual perceptual training does not help reading. Therefore, the time that would be used by teachers to apply such training is suggested as being ineffectual for the majority of students in helping improve reading vocabulary skills.

Further studies should investigate the various treatments at the kindergarten and second grade level to see if the reading vocabulary skills could be improved at these grade levels by such programs. It would be of particular interest to see if at the second grade boys would improve with the cognitive treatment, as the girls did at the first grade.

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APPENDIX

A Piaget Program by Celia S. Lavatelli, Early Childhood Curriculum, American Science and Engineering, Inc., Boston, 1970.

There are two parts, in the form of boxes with drawers containing the materials which the teacher gives the child to explain, guided by specific questioning given in the teacher's manual. The divisions of training are listed below:

Classification

1. Identifying properties of objects and matching objects by a one-to-one correspondence of properties.
2. Completing sets by discovering relationships.
3. Finding the intersection of two sets of objects.
4. Combining objects to make subclasses.
5. Recognizing complementary classes.
6. Flexibility of grouping.
7. Making classes from subclasses.
8. Reversing to compare whole classes to parts.
9. Extending awareness of common properties of groups.
10. Increase combinations.

Number

1. Establishing equivalence of sets by one-to-one exchange of objects.
2. Upsetting equivalence.
3. Develop concept of half.
4. Establish equivalence of sets by identity.
5. Develop conservation by changing dimensions without changing quantity.
6. Visualizing object in space bounded by horizontal and vertical lines.
7. Establish conservation of area.

Measurement and Space

1. Conservation of length.
2. Left-right transformations with 180^{o} rotation.
3. Representations of models.
4. Coordinating different views of models.
5. Transposing models.