ACKNOWLEDGMENTS

This study was made possible by the cooperation of many people. Appreciation is expressed to Mrs. Charlesana Workman and Mrs. Janice Williamson for permitting me the use of their kindergarten classes and for their encouragement throughout the teaching. A note of thanks to Dr. Charles M. Galloway, Dr. Lorren L. Stull, and Dr. Roger T. Cunningham for their assistance in the various phases of my total program. The statistical analyses were made possible with the assistance of Dr. Arthur White and Mr. Ted Smith.

A very special appreciation is expressed to Dr. Marlin L. Languis for his cooperation, advice, and friendship during my entire program. His encouragement and support have helped make the program a worthwhile and enjoyable effort.

The support and cooperation given by my Mother and my sister, Shirley, have made the entire endeavor more meaningful. Also a thanks to all the other family and friends who have contributed by their thoughtfulness and assistance.
VITA

June 15, 1932 .......... Born - Twinbranch, West Virginia

1954 .................. A.B., Morehead State University, Morehead, Kentucky

1954-1960 ............ Teacher, Yellow Springs Exempted Village Schools, Yellow Springs, Ohio

1960-1966 ............ Teacher, Xenia Public Schools Xenia, Ohio

1966 .................. M.Ed., Miami University, Oxford, Ohio

1966-1968 ............ Science - Mathematics Teacher and Consultant, Xenia Center for Educational Programming, Xenia, Ohio

1968-1971 ............ Teaching Associate, Early and Middle Childhood Education, The Ohio State University, Columbus, Ohio

PUBLICATIONS


FIELDS OF STUDY

Major Field: Early and Middle Childhood Education

Studies in Elementary Science and Mathematics.
Professor Marlin L. Languis
Studies in Elementary Education. Professor Lorren L. Stull

Studies in Curriculum and Supervision. Professor Charles M. Galloway
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CHAPTER I

INTRODUCTION TO THE PROBLEM

The schools of today are committed to teach all the children of all the people and to teach them so that they become productive, participating members of the society. The task of how to teach the many different groups of children who make up the schools so that each one learns to the best of his potential ability has become a gigantic challenge. Yet this is a challenge which must be met in a more successful way than it has to date if our educational system and our nation are to survive.

This study examines one aspect of the challenge, that of providing a guide to building essential oral language communication skills in students who are members of the lower socio-economic strata of the society. The problem investigated is to determine the effects of the use of science process activities on the development of the oral communication skills of disadvantaged kindergarten children. The rationale of the problem is discussed in four sections: characteristics of the disadvantaged student, building programs to develop language communication in the disadvantaged, science as a vehicle for developing the
communication skills, and the justification for the study.

**Characteristics of Disadvantaged Students**

Psychological studies in recent years have revealed that learning is an individual thing. We now know there are different types of learners and that they need different types of teaching. Our schools traditionally have assumed that for a person to be educated he has mastered the same knowledge as all other "educated" people. Is it possible in our present diverse social structure for this to continue to be a criterion for education?

One group showing a difference from the traditional type of learner is the large, and rapidly increasing, group of children who have socio-economic and experiential backgrounds which mark them in our present structure as "educationally disadvantaged". Much study has been done on the learning of these children and the results show that these disadvantaged children do not learn in the same manner nor at the same rate as their more privileged peers (Giddings, 1966, p. 210). As a result they do not experience academic success as readily as do the more advantaged children. It has been estimated that many of these children are performing at one to two and one-half years below the level expected upon their entrance to the elementary school (Giddings, 1966, p. 208). This lack of academic achievement does not mean they cannot learn, but that they
approach learning in a different way and with a different background of experiences.

The schools have not been providing for this difference in background and learning technique with the result that these children are early identified as "failures" or "slow-learners". They retain this label as they progress through year after year of schooling. The consistent pattern of failure of the disadvantaged child results in different behavioral responses from these children. Many display an apathy toward school and toward themselves which appears to be an apathy toward life. Others develop an attitude of open hostility toward learning in general and toward the school and teachers in particular, thus gaining the reputation of "trouble makers" both in the school and in the community (Stodolsky and Lesser, 1967, p. 559). The disadvantaged child, unable to make it in the traditional school setting, begins to feel that school has nothing for him and that he cannot succeed in the school. His goal is then to get out of this frustrating environment and into something more relevant to his needs. For these students school has made a difference, but on the negative side of the educational ledger (Barnard, 1965, p. 25).

One major background difference which accounts for school failure of these disadvantaged children, especially in the area of learning to read, is the level of language skill ability with which they enter formal schooling.
These educationally disadvantaged children show a deficiency in language which is never remedied. In fact, the gap widens with the number of years in school (Stodolsky and Lesser, 1967, p. 549). It seems important that some way of overcoming this deficiency by providing for language skill development in early school years be found. With the acquisition of these necessary language skills, the disadvantaged child stands a better chance of having a successful learning experience.

Building Programs to Develop Language Skills in the Disadvantaged

In order for a program to be successful in developing these language skills, it would have to meet several requirements. One requirement of such a program would be that it be relatively free from the cultural biases and from expectations that are based on the child's previous experiences that most of the programs of the past have contained. These programs would need to be so designed that the limited background of these disadvantaged children would be sufficient for them to have successful learning experiences. These programs also need to be interesting and relevant to the daily lives of these children. They should be so organized that there is much manipulation of concrete materials and that the time required to complete the various parts of the programs be flexible, allowing for more exploring and building of background for these
children. And, most important, these programs must provide time, place, opportunity, and encouragement for verbal interaction to take place if there is to be successful development of the oral communication skills. There must be opportunity to speak and to listen in a permissive and a responsive environment.

In implementing such a program into the school it is necessary to find an area which is open-ended, centers around inquiry, provides materials to manipulate, and depends upon communication to develop the learnings. Science is the one curricular area which provides both the method and the materials to meet these requirements. The materials of science are real and provide the child with opportunity to manipulate familiar objects in his environment. Science does not demand a heavy background of factual knowledge for understanding and success and thereby offers each child an equal starting point for learning. Giddings (1966, p. 439) reports that because of a scientific-technological society, disadvantaged children have a respect for science. This provides a motivation and an area of interest upon which the teacher can build concepts and process skills. Recent developments and innovations in elementary science have made these points even stronger and more evident.
Science as a Vehicle for Developing the Communication Skills

During the past decade new science programs have been developed and carefully designed to be used with all children. They are built upon subjects and activities of interest to children because they use familiar materials and allow for creative exploration of these materials. Children are encouraged in these programs to explore and to find information about their environments for themselves. The skill of communication is vital to these programs, in that the children identify problems, develop their own investigations, and share their results by communicating with each other and with their teacher. The use of language to explore a question or problem, to gather and record data, to report findings, and to draw inferences and conclusions make these new programs in science a vehicle for the development of communication skills. These programs have been tested and evaluated with many types of children, including urban disadvantaged children. It was found in the pilot studies conducted by these program developers that the disadvantaged children had an equal chance for success with the other groups tested.

One of these programs, Science - A Process Approach developed by the American Association for the Advancement of Science (AAAS), predicts that teachers will notice improvement in the verbal communication skills of students
as they use the program. This prediction is based upon the informally reported experience of teachers who have used the program. This experience has been summarized in the statement, "No part of a child's experience in this science program will be more valuable to him in school and in later life than the development of his competence in communicating" (Commission on Science Education, 1968, p. 113).

The philosophy upon which Science - A Process Approach is founded depends upon language and communication for its success. In fact,

verbal communication forms the basis of much of the classroom procedure, particularly in the primary grades... Those responsible for this program believe that the child's own observations of phenomena, his experiences in measuring, in classifying, in using space/time relationships, do communicate to him. The process of communicating becomes important to the child as he communicates to others what he has observed, classified, or measured, and the way he has used space/time relationships and in turn as information is communicated to him by others (Commission on Science Education, 1968, p. 112).

That this approach can make a difference in language learning has been shown in the studies of Horn (1966), Stemmler (1966), and Ayers and Mason (1969). Horn and Stemmler report on the utilization of the Science - A Process Approach as culture-fair material, as well as an interesting subject matter approach, in studying oral language development as a basis for learning to read in culturally deprived Spanish-speaking children in the first grade. From their observational data the investigators concluded,
The science-based program and its techniques appeared to be making a direct assault upon the problem of language and the acquisition of abilities and knowledge specifically needed for academic learning and reading (Horn, 1966, p. 42).

These activities which allowed for participation and concrete manipulation gave these children the foundation for a successful experience in learning. They began speaking in more complete sentences and showed an increase in attention span, auditory and visual discrimination, direction-following and listening. Teachers also noted that the children seemed to have more confidence in their ability to read (Stemmler, 1966, p. 51).

Part A, the kindergarten level, of Science - A Process Approach was used in a study of reading readiness achievement in kindergarten children. The investigators chose this program because they felt that it was one designed for vocabulary development and form discrimination through its emphasis on observing and communication of observations. It was found that the group instructed in Science - A Process Approach obtained scores on the Metropolitan Reading Readiness Test that were significantly higher than those of the control group. Doris M. Lee, at the conclusion of the report, says that continued studies are needed to see if there is any relationship between participation in Science - A Process Approach and success in reading in the primary grades (Ayers and Mason, 1969,
The structure of *Science - A Process Approach* makes it appear to be a vehicle by which oral communication could be effectively developed. This structure is such that the processes and concepts of science are learned through laboratory experiences involving interaction among pupils and interaction between pupils and the teacher. This interaction primarily involves the use of oral language through which vocabulary and skill in communicating thoughts and ideas can be developed. Group participation with its cooperative exchange of ideas makes listening a very important part of the program. Other language skills such as visual and auditory discrimination, spatial concepts, and motor coordination can also be a part of the overall development as a result of guided activity in such exercises as those involving the processes of observing, inferring, classifying, using space/time relationships, measuring, and predicting. It is a program which provides activities which are at an interest, ability, and experiential level for disadvantaged children and furnishes them an opportunity to use language in a meaningful and enjoyable context. As such it seems that it would be a successful approach in increasing the oral communications skills of these children.  

**Justification for the Study**

The preceding discussion shows that factors do exist which clearly give a justification for a study that
would assess the oral communication skills of disadvantaged children participating in Science - A Process Approach. The information obtained from this study would be of great value to classroom teachers and curriculum builders in planning programs for language development and reading readiness for the pre-school and primary grades. An identification of these oral communication skills would also benefit the teacher education programs in designing and implementing experiences for prospective teachers of young children.

Statement of the Problem

The purpose of this study is to investigate the effects of the use of the activities from the program Science - A Process Approach on the oral communication skills of disadvantaged kindergarten children in an inner-city school environment.

The problem presented in this study is: Can participation in the activities of Science - A Process Approach make a significant improvement in the oral communication skills of disadvantaged kindergarten children?

The oral communication skills to be investigated by this study are:

1) Transmitting communication to others (Speaking)
   A) Language Output and Expressiveness
   B) Vocabulary
The study will also examine the following variables as predictors of performance in oral communication skills:

(a) I. Q.
(b) sex
(c) chronological age (in months)
(d) pre-kindergarten educational background
(e) morning or afternoon kindergarten class membership

Hypotheses

The following hypotheses are tested by this study:

H₀₁ There is no significant difference at the .05 level between disadvantaged kindergarten subjects (Ss) who have participated in the activities of Science - A Process Approach and those Ss who have not on the Ss total performance in the oral transmitting skills and on the Ss performance on the following subtests of oral transmitting skills:
(A) Language Output and Expressiveness
(B) Vocabulary
(C) General Meaning and Ideas
(D) Sentence Structure
(E) Defining Words
(F) Average Length of Sentences

H₀² There is no significant difference at the .05 level between disadvantaged kindergarten subjects (Ss) who have participated in the activities of Science - A Process Approach and those who have not on the Ss total performance in the oral receiving skills and on the Ss performance on the following subtests of oral receiving skills:

(A) Listening Behavior
(B) Listening Comprehension

H₀³ Of the following independent variables there is no one variable or combination of variables that is a predictor of oral communication skills ability in disadvantaged kindergarten children:

\[ X_1 \] I. Q.
\[ X_2 \] sex
\[ X_3 \] chronological age (in months)
\[ X_4 \] pre-kindergarten educational experience
\[ X_5 \] morning or afternoon class membership
Overview of Design

The design used in this study was that of non-randomized, pretest - treatment - posttest, experimental-control group.

The study was composed of four stages: a pilot study to test and refine the instrument, a pretest of oral communication skills, the experimental treatment, and the posttest. The subjects were disadvantaged kindergarten children who were enrolled in a regular program in an inner-city school.

Operational Definitions of Terms

The following terms are defined as they are used in this investigation.

Disadvantaged Children. - - Children of a low socio-economic status attending a neighborhood school which is a part of the Title I Program, Elementary and Secondary Education Act of 1965.

Inner-City. - - A portion of a metropolitan area, minimum population 500,000, of which all the boundaries are contained within and do not coincide with the geographical limits of the city.

Inner-City School Environment. - - A neighborhood school located within the environs of the inner-city and which serves a population in which a minimum of 15 percent
of the families with children between five and seventeen years of age receive support under the Aid to Families with Dependent Children (AFDC) program. The children enrolled in the school are classified as disadvantaged as defined above.

Kindergarten Children. - - Those children enrolled in the regularly scheduled kindergarten program of a public school system.

Pre-Kindergarten Educational Background. - - Enrollment in a Head Start program or the regularly scheduled pre-kindergarten program of the public school system.

Oral Communication Skills. - - Those verbal skills used in interacting and communicating with others by means of speaking and listening.

Oral Transmitting Skills. - - Those skills used in communicating by speaking and listed in hypothesis $H_0^1$ above.

Oral Receiving Skills. - - Those skills used in communicating by listening and listed in hypothesis $H_0^2$ above.

Language Output and Expressiveness. - - The child's fluency of expression, as measured by the responses to the stimulus questions on the Test of Oral Communication Skills.

Vocabulary. - - The number of words used by the child, the complexity of these words and the classification
according to parts of speech of the words.

**General Meaning and Ideas.** - The nature and quality of the child's ideas as measured by his oral responses in terms of interpretations and inferences concerning the picture stimuli on the Test of Oral Communications Skills.

**Sentence Structure.** - The language patterns and grammatical construction of the responses used by the child.

**Defining Words.** - The defining of words which reflects both the extent and the depth of a child's word knowledge. This also includes his ability to identify a pictorial representation of the word and/or give his meaning for the word.

**Average Length of Sentences.** - The measure of the mean length of sentence response and frequency.

**Listening Behavior.** - The measure of the child's listening in terms of his overt behavior and his involvement with the story as reflected by his responses to the content of the story.

**Listening Comprehension.** - The measure of the child's assimilation of the content of the story by his ability to relate characters, plot, and sequence of the story.
Assumptions and Limitations

The following assumptions are made in this study:

1. The investigator was adequately prepared to teach Science - A Process Approach to kindergarten children.
2. The subjects in this study possess mental ability at an educable level.
3. The I. Q. test used is valid and reliable.
4. English is the native language of the subjects.
5. The data collected were analyzed by the appropriate statistical procedures.

Limitations

The problem investigated by this study is limited by the following:

1. This study is confined to one group of the population in one area of one city, limiting generalizations to other populations.
2. The time of the study is limited, 12 weeks, not allowing time for assessment of any long term gains.
3. The study was confined to two one-half hour periods per week. The remainder of the time the students were in the classroom was not controlled in terms of the study.
4. The sample was taken as classroom units, it
was not randomized. However, assignment to the classes was made randomly by the school administration.

5. The accuracy of the measure of the test is determined by the child's response to and rapport with the investigator.

6. Due to physical limitations, the tests could not be administered at the same time of day nor in the same location for all subjects.

7. The test measures the observable oral communication skill of the child through his speaking behavior. Thinking, as a communication, cannot be measured separately in terms of the instrument used in this study.

8. There were science education students in both control groups during the last six weeks of the study. These participants taught science lessons to the control subjects during this time.

9. Generalizations are limited only to those communication skills identified by the Test of Oral Communication Skills, the many other facets of oral communication are not measured.

Summary

This chapter, chapter one, has identified the
problem to be studied and presented the rationale for this problem. Also presented were the hypotheses to be tested, the operational definitions of terms used in the study, and the assumptions and limitations of the study.

The next chapter, chapter two, is a review of the related literature. The chapter is divided into the sections dealing with the different aspects of the literature relevant to this study.
CHAPTER II

REVIEW OF RELATED LITERATURE

The review of the literature related to the study of science process skills and the development of oral communication skills in children is presented in this chapter. The chapter is divided into three sections: (1) literature related to the language development of children, (2) literature related to oral communication of disadvantaged children, and (3) literature related to science process activities and communication skill development.

Literature Related To Language Development Of Children

This section presents a review of the literature which is relevant to the development of oral communication skills in children. The findings and theories reported here formed the basis for the instrument used to measure the child's level of ability in the Test of Oral Communication Skills.

Overview of Language Development

Even though it is the foundation of our modern communication, language is not the same to all men for there are individual differences in the ability to use language
at all stages of man's development. This is especially evident during the formative years of childhood. Simple observations, such as those reported by Monroe, show there is a wide range of individual differences in ability to use and understand language among 5 and 6 year old children (Monroe, 1951, p. 69). These differences are not reflections of a totally unique development of each individual, but rather are displays of different stages in an overall sequential development which is common to all men. Strickland points this out in her statement,

The time schedule of personality and language development will depend, for each individual, on his capacity to learn and on his environmental experience; but each element, whether learned rapidly or slowly, easily or with difficulty, will tend to follow a normal sequence (Strickland, 1957, p. 8).

Dawson and Newman report that recent studies show that the English-speaking children upon entrance to school have developed a mastery of the basic patterns of English, regardless of their native ability or the influences of their environment. However, the report continues,

They differ in conceptual background, size and nature of vocabulary, length and vividness of sentences, and ability and willingness to participate freely in oral language situations (Dawson and Newman, 1966, p. 1).

Evidence of sequential development in language is also reported by Piaget in his study of the language and thought of the child. The subjects for this study were twenty nursery school children whose language was recorded
verbatim as they moved freely about the room and as they moved into and out of the room. These conversations were then classified to examine the process of evolution by which a child passes to different levels of conversation. The study revealed that the first speech was connected with the activity of the moment. Later there appeared explanation, reconstructing a story or a memory, and discussing the order of events or the truth of a tale (Piaget, 1959).

Landreth also found in her studies of pre-school children that the first utterances of children are concerned with the here and now (Landreth, 1967, p. 185). This is further supported by the studies of Strickland in which she concluded that the child moves in language themes and vocabulary from the concrete to the abstract (Strickland, 1924, p. 8).

As the child's language and skills in oral communication develop there are definite patterns of progression which occur. These are observable in the manner in which the child interacts verbally with his environment and can be classified according to a hierarchy of development.

The child's oral communication skills involve both speaking, or the sending of communication, and listening, the receiving of communication. The sending requires that the child does speak or has a language output; that he has a vocabulary adequate to relay his message; that he has knowledge of meanings of words that enable him to express
his thoughts; and that he can organize the words into meaningful ideas which are capable of comprehension by his listeners.

Language Output and Expressiveness

Very young children often communicate with gestures and actions rather than words. However, the child soon discovers that talking can obtain the same results and obtain them quicker and in a more acceptable manner. Based on results of numerous studies and on her own observations, Strickland reports:

The average child is talking a great deal by the time he reaches 4 years of age. He confuses words and makes many mistakes in usage but his meaning is clear... By the time he is 5 he likes to talk and may talk constantly and with everyone (Strickland, 1957, p. 77).

Piaget, as related by Strickland, reports that he found little ability to carry on conversation or use language for a real meeting of minds below the age of seven or eight years. Strickland in analyzing the language and conversation of five year olds, says that this does not appear to be true in our school. "Many examples can be observed in which speech is definitely of the sharing and interaction type" (Strickland, 1957, p. 26).

Loban in his studies of the language of elementary school children determined that the amount of language was an important facet of measuring the child's language ability (Loban, 1963, p. 24). This is expanded by Monroe
in her statement of rationale for the scale used in measuring language expressiveness:

The child's fluency of expression is indicated in a rough way by the quantity of speech he produces when he is given the opportunity to talk. Some children open up freely and language pours forth as a stream. Other children struggle for words, block, and bring forth only a phrase or two (Monroe, 1951, p. 77).

Monroe developed a five level scale of progression of output and expressiveness of language, ranging from level 1, in which the child does not respond to the stimuli until he is encouraged, through level 2 where he responds with 1 or 2 remarks but cannot continue even when encouraged, level 3 in which he responds with 1 or 2 remarks and can continue when requested, level 4 with a free flowing response to level 5 where the child engages in a true give-and-take conversation involving the adult examiner (Monroe, 1951).

The concern for and interest in the output of language is not only for studying the fluency of communication but is also the very basis for the study of all the other aspects of oral communication. The child must produce language for any ideas to be conveyed, and for speaking vocabulary to be developed.

**General Meaning and Ideas**

In order for oral communication to take place the child must have ideas to be communicated and words with
which to express these ideas. Rating the wealth of ideas expressed was one of the primary analyses made by Loban in his study of elementary school children's language (Loban, 1963, p. 24).

Monroe places a strong emphasis upon meaning and ideas in her statement, "The quality of ideas which the child wishes to express determines to a great extent the level of language which he will use" (Monroe, 1951, p. 78). She further explains this by pointing out that if the child observes only unrelated objects in a picture or situation he will use a very low level of language because he needs only to enumerate the objects to communicate what he is thinking. If he can identify qualities and/or properties he needs words which will relate these actions, usually adjectives and verbs. If he is able to extend his ideas still further by inferring relationships he needs language to adequately express these richer meanings (Monroe, 1951, p. 78).

Vocabulary

The vocabulary used by the child in expressing his ideas reflects the level of his development in oral language. The most common way to measure vocabulary level has been to count the different words used by the child. Loban refers to the Thorndike and Lorge word list, The Teacher's Word Book of 30,000 Words, in tabulating the vocabulary words used by kindergarten children. He found
a range of from 180 to 5,000 words used by the children in his study with an average of 3,000 (Loban, 1963, p. 24). Strickland states this more broadly in reporting the vocabulary development, "It is probably safe to say that the average child on entrance to first grade has a vocabulary of several thousand words" (Strickland, 1957, p. 79). However, she later reports on the average words of 2, 3, and 4 year olds as being 270, 900, and 1500 different words, respectively. This report extends beyond the simple count of words by specifying the classifications of words used. For example, a large proportion of the 270 words of the average 2 year old are nouns. First person pronouns and common prepositions are added to nouns as the basis of the average 3 year old child's vocabulary. By the age of 4 the average child is using the simple language patterns of the ordinary adult (Strickland, 1957, p. 98). This seems to indicate that the type of word, or the classification of the word, is as good as or better than a simple numerical count in determining the vocabulary level of children.

Studies have revealed that the sequence of vocabulary development in terms of classifications of words is clearly defined. Strickland (1957), Lefevre (1970), Landreth (1967), and Watts (1944) all report the beginning vocabulary consists mainly of nouns with verbs, descriptive adjectives and adverbs added early to express simple wants.
and ideas. Strickland hypothesizes in this way:

He becomes interested first in the fact that things have names and acquires a number of nouns which he supplements with verbs expressing common activities of things. . . . Common descriptive adjectives such as "big" and "little" are used by the child at an early age (Strickland, 1957, p. 23).

The fact that naming holds great interest for children is shown by their enthusiastic use of color naming between the ages of 4 and 6 (Strickland, 1957, p. 31). Strickland also cites the early studies of Shirley which found that the first words are nouns with an increased sprinkling of verbs, adverbs, and adjectives as the child extended his speech. Pronouns did not appear in these children until later (Strickland, 1924, p. 8). Likewise, Lefevre concluded that the progression of words in the vocabulary was (1) nouns, which were early used as sentences; (2) verbs; (3) adverbs and adjectives; and (4) pronouns (Lefevre, 1970, p. 47). Landreth defined the progression of vocabulary as contentives, functors or operators, and markers. She found that contentives (nouns and verbs) dominate the child's early speech and that this speech lacked functors (prepositions and conjunctions) and markers (articles) (Landreth, 1967, p. 185). Watts in an extensive study found that children age 3 used three pronouns: I, you, me; and three prepositions: in, under, behind. The four year olds could name the common colors and common objects in pictures. By five the children were using descriptive
words spontaneously and could identify opposites. He found that the most simple connective of all ages of children was and (Watts, 1944).

These reports again indicate that as the child matures in thought he moves in vocabulary from words which simply name, nouns, and combine with verbs to show action to the more descriptive and complex words, adjectives, adverbs, conjunctions, prepositions, pronouns, and interjections, which are needed to express his more complex thoughts and ideas.

Monroe has concluded that a child's vocabulary is much more than just the words he uses. "The child's vocabulary may be extensive, in that he knows many words, or intensive, in that he knows a great deal about each word, or both (Monroe, 1951, p. 81).

Defining Words

Terman, Weiser, and Strickland report that the type of definition given by the child is an indication of his level of verbal maturity. There is sequential development in word definition growth as in all other aspects of language skill. Terman wrote that types of definitions used by children given information about a child's apperceptive processes, and that it would be possible to differentiate at least a half-dozen degrees of excellence in definitions, according to the maturity of the subject (Terman, 1916, p. 169). Weiser concludes that there is a definite rela-
tionship between age and the type of qualitative definitions children use (Weiser, 1969, p. 165). She developed an instrument in the form of a Guttman scale which places class as the highest order of definition and synonym/antonym, attribute, function, association and verbalism in descending order. She elucidates these categories by definition for each, highest to lowest: class, placing the word into a classification based on properties or similarities; synonym/antonym defining by giving synonyms or antonyms of the word; attribute, giving an observable property to the word; function, stating the use of the object designated by the word; association, defining the word by stating known usage of the word; and verbalism, repeating the word or pointing to the object the word names (Weiser, 1969, p. 167). This sequence moves from the concrete observable definitions to the abstract classification.

Strickland writes that children are able to recognize all types, colors, and sizes of birds as "birds" long before their thinking can classify them as "animals" (Strickland, 1957, p. 23). Feifel and Lorge (1950) and Strickland (1957) report on studies and tests which show that children in the primary level define or describe an object in terms of its use. It is not until later elementary grades that the child learns to classify objects on the basis of like factors. Still later relatively difficult classifications can be learned (Strickland, 1957,
In a study of vocabularies of intellectually average children, Weiser presents the conclusion that a vocabulary scale designed to elicit quality of definition rather than quantity of words known might be a better instrument for assessing levels of conceptualization (Weiser, 1969, p. 270). The possession of a large number of words is necessary, but it is not enough to enable the individual to communicate a wealth of ideas at varying levels of complexity. There must also be an understanding of the words, an insight into the meanings and the abstractness of words as vehicles to convey thought, feelings, and knowledge.

**Sentence Structure and Length**

In order for these words to have meaning to the receivers they must be organized and structured in such a manner that listening is both interesting and rewarding. These arrangements of thoughts into words are referred to as sentences. The complexity and amount of these organized thoughts are factors in determining the level of the individual's speaking communication skill.

The length and complexity of the sentences is considered to be an important indication of the language power of children. Strickland (1924, p. 12), Templin (1957, p. 15), and Watts (1944, p. 85) all report that advancement in length and complexity of sentences indicates a growth in
language power. Watts has identified the stages of advance in mastery of free expression as:

<table>
<thead>
<tr>
<th>Level</th>
<th>Behavior</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>The child names things.</td>
</tr>
<tr>
<td>2</td>
<td>The child is able to speak of relations observed.</td>
</tr>
<tr>
<td>3</td>
<td>The child adds prepositional phrases.</td>
</tr>
<tr>
<td>4</td>
<td>The child uses complex sentences.</td>
</tr>
<tr>
<td>5</td>
<td>The child denotes relationships between levels 2 and 3.</td>
</tr>
<tr>
<td>6</td>
<td>The child uses complex sentences with noun clauses.</td>
</tr>
<tr>
<td>7</td>
<td>The child uses adjective clauses and pronouns (Watts, 1944, p. 85).</td>
</tr>
</tbody>
</table>

Brown and Bellugi identify the progression of sentence development in young children in three simple stages: single word sentences, two-word sentences, and finally full sentences with adult patterns (Brown and Bellugi, 1966, p. 131). This implies that language maturity involves both a lengthening of what is said and an increase in complexity of patterns. Templin says that the measure of sentence skill development in children is determined by a study of the length of the response, the use of different words, the use of varied parts of speech, and the grammatical structure (Templin, 1957, p. 15). Shriner in reviewing measures of language development, points out that an often used and
frequently reported measure is the mean length of the response (Shriner, 1969, p. 61).

In viewing sentence structure as a measure of the level of children's oral language skill, Monroe states:

It is not always desirable to express meaning in long compound or complex sentences, but the child who can do so has more language power than a child who can command only incomplete or fragmentary sentences (Monroe, 1951, p. 80).

The sequential scale developed by Monroe to rate the level of sentence structure is as follows: (lowest to highest)

1: isolated words or phrases
2: simple sentences with one subject and one verb
3: simple sentences with compound subject, predicate or object
4: compound sentences containing a conjunction other than and, or complex sentences containing one dependent clause
5: sentences containing more than one dependent clause (Monroe, 1951, pp. 80-81).

O'Donnell, Griffin, and Norris in an analysis of syntax of kindergarten and elementary school children reached the conclusions that:

(1) total length of responses increased with every grade level

(2) the structure patterns of subject-verb and subject-verb-object account for 80% of the sentences of children at the three lower levels

(3) mean length of oral responses of boys was greater than that of girls in all grades except 5
the incidence of coordinating conjunctions was higher in the speech of kindergarten boys than girls (O'Donnell, Griffin, and Norris, 1967).

Studies have been conducted which report the averages of sentence lengths at differing stages of development. Landreth reports that mean sentence length from birth to six years is 4.85 words (Landreth, 1967, p. 206). Strickland reports that the average child of 3 1/2 speaks in functionally complete sentences which average about 4 words. The five year old uses an average of 5 words per sentence. The studies also show that the structure of sentences at age 2 to be all simple sentences. By age 4 1/2 the proportion of simple sentences had dropped to 85%, with about 13% of the remaining being complex and 3% compound (Strickland, 1957, pp. 81-82).

These reports strongly support the theory of sequential development of all facets of oral language. A child's language development can be measured by identifying his position in this sequential progression.

Listening

The speaking skill development of children does not occur separate from the other skills. An especially close interrelationship occurs between growth in speaking and growth in listening. The child cannot develop speech without a model on which to build. This model is furnished him by listening. A report by the Commission of English Curriculum states this clearly: "Listening is a forerunner
of speaking and continues to bear a reciprocal relationship to it" (The Commission of the English Curriculum NCTE, 1954, p. 71). After the child learns to speak from the model given by listening, the importance of listening does not decrease. Speech as a form of communication is of no value unless someone is receiving the communication. This requires a listener. Strickland puts this succinctly in the statement:

Real social interaction calls for listening as well as speaking. The child must learn to give attention to responses, to take in and comprehend them, and to react to them . . . A real meeting of minds is evidence of mature interaction (Strickland, 1959, p. 27).

Listening is a highly complex skill. It involves more than hearing. To listen is to follow attentively the thread of a conversation, the development of an idea, the points of an argument. Listening, like reading, requires comprehension in terms of past experience and often involves a critical examination of what is heard (The Commission of the English Curriculum, 1954, p. 77).

In a review on research studies in language development, Shane reports that studies show all children do not have equivalent ability to listen and to observe. It was also found that listening comprehension is on the whole significantly superior to reading comprehension during early and middle childhood (Shane, 1963, pp. 112, 114).

As the skill of speaking is the output of self, the
skill of listening is the input aspect of self-expansion. Strickland has ordered the levels of listening from low to high as:

1: little conscious listening: easily distracted by people or things in the environment
2: half-listening: holding fast to own ideas and waiting to insert them at the first opportunity
3: listening passively: apparent absorption but little or no reaction
4: listening: responding with items from own experience as result of associations brought to mind
5: listening: some reactions through questions or comments
6: listening: some genuine emotional and mental participation
7: listening: meeting of the minds (Strickland, 1962).

The Commission of the English Curriculum of the National Council of Teachers of English has developed a more expanded order of the levels of quality in listening:

1: little conscious listening except as the child is directly and personally concerned with what is being presented
2: intermittent listening as the child is easily distracted by people and things in the environment
3: half-listening while the child holds fast to his own ideas and waits to insert them at the first opportunity
4: passive listening with apparent absorption but little or no reaction
5: erratic listening, that is, listening for a time but running off at a tangent when a word
or idea presented calls to mind a personal interest or experience

6: listening, forming associations, and responding with items from his own experience rather than reacting to what is presented

7: listening and expressing some reaction through questions or comments

8: listening with evidence of genuine mental and emotional participation


Listening is a vital skill in the total development of the communicative child. He listens to better understand his environment; to interact with others; to learn; to determine his role in society; and he listens for the enjoyment he can get from it.

The child is growing in ability to speak and to listen as he is growing in physical characteristics and this growth is at varying rates. The growth is evidenced as he passes through the sequence of speaking and of listening skills. His total oral communication is a composite of his levels in these various skills. A measurement of these skills is important in determining where he is so that he can be guided and assisted to progress to the higher sequential levels. Research has labeled the sequence of development and has made it possible to place the child with a fair degree of accuracy at a level of ability at any particular stage of his maturity. This permits a
measure of his rate of growth and a guide for studying various approaches toward fostering this growth.

**Instruments for Measuring Oral Communication Skills**

Devising instruments to measure the oral communication skills is a difficult task. Since the young child cannot read, some other form of stimulus must be provided. Boener (1966), Gupta and Stern (1969), Watts (1944), and Loban (1963) all report on the use of pictures as effective stimuli for measuring oral language of children.

Listening, likewise, presents some difficulty. Slingerland (1969) and the developers of the Sequential Tests of Educational Progress (STEP) (1957) found that stories are an effective stimulus to very young children. The method of presenting the story has also been examined by Slingerland (1969), Strickland (1924, 1962), and Sawyer (1942). They postulate that telling the story to the child is more effective than reading the story. There is more involvement and interaction when the examiner as teller is interpreting the story and looking at the child than when the attention of the examiner as reader is on the printed page.

The study of oral communication skill development in children is an important task for education. But identification of this development, while vital to understanding of children, is not enough. Ways and means to enhance
the development need to be identified and tested. This is especially true for the large population of children which are identified as disadvantaged.

Literature Related To Oral Communication of Disadvantaged Children

The emphasis which our literacy-oriented society places upon reading and writing is not of any worth unless there is preceding it and accompanying it an equal stress upon oral language communication. Loban supports this by saying,

Many pupils who lack skill in using speech will have difficulty in mastering written tradition. Competence in the spoken language appears to be a necessary base for competence in writing and reading (Loban, 1963, p. 88).

Monroe strengthens the argument with, "There is no better insurance for good reading at any level than language proficiency" (Monroe, 1951, 107). Reading, thinking, and conceptualization are built upon and intimately connected with verbal language skill (Mukerji, 1968, p. 35).

Based upon these arguments, it is concluded that skill in oral communication is a necessity for all children as it provides the basis for success in the verbal centered schools of the present society. The average middle class child has developed these skills through experiences at home and in the community. However, many of the children of the lower socio-economic status, often called
disadvantaged or deprived, do not possess these skills upon entrance to school and thus experience failure in the academic setting.

There is supportative evidence of this in much of the current literature relating to the difficulties that the disadvantaged children meet when faced with the school setting. Stodolsky and Lesser cite evidence which shows that first grade children of low socio-economic status and children who are members of minority groups start school with mean scores on verbal and nonverbal tests of general ability that are below the national average (Stodolsky and Lesser, 1967, p. 549). Giddings more specifically describes this educationally retarded status of the disadvantaged as being one to two and one-half years below the grade level where tested (Giddings, 1966, p. 206).

A study was conducted by George and Dietz which compared urban and suburban children on eight tasks of basic skills identified as being necessary for school success. These included identifying colors, drawing shapes, writing numbers, observing, classifying, and distinguishing right and left. The tasks were measured by the oral response of the child and by the child's responding to oral directions. The results are clearly dependent upon the child's oral communication skills - speaking and listening. On the basis of the results of the test, it was concluded that there is a difference between urban and suburban primary
children in the level of performance on the basic skills necessary for success in school. The findings showed that many skills which were successfully performed by suburban children in grade one were not achieved by urban children until grade three (George and Dietz, 1969).

Kropf and Bowman (1966, p. 36), Mukerji (1957, p. 34), and Black (1966, p. 46) have found that the vocabulary of the disadvantaged child shows a noticeable lag in development. The average first-grader has a vocabulary of 24,000 words, whereas the disadvantaged child's vocabulary is often limited to such words as "nope", "naw", "uh huh", or profanities that shock the sensitive ears of teachers. In some cases the child may appear to be nonverbal because he does not speak at all due to factors of fear and anxiety or a feeling of inadequacy in the situation. This does not mean that these children have no language or communication ability, for disadvantaged children are often verbal outside the school and in role-playing situations. However, this language is not the elaborated, colorful, complex language of the middle class child but is rather of a restricted form with simple structure and organization (Getzels, 1967, p. 37). It is usually of an informal nature and by its simplicity "lacks breadth and depth for precise statement of ideas or emotions" (Frost, 1967a, p. 266). "The language of these children tends to be repetitious and dull, colorless and unimaginative -
reflecting the environment within which they exist" (Frost and Rowland, 1967, p. 379). That the language is delayed in development is reported by Frost (1967b) and Spain (1962) in finding that functional definitions (the lowest form on the scale of defining words) were the predominant response for the deprived children at all age levels.

Frost writes that this simple, restrictive language had yet another effect upon these children. "It does not require - indeed it prohibits - deep thinking which results in conceptual development" (Frost, 1967a, p. 267).

Riechard (1970, p. 99) states that language may be a constraint in inner-city children's ability to deal with concepts.

Reports of a study by McConnell, Horton, and Smith show that culturally disadvantaged children do not develop at rates equivalent to the middle class with reference to all of the sensory capacities. They found a highly significant lag in the development of auditory facilities. This is of great importance to the understanding of the failure of these children in school situations because of the tremendous role of listening in a successful school performance (McConnell, Horton, and Smith, 1969, p. 603).

Almy reports that a delay of development in verbal skills was found in urban children in her study of urban and suburban children's performance on Piaget's test of conservation ability (Almy, 1966, p. 123).
This lack of skill in the oral communication of disadvantaged children is recognized and the causal factors are being inferred. Most writers are agreed that the environmental influence is the prime factor in this deficiency of skill development (Cazden, 1966; Frost, 1968a; Gordon, 1968; Loban, 1966; McConnell, 1969; Mukerji, 1957; Bromwich, 1969). The early linguistic environment of the disadvantaged child provides him with a restricted language experience. This is, in part, due to the lack of press for language development and achievement and an apathy toward learning found in many lower socio-economic homes (Loban, 1966, p. 97; Kropf and Bowman, 1966, p. 36; Gordon, 1968, p. 12). Language is not prized in the lower class home. In fact, the ability to use language to solve life problems is not characteristic of the lower socio-economic family (McConnell and Horton, 1969, p. 661).

This deficiency becomes of even greater importance when it is recognized that the lack of adequate language development inhibits the growth of intelligence as reported by McConnell, Horton, and Smith. The crucial factors of verbalism and motivation which influence the growth of intelligence are not a part of the deprived environment. It is concluded that a major concomitant of environmentally induced mental retardation appears to be retarded language development (McConnell, Horton, and Smith, 1969).

Since the major pattern for language development is
the home and the adjacent neighborhood, the disadvantaged child does not have opportunity to hear and imitate the standardized language model (Frost, 1967a, p. 266).

Anastasi (1958), McConnell and Horton (1969), Frost (1967a), Monroe (1951), Dawson and Newman (1966), Lisonbee (1963), and Anderson et al. (1970) discuss the disadvantages the children from homes where dialects and faulty English are the language patterns bring to the school setting. Their conclusions are that in addition to a poor language model, these children do not have verbal interaction or chances to participate in using the skills of communication with adults. They are not read to nor perhaps even spoken to except in anger or frustration. These children need to have opportunity to communicate individually with each other, in small and large groups, and in a free situation with adults.

Dawson and Newman place a strong emphasis upon the participation of these children in verbal activity and interchange. They say,

The boys and girls should be encouraged to participate in discussion and conversation and thus to add to their meager vocabulary and to build feeling of belonging and being important in their group (Dawson and Newman, 1966, p. 4).

Participation is also encouraged by Gardner because he believes that language is learned and that

In order for the learning to occur, there must be motivation on the part of the child. The child must somehow discover that he can satisfy
his own needs better by talking than not talking, and by talking well rather than poorly (Gardner, 1964, p. 170).

That these disadvantaged children are lacking in standard language and that they often feel frustration as a result is a great concern of educators. Bingham and Cronin, in a study directed at providing success experiences for the educationally deprived, observed that much of what happens in our present schools tells these children that they are failures. In reporting on the classroom communication of the disadvantaged child, they write

He expresses himself poorly - someone else always says what he is trying to say first, and says it better than he can say it (Bingham and Cronin, 1968, p. 38).

Encouragement, acceptance, and support of the child as he becomes an active participant should help him to overcome these handicaps.

Having recognized that the disadvantaged child is lacking in oral communication skill, efforts are now being made to counteract this deficiency by providing experiences which will aid in developing the oral language skills. Reissman has reached two conclusions on aiding these children. He says that the pace of instruction should be slower and that much physical, motor involvement should be employed. He adds that short, immediately reinforced tasks are more successful for these children (Reissman, 1962). The type of curriculum needed to develop oral communication
must provide many and varied experiences along with time and opportunity for oral communication to take place.

**Literature Related to Science Process Activities and Communication Skill Development**

To arouse interest, to stimulate inquiry, and to kindle the imagination are all important roles of the education process if we are to develop the human resource to its greatest potential. There has been a lack of providing this type of rich learning experience for our children, and especially the disadvantaged children. Malkin (1964, p. 7) states:

> We have, so far, failed to tap America's greatest resources, the creative skills and abilities of all its children. Among these disadvantaged children, there is a reservoir of future high-level, professional, and skilled personnel and we must learn how to help them realize their potential.

He hypothesizes that a proper adaptation of elementary science to the needs of disadvantaged children could bring about an enrichment of their lives, which, in turn, will benefit the entire community.

The motivation of science offers a way by which children can achieve success experiences. Science involves the wonder of the natural world which surrounds the child. The natural, taken-for-granted sunshine and the common weed are sources of delight and new experience to the child who has looked but never really seen (Bradley, 1967, p. 31).
Science offers the child experience with meaningful, concrete activities, an experience deemed necessary for success in learning (Giddings, 1966, p. 441; Anderson et al., 1970, p. 246). Science is action - action of being involved with discovery of the world around us. This involvement makes science a subject that is alive. The aliveness of science is a prerequisite to the "now" world of the urban child. "To the urban child, science must be a living thing with live, swinging, soulful people" (Paige, 1969, p. 28). Science is the way of "... stirring children up instead of tying them up" (McGavack and LaSalle, 1969, p. 29). All these facets of science identify it as an area where thinking, exchanging ideas, and defending ideas is an ongoing process. The very processes of science need communication before they can be developed and implemented into the thought patterns of children.

The science processes require that the child be able to describe properties of objects, to interpret events, and to tell what he has found out. As he investigates the world around him, he is provided with something to talk about, to write about and to read about. Even before reading ability is developed he can be well informed about many things (Owsley, 1968, p. 389; Wann et al., 1962; Shepherd, 1967, p. 75; Bradley, 1967, p. 32). That science can effectively be used to develop the communication skills of children is apparent in Barnard's statement
that knowledgable teachers have been able to exploit science effectively in developing reading skills (Barnard, 1965, p. 26). Even though teachers have used science as a means of developing communication in the past, only recently have serious efforts been made to study just how effective science can be in developing these skills.

In spite of the fact that intelligence is labeled under the categories of "verbal" and "nonverbal", the performance of an individual on any standard test of intelligence depends upon his oral communication skills - speaking and listening. Johnson (1970) and Sheffer and Mosegard (1969) studied the effects of science process activities upon the intelligence of disadvantaged children.

Johnson hypothesized that children who were taught the process approach would show a greater increase in I. Q. scores than children who were not taught the process approach. The subjects of the study were 30 third grade children in a Title I school. The children were administered a pretest using the California Test of Mental Maturity, Primary, 1957 Edition. The results were used to match the students in pairs. One member of the pair was arbitrarily assigned to the experimental group and the remaining member to the control group. The experimental group was exposed to fifteen lessons from Science - A Process Approach. Both groups were then posttested using the same test. The results showed a significant increase
in the scores for the experimental group. The investigator concluded that the process approach had benefited the subjects in the ability to think rationally.

Sheffer and Mosegard report on a study in compensatory education for disadvantaged children using the activities of the Science Curriculum Improvement Study (SCIS). These activities involved the processes of science. The results of this program were that the mean verbal intelligence as measured by the Peabody Picture Vocabulary Test increased from 69.9 in September, 1968, to 87.4 in May, 1969. The English language level moved from three years four months to four years eleven months - 19 months growth in 9 months. Some of the children in the group gained as much as 40 I. Q. points.

On the basis of these results they conclude that the process activities of science can increase the language understanding and that this can, in turn, change the intelligence scores.

Walbesser and Carter (1968) and Allen (1969) examined the process ability of children as a result of instruction in one or more of the science processes. Walbesser and Carter used three socio-economic categories to see if there was any difference in the acquisition of the process skills of Science - A Process Approach. They found that the advantaged and middle income groups did show a greater percentage acquisition but that the disadvantaged
group displayed successful performance and was higher than the other two groups on the processes of Observing and Classifying.

Allen compared classification ability of children who had taken part in SCIS with those who had not taken part in such a program. The results were not significant. His implication was that the Science - A Process Approach might be a more successful program due to the carefully sequenced classification exercises.

Studies using the Science - A Process Approach as a way of developing reading readiness skills have been done by Horn (1966) and Stemmler (1966), Ayers and Mason (1966), and Ritz and Raven (1970).

A population of Spanish speaking children in Texas was divided into three sub-groups. One group received audio-lingual technique in English with the science-based materials, the second group received the same type of treatment in Spanish, and the third group received the regular basal reading readiness program. Both Horn and Stemmler report that the results were not easy to interpret due to the limitations of instrumentation to measure the readiness of Spanish speaking children. However, the writers are agreed that the children using the science-based materials (Science - A Process Approach) did better on the test and showed a marked improvement in their daily classroom language skills as well as more interest in what they
were learning. The high scores of these children on the process skills measures developed by the American Association for the Advancement of Science, AAAS, led Stemmler to the conclusion that the material of *Science - A Process Approach* is indeed culturally fair (Stemmler, 1966, p. 50).

Ayers and Mason tested the inference that the language skills related to reading readiness of kindergarten children should increase with the communication of experiences as a result of completion of Part A of the *Science - A Process Approach*. Their rationale is based upon the content and technique of the program. The experimental group received one hour per week of instruction in *Science - A Process Approach*, Part A, for twenty-two weeks. The control group spent this time in the normal routine of study. The results of the posttest were analyzed by *t*-test and yielded a significant difference in favor of the experimental group on Listening, Numbers, and Copying sub-tests and on the total test score. There was a significant difference in favor of the control group on the Word Meaning sub-test. The conclusion of the investigators was that the science program can make a contribution to a reading readiness program for kindergarten children.

A study using Part A of *Science - A Process Approach* to enhance reading readiness of kindergarten children by developing visual perception skills was conducted by Ritz and Raven. They found that almost sixty-five
percent of the activities of Part A focused upon Observing and Space/Time Relationships, both of which place a great deal of emphasis upon visual perception. The subjects were divided into three groups. Group I received instruction in activities a through k of Part A, Science - A Process Approach. Group II also received the science and, in addition, a portion of the Frostig Perceptual Constance unit. Group III received only the Frostig exercises. Using the one-way analysis of variance, it was found that there was no significant difference between the three groups of mean readiness or visual perceptual abilities. However, the groups receiving the science scored significantly higher on the AAAS Science Competency Measure than did Group III. The investigators concluded that class time spent in both the Science - A Process Approach and Frostig programs did not detract from performance on the readiness measure, as some critics have stated. Support, based on the data, is given that there is not only time for science but that reasonable amounts do appear to enhance the attainment of science process skills.

Research studies do indicate that there is a place for process science in the curriculum and that inclusion can help develop the learning skills of the child.

Summary

This chapter, chapter two, has presented a review
of the literature related to the study of oral communication skills and science processes in disadvantaged children. The literature review was divided into three parts; (1) literature related to the language development of children, (2) literature related to oral communication of disadvantaged children, and (3) literature related to science process activities and communication skill development.

The next chapter, chapter three, presents the procedures used in this study.
CHAPTER III

PROCEDURE

In this chapter the design of the investigation and the methodology used is discussed. The design was a non-randomized, pretest - treatment - posttest, experimental - control group design. The subjects were kindergarten children enrolled in a public school receiving funds for disadvantaged children under Title I, Elementary and Secondary Education Act (ESEA) of 1965. The treatment was in the form of specific lessons taught to the groups. Also discussed are the methods used to obtain the data and to analyze this data.

Hypotheses

The following hypotheses were tested by this study.

\( H_{01} \) There is no significant difference at the .05 level between disadvantaged kindergarten subjects (Ss) who have participated in the activities of Science - A Process Approach and those Ss who have not on the Ss total performance in the oral transmitting skills and on the Ss performance on the following subtests of oral
transmitting skills:
A) Language Output and Expressiveness
B) Vocabulary
C) General Meaning and Ideas
D) Sentence Structure
E) Defining Words
F) Average Length of Sentences

$H_0^2$ There is no significant difference at the .05 level between disadvantaged kindergarten subjects (Ss) who have participated in the activities of Science - A Process Approach and Ss who have not on the Ss performance on the following subtests of oral receiving skills:
A) Listening Behavior
B) Listening Comprehension

$H_0^3$ Of the following independent variables there is no one variable or combination of variables that is a predictor of oral communication skills ability in disadvantaged kindergarten children:

- $X_1$ I. Q.
- $X_2$ sex
- $X_3$ chronological age (in months)
- $X_4$ pre-kindergarten educational experience
- $X_5$ morning or afternoon class membership
Selection of Subjects

As a control for the between schools variable, all students selected as subjects for the study were enrolled in a single participating school. In selecting the participating school for this study the following criteria were used:

1. The school must be located in the area identified as being inner-city.
2. The school must have an enrollment of children who are classified as disadvantaged as defined under Title I, ESEA of 1965.
3. The principal and kindergarten teachers must be willing for the pupils to participate in the study.
4. There should be a minimum of four kindergarten classes, two morning and two afternoon, consisting of not less than 25 students per class.

On the basis of the criteria, four schools were identified by the central administration office. Final selection of the participating school was made arbitrarily by the investigator.

The subjects for the study were enrolled in the regularly scheduled kindergarten sections in the participating school. Since the sessions were half-day sessions, each of the two teachers was assigned two groups of
students, one morning and one afternoon. The children were assigned to either morning or afternoon classes by the school administration. This assignment of students was assumed to be randomly made.

The selection of classes for the experimental treatment group was determined by the toss of a coin. The group selected by the toss was identified as the morning experimental group. In order to control the teacher variable as much as possible, the afternoon class of the second teacher was designated as the afternoon experimental group. The remaining two groups became the control group.

There were one hundred thirteen students in the four classes at the beginning of the treatment. However, due to the high rate of students transferring out of the district, final data were available on one hundred students. Forty-eight of these were in the control group, twenty-four females and twenty-four males. The experimental group was composed of fifty-two students, twenty-three females and twenty-nine males.

Instruments

The instrument used to measure the oral communication of the children was the Test of Oral Communication Skills developed by the investigator. The test is an individually administered oral test. Part 1, Transmitting Skills, consists of four stimulus pictures which are
presented, one at a time, to the child. He is then asked questions designed to elicit a verbal response on his interpretations of the picture. These responses are audio tape recorded for later transcription and analysis. Part 2, Receiving Skills, is composed of two stories which are told to the child. After each story, the child is asked questions designed to obtain an oral response which reflects a measure of his listening skills. These are also audio tape recorded.

Following the administration of the test, a written transcription is made of each child's responses. These responses are then rated on a five point rating scale, ranging from 1 as the lowest level of performance to 5 as highest level. The responses are rated for the level of performance on

Transmitting Skills
1. language output and expressiveness
2. vocabulary
3. general meaning and ideas
4. sentence structure
5. defining words
6. average length of sentences

Receiving Skills
1. listening behavior
2. listening comprehension

A copy of the instrument is located in Appendix A.
The instrument was developed, refined, and tested for reliability and validity through a two-phase pilot study. Phase one of the pilot study also served to strengthen the investigator's technique in administering the instrument to kindergarten children. Phase one was conducted with a sample of kindergarten children who were similar to the subjects used in the study while phase two utilized the pretest data of the subjects to further establish reliability and validity for the instrument.

The instrument was found to discriminate levels of oral language performance. The levels of the rating scale were found to be in a sequential order using a panel of judges. The judges agreement with that of the investigator in the placement of the levels was beyond the .01 level of confidence. Instrument reliability was tested by repeating the test with the same group of children ten days later. The children ranked from lowest to highest in the same order on both administrations, a correlation of +1.00. Construct validity of the instrument using item to total score correlation was significant at .05 for one item and at .01 for the remaining 9 items. The reliability coefficient was .8956. Investigator rating reliability was measured by correlating the ratings of the investigator with those of a second rater. The correlations were significant at .05 on Listening Behavior and .01 on the remaining items. A detailed report of the pilot study is included in
Appendix B.

Pretest

The Test of Oral Communication Skills was administered as a pretest during November, 1970. Prior to the test administration, the investigator spent four sessions of one hour each in the classrooms of the four classes participating in the study. This was to enable the investigator to become familiar with the children and to build a foundation for rapport during the testing situation.

The pretests were administered in an office and a special projects room, both of which were located in the area of the classrooms. The length of the test administration averaged 20 minutes per child.

The subjects were identified by number for scoring purposes. A list of the names of the children was obtained from both classroom teachers. The names were then arranged in alphabetical order and numbered consecutively. These identification numbers were used for all data collected in the study.

The pretest data were analyzed using the one-way analysis of variance, computer program BioMedical Division 01V (BMD 01V), version of June 15, 1966, Health Sciences Computing Facility, UCLA. An F ratio was obtained for the two parts of the test, Transmitting Skills and Receiving Skills, and for each of the individual subtests of the two
parts. The summary tables for the total transmitting skills and the total receiving skills are presented below.

TABLE 1
PRETEST: TOTAL TRANSMITTING SKILLS
SUMMARY TABLE FOR ANALYSIS OF VARIANCE

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>MS</th>
<th>Fα</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between</td>
<td>3</td>
<td>276.3804</td>
<td>1.8706</td>
</tr>
<tr>
<td>Within</td>
<td>96</td>
<td>147.7498</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>99</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

aCritical value of F at .05 level of confidence is 2.70.

TABLE 2
PRETEST: TOTAL RECEIVING SKILLS
SUMMARY TABLE FOR ANALYSIS OF VARIANCE

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>MS</th>
<th>Fα</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between</td>
<td>3</td>
<td>6.1719</td>
<td>0.6204</td>
</tr>
<tr>
<td>Within</td>
<td>96</td>
<td>9.9487</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>99</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

aCritical value of F at .05 level of confidence is 2.70.

The summaries of the analyses show that there were no statistically significant differences between the four groups on the pretest of the two parts of the Test of Oral Communication Skills. There were, likewise, no significant
differences on individual subtest scores. The summary tables for these subtests appear in Appendix C.

Intelligence Testing

As a part of the study design to test for predictors of performance on the Test of Oral Communication Skill, an intelligence test (I. Q.) was administered to the subjects of the study. The test used was the California Short-Form Test of Mental Maturity, Level 0, 1963 Revision. Scores on language, non-language, and total I. Q. are furnished by this test. The sections of this test have been correlated with the Stanford-Binet Intelligence Scale, 1960 Revision. The Pearson product moment coefficient of correlation, corrected for range and attenuation, for total, language, and nonlanguage between the tests were .87, .85, and .86 respectively (California Test Bureau, 1965, p. 24).

Treatment

The treatment for both the experimental and the control groups consisted of twenty-two lessons. The lessons were taught by the investigator, an experienced elementary science teacher who had training and experience in teaching the Science - A Process Approach curriculum. The lessons were presented in one-half hour periods, two days per week for a total of twelve academic weeks. Due
to the school calendar, two of these weeks contained only one day of instruction.

The experimental group participated in exercises $a$ through $k$ of Part A, *Science - A Process Approach*. These exercises were presented as nearly as possible according to the suggested procedure of the program. The materials used for the exercises were from the kit prepared by the Xerox Corporation, the publisher of *Science - A Process Approach*. These exercises consisted of large group discussions, small group laboratory activities, and small group discussions. There were five exercises in the process of Observing, three in Space/Time Relationships, and one each in Classifying, Using Numbers, and Measuring. The physical arrangement of the children varied according to the activity in which they were engaged.

The control group was instructed using the lessons from *Springboards In Science* (Fuller and Ellis, 1959), a resource book recommended by the kindergarten curriculum guide. All lessons except "Earthworms Help Mix and Improve the Soil" were used. The major subjects covered by these lessons were simple properties of air, simple properties of water, and plant growth. These lessons were presented in a manner as nearly as possible to that used by the typical kindergarten classroom teacher in teaching science lessons.

The children were seated on a rug in circular formation for the lessons. The lessons were teacher-directed
demonstrations with teacherposed questions related to the demonstration. Verbal interaction was in the form of student response to teacher questions and, occasionally, student questions to the teacher. Most of these questions related to the teacher's comments or to the demonstration. There was no encouraged verbal interchange among the students. Sample lesson plans are in Appendix D.

Prior to the start of the study the regular classroom teachers were observed while they were teaching two science lessons. The classroom teachers did not teach science lessons during the period of the study.

Posttest

The subjects were posttested during March, 1971, using the same instrument as the pretest, the Test of Oral Communication Skills. This test was administered in the same manner as was the pretest. The average time of administration on the posttest increased to 23 minutes. The responses were audio tape recorded, written transcriptions were made, and the responses were rated.

Analyses of Data

The posttest data were analyzed using the analysis of covariance, one-way design, BioMedical Division 04V (BMD 04V), Revised September 12, 1969, Health Sciences Computing Facility, UCLA (Dixon, 1970). The pretest score
served as the covariate. Where the F ratio was significant, the Tukey (b) test was employed to search for the source of different (Winer, 1962, p. 77).

A step-wise multiple regression, BMD 02R, Version of May 2, 1966, Health Science Computing Facility, UCLA was used to examine the predictability of the variables in \( H_0^3 \) to the scores on the pretest of the Test of Oral Communication Skills.

**Summary**

This chapter, chapter three, has examined and discussed the design of the study and the methodology used in the study. Included were discussions on selection of the subjects, instruments used in the study, the data gathering procedures, and the treatment used.

The next chapter, chapter four, presents the results of the study and discusses these results.
CHAPTER IV

RESULTS

This chapter presents the results of the analyses and the discussions of the results. These are presented in three sections. Each section reports the testing of a major hypothesis. The sections are (1) differences between groups on oral transmitting skills, (2) differences between groups on oral receiving skills, and (3) variables as predictors of performance on the Test of Oral Communication Skills.

Differences Between Groups on Oral Transmitting Skills

Analyses were done using the analysis of covariance for the total oral transmitting skills and for each of the subtests which composed the total scores for oral transmitting skills. Where the F ratio of the analysis of covariance was found to be significant at .05 or above, the Tukey (b) was employed to examine the adjusted means for the source of the difference (Winer, 1962, p. 77). The groups are identified as E-1, Experimental morning; E-2, Experimental afternoon; C-1, Control morning; and C-2, Control 64
afternoon.

**TABLE 3**

TOTAL TRANSMITTING SKILLS
SUMMARY OF ANALYSIS OF COVARIANCE

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>MS</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Error (Within)</td>
<td>95</td>
<td>121.2836</td>
<td>14.094a</td>
</tr>
<tr>
<td>Treatment + Error (Total)</td>
<td>98</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Difference for Testing Adjusted Treatment Means</td>
<td>3</td>
<td>1709.4009</td>
<td></td>
</tr>
</tbody>
</table>

aSignificant at the .01 level of confidence.

The examination of Table 4, Total Transmitting skills reveals that:

1. There is a significant difference at the .01 level between the afternoon experimental group and the morning control group. This difference is in favor of the experimental group.

2. There is a significant difference at the .01 level in favor of the experimental group between the afternoon experimental group and the afternoon control group.

3. There is a significant difference at the .01 level between the morning experimental group and the morning control group.

4. There is a significant difference at the .01
### TABLE 4

**TOTAL TRANSMITTING SKILLS**
**TUKEY (b) A POSTERIORI**
**COMPARISON OF DIFFERENCE BETWEEN MEANS**

<table>
<thead>
<tr>
<th>Group</th>
<th>C-1</th>
<th>C-2</th>
<th>E-1</th>
<th>E-2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>52.3805</td>
<td>53.4746</td>
<td>64.9464</td>
<td>69.1131</td>
</tr>
<tr>
<td>C-1</td>
<td>---</td>
<td>1.0941</td>
<td>12.5659</td>
<td>26.7326</td>
</tr>
<tr>
<td>C-2</td>
<td>---</td>
<td>11.4718</td>
<td>15.6385</td>
<td></td>
</tr>
<tr>
<td>E-1</td>
<td>---</td>
<td></td>
<td>4.1667</td>
<td></td>
</tr>
<tr>
<td>E-2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th>Truncated range $r$</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>$q_{99}$ ($r, 96$)</td>
<td>3.73</td>
<td>4.24</td>
<td>4.55</td>
</tr>
<tr>
<td>$q_{95}$ ($r, 96$)</td>
<td>2.815</td>
<td>3.38</td>
<td>3.715</td>
</tr>
<tr>
<td>$q_{99} (r, 96)\sqrt{MS_{error}/2}$</td>
<td>8.513</td>
<td>9.336</td>
<td>10.019 (critical)</td>
</tr>
<tr>
<td>$q_{95} (r, 96)\sqrt{MS_{error}/2}$</td>
<td>6.198</td>
<td>7.442</td>
<td>8.180 (critical)</td>
</tr>
</tbody>
</table>

level between the morning experimental group and the afternoon control group. An examination of Table 6, Language Output and Expressiveness reveals:

1. There is a significant difference at the .01 level between the afternoon experimental and the morning control group.

2. There is a significant difference at the .01 level between the afternoon experimental group
TABLE 5

LANGUAGE OUTPUT AND EXPRESSIVENESS
SUMMARY OF ANALYSIS OF COVARIANCE

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>MS</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Error (Within)</td>
<td>95</td>
<td>3.9701</td>
<td>16.526a</td>
</tr>
<tr>
<td>Treatment +</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Error (Total)</td>
<td>98</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Difference for Testing Adjusted</td>
<td>Mean</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Means</td>
<td>3</td>
<td>65.6110</td>
<td></td>
</tr>
</tbody>
</table>

aSignificant at the .01 level.

and the afternoon control group.

3. There is a significant difference at the .01 level between the morning experimental group and the morning control group.

4. There is a significant difference at the .01 level between the morning experimental group and the afternoon control group.

5. There is a significant difference at the .05 level between the afternoon experimental group and the morning experimental group.

Examination of Table 8, Vocabulary, reveals:

1. There is a significant difference at the .01 level between the afternoon experimental group and the morning control group.
TABLE 6

LANGUAGE OUTPUT AND EXPRESSIVENESS
TUKEY (b) A POSTERIORI
COMPARISON OF DIFFERENCE BETWEEN MEANS

<table>
<thead>
<tr>
<th>Group</th>
<th>C-1</th>
<th>C-2</th>
<th>E-1</th>
<th>E-2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>9.5930</td>
<td>10.2179</td>
<td>11.9817</td>
<td>13.1763</td>
</tr>
</tbody>
</table>

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>C-1</td>
<td>---</td>
<td>0.6249</td>
<td>2.3887</td>
<td>3.5833</td>
</tr>
<tr>
<td>C-2</td>
<td>---</td>
<td>1.7638</td>
<td>2.9584</td>
<td></td>
</tr>
<tr>
<td>E-1</td>
<td>---</td>
<td>---</td>
<td>1.1946</td>
<td></td>
</tr>
<tr>
<td>E-2</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td></td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th>Truncated range ( r )</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>( q_{99} (r,96) )</td>
<td>3.73</td>
<td>4.24</td>
<td>4.55</td>
</tr>
<tr>
<td>( q_{95} (r,96) )</td>
<td>2.815</td>
<td>3.38</td>
<td>3.715</td>
</tr>
<tr>
<td>( q_{99} (r,96) \sqrt{MS_{error}/2} )</td>
<td>1.463</td>
<td>1.674</td>
<td>1.797 (critical)</td>
</tr>
<tr>
<td>( q_{95} (r,96) \sqrt{MS_{error}/2} )</td>
<td>1.112</td>
<td>1.335</td>
<td>1.460 (critical)</td>
</tr>
</tbody>
</table>

2. There is a significant difference at the .01 level between the afternoon experimental group and the afternoon control group.

3. There is a significant difference at the .01 level between the morning experimental group and the morning control group.

4. There is a significant difference at the .01 level between the morning experimental group and the afternoon control group.
TABLE 7

VOCABULARY
SUMMARY OF ANALYSIS OF COVARIANCE

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>MS</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Error (Within)</td>
<td>95</td>
<td>3.2223</td>
<td>8.047&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Treatment + Error (Total)</td>
<td>98</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Difference for Testing Adjusted Means</td>
<td>3</td>
<td>65.6110</td>
<td></td>
</tr>
</tbody>
</table>

<sup>a</sup>Significant at the .01 level.

The examination of Table 10, General Meaning and Ideas, reveals:

1. There is a significant difference at the .01 level between the afternoon experimental and the morning control group.
2. There is a significant difference at the .01 level between the afternoon experimental group and the afternoon control group.
3. There is a significant difference at the .01 level between the morning experimental group and the morning control group.
4. There is a significant difference at the .01 level between the morning experimental group and the afternoon control group.
5. There is a significant difference at the .05 level between the afternoon experimental group
TABLE 8

VOCABULARY
TUKEY (b) A POSTERIORI
COMPARISON OF DIFFERENCE BETWEEN MEANS

<table>
<thead>
<tr>
<th>Group</th>
<th>C-1</th>
<th>C-2</th>
<th>E-1</th>
<th>E-2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>8.3854</td>
<td>8.8695</td>
<td>10.3459</td>
<td>10.4023</td>
</tr>
<tr>
<td>C-1</td>
<td>---</td>
<td>0.4841</td>
<td>1.9605</td>
<td>2.0169</td>
</tr>
<tr>
<td>C-2</td>
<td>---</td>
<td>1.4764</td>
<td>1.5328</td>
<td></td>
</tr>
<tr>
<td>E-1</td>
<td>---</td>
<td>0.0564</td>
<td></td>
<td></td>
</tr>
<tr>
<td>E-2</td>
<td>---</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Truncated range r

<table>
<thead>
<tr>
<th></th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>q_{99} (r, 96)</td>
<td>3.73</td>
<td>4.24</td>
<td>4.55</td>
</tr>
<tr>
<td>q_{95} (r, 96)</td>
<td>2.815</td>
<td>3.38</td>
<td>3.715</td>
</tr>
<tr>
<td>q_{99} (r, 96) \sqrt{MS_{error}/2}</td>
<td>1.226</td>
<td>1.519</td>
<td>1.629 (critical)</td>
</tr>
<tr>
<td>q_{95} (r, 96) \sqrt{MS_{error}/2}</td>
<td>1.007</td>
<td>1.210</td>
<td>1.330 (critical)</td>
</tr>
</tbody>
</table>

and the morning experimental group.

Examination of Table 12, Sentence Structure, reveals:

1. There is a significant difference at the .01 level between the afternoon experimental group and the morning control group.

2. There is a significant difference at the .05 level between the afternoon experimental group and the afternoon control group.

3. There is no significant difference between the
**TABLE 9**

**GENERAL MEANING AND IDEAS**  
**SUMMARY OF ANALYSIS OF COVARIANCE**

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>MS</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Error (Within)</td>
<td>95</td>
<td>4.9008</td>
<td>17.423a</td>
</tr>
<tr>
<td>Treatment + Error (Total)</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Difference for Testing Adjusted Means</td>
<td>98</td>
<td>85.3857</td>
<td></td>
</tr>
</tbody>
</table>

*Significant at the .01 level.*

morning experimental group and the afternoon or morning control group.  
An examination of Table 14, Defining Words, reveals:

1. There is a significant difference at the .05 level between the afternoon experimental group and the morning control group.

2. There are no significant differences between any of the other groups.

The examination of TABLE 15 reveals that there is no significant difference between the means of the control and experimental groups on the subtest Average Length of Sentences.

**Discussion of Results**

Analyses of the data of the Transmitting Skills reveals that the experimental groups were significantly
TABLE 10
GENERAL MEANING AND IDEAS
TUKEY (b) A POSTERIORI
COMPARISON OF DIFFERENCE BETWEEN MEANS

<table>
<thead>
<tr>
<th>Group</th>
<th>C-1</th>
<th>C-2</th>
<th>E-1</th>
<th>E-2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>8.5825</td>
<td>9.4818</td>
<td>11.1847</td>
<td>12.8228</td>
</tr>
<tr>
<td>C-1</td>
<td>---</td>
<td>0.8993</td>
<td>2.6022</td>
<td>4.2403</td>
</tr>
<tr>
<td>C-2</td>
<td>---</td>
<td>1.7029</td>
<td>3.3410</td>
<td></td>
</tr>
<tr>
<td>E-1</td>
<td>---</td>
<td></td>
<td>1.6381</td>
<td></td>
</tr>
</tbody>
</table>

Truncated range $r$

<table>
<thead>
<tr>
<th></th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>$q_{99}$ ($r, 96)$</td>
<td>3.73</td>
<td>4.24</td>
<td>4.55</td>
</tr>
<tr>
<td>$q_{95}$ ($r, 96)$</td>
<td>2.815</td>
<td>3.38</td>
<td>3.715</td>
</tr>
</tbody>
</table>

$\frac{\sqrt{MS_{error}}}{2}$

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>$q_{99}$ ($r, 96)$</td>
<td>1.6848</td>
<td>1.874</td>
<td>2.011 (critical)</td>
</tr>
<tr>
<td>$q_{95}$ ($r, 96)$</td>
<td>1.244</td>
<td>1.493</td>
<td>1.642 (critical)</td>
</tr>
</tbody>
</table>

higher than the control groups on the Total Transmitting Skills and on the subtests of Language Output and Expressiveness, Vocabulary, and General Meaning and Ideas. These results support the findings of Ritz and Raven (1970) that participation in the activities of Science - A Process Approach does not hinder the development of the other abilities of the child. In fact, the results of this study imply that such instruction can increase the performance of the disadvantaged kindergarten child in overall oral
TABLE 11

SENTENCE STRUCTURE
SUMMARY OF ANALYSIS OF COVARIANCE

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>MS</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Error (Within)</td>
<td>95</td>
<td>5.5610</td>
<td>4.979a</td>
</tr>
<tr>
<td>Treatment +</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Error (Total)</td>
<td>98</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Difference for</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Testing Adjusted</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Means</td>
<td>3</td>
<td>65.6110</td>
<td></td>
</tr>
</tbody>
</table>

aSignificant at the .01 level.

transmitting skills.

The results of this study also support the findings of Ayers and Mason (1969) that participation in Science - A Process Approach increases the performance on the total scores of the tests. The findings of Horn and Stemmler (1966), Sheffer and Mosegard (1969), and Johnson (1970) that the use of process science increases the language of children are supported by this study.

The difference in the Language Output and Expressiveness is reflected in the experimental groups' quick responses to the stimulus pictures and their ability to exhaust the subject of the picture with little or no need for added encouragement by the investigator. The control group needed more encouraging remarks to exhaust their ideas, as observed in study of the written transcriptions.
TABLE 12

SENTENCE STRUCTURE
TUKEY (b) A POSTERIORI
COMPARISON OF DIFFERENCE BETWEEN MEANS

<table>
<thead>
<tr>
<th>Group</th>
<th>C-1</th>
<th>C-2</th>
<th>E-1</th>
<th>E-2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>7.0479</td>
<td>7.8030</td>
<td>8.6048</td>
<td>9.5397</td>
</tr>
<tr>
<td>C-1</td>
<td>---</td>
<td>0.7551</td>
<td>1.5569</td>
<td>2.4918</td>
</tr>
<tr>
<td>C-2</td>
<td>---</td>
<td>---</td>
<td>0.8018</td>
<td>1.7367</td>
</tr>
<tr>
<td>E-1</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>0.9349</td>
</tr>
<tr>
<td>E-2</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
</tbody>
</table>

Truncated range \( r \)

<table>
<thead>
<tr>
<th>Truncated range ( r )</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>( q_{99} (r,96) )</td>
<td>3.73</td>
<td>4.24</td>
<td>4.55</td>
</tr>
<tr>
<td>( q_{95} (r,96) )</td>
<td>2.815</td>
<td>3.38</td>
<td>3.715</td>
</tr>
<tr>
<td>( q_{99}(r,96) \sqrt{\text{MS}_{\text{error}}/2} )</td>
<td>1.756</td>
<td>1.997</td>
<td>2.143 (critical)</td>
</tr>
<tr>
<td>( q_{95}(r,96) \sqrt{\text{MS}_{\text{error}}/2} )</td>
<td>1.125</td>
<td>1.591</td>
<td>1.749 (critical)</td>
</tr>
</tbody>
</table>

The experimental group made inferences and spoke in more terms involving logical thinking than did the control groups. Such expressions as "She is crying"; "She is not happy"; and "If she put her hand there the bird bite her" were found more among the experimental group. The control group tended to enumerate the objects in the pictures more often. This accounted for the differences in the subtests General Meaning and Ideas and Vocabulary.

The differences between the morning experimental
and afternoon experimental groups in Language Output and Expressiveness and General Meaning and Ideas were of particular interest. In examining the observable differences in the two experimental groups, only that of teacher and age were apparent. The groups had different regular classroom teachers. The afternoon experimental group had a higher mean age, 73 months, than that of the morning group, 71 months.

The results that the experimental treatment groups did not differ significantly from the control groups in Defining Words is of interest. The finding of lack of difference is somewhat surprising in view of responses in which several of the children in the experimental groups used observable properties especially related to plane geometrical shapes and colors in their definitions, such
TABLE 14
DEFINING WORDS
TUKEY (b) A POSTERIORI COMPARISON OF DIFFERENCE BETWEEN MEANS

<table>
<thead>
<tr>
<th>Group</th>
<th>C-1</th>
<th>C-2</th>
<th>E-1</th>
<th>E-2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>10.8750</td>
<td>11.4797</td>
<td>11.8126</td>
<td>11.9976</td>
</tr>
<tr>
<td>C-1</td>
<td>---</td>
<td>0.6047</td>
<td>0.9376</td>
<td>1.1226</td>
</tr>
<tr>
<td>C-2</td>
<td>---</td>
<td>---</td>
<td>0.3329</td>
<td>0.5199</td>
</tr>
<tr>
<td>E-1</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>0.1850</td>
</tr>
<tr>
<td>E-2</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
</tbody>
</table>

Truncated range $r$

<table>
<thead>
<tr>
<th></th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>$q_{99} (r,96)$</td>
<td>3.73</td>
<td>4.24</td>
<td>4.55</td>
</tr>
<tr>
<td>$q_{95} (r,96)$</td>
<td>2.815</td>
<td>3.38</td>
<td>3.715</td>
</tr>
<tr>
<td>$q_{99} (r,96)\sqrt{MS_{error}/2}$</td>
<td>1.074</td>
<td>1.221</td>
<td>1.310 (critical)</td>
</tr>
<tr>
<td>$q_{95} (r,96)\sqrt{MS_{error}/2}$</td>
<td>0.811</td>
<td>0.973</td>
<td>1.069 (critical)</td>
</tr>
</tbody>
</table>

as: "The wagon is blue with a rectangle and black circles and a thing to pull it"; "the basket is made of straw"; and "it oval". Several activities of the Science - A Process Approach involved geometrical shape and color and so it would seem that responses involving these properties should make a difference. However, the testing situation did not ask the child for any expanded ideas. The question to secure the definition was worded: "What is a _____?" Most
TABLE 15
AVERAGE LENGTH OF SENTENCES
SUMMARY OF ANALYSIS OF COVARIANCE

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>MS</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Error (Within)</td>
<td>95</td>
<td>50.2492</td>
<td>0.944</td>
</tr>
<tr>
<td>Treatment + Error (Total)</td>
<td>98</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Difference for Testing Adjusted Means</td>
<td>3</td>
<td>47.4583</td>
<td></td>
</tr>
</tbody>
</table>

of the children responded with the use of the object and did not continue their response to describe the object.

The results show that on the subtest of Sentence Structure the afternoon experimental group was significantly different from the morning control group at the .01 level and from the afternoon control group at the .05 level. The morning experimental group is approaching a significant difference from the afternoon control group. A note should be made here that the Tukey test is a conservative test and that a possible difference might exist which could be identified by a less conservative measure (Winer, 1962, p. 87).

The findings of no differences in Average Length of Sentences was not as surprising when the responses were reviewed. The pattern of response of the children with
higher language output was usually in a form such as, "They playing with the dolls"; "They holding cats and going to put them in a basket"; and "He pushing the cart". These phrases are complete ideas and they communicate the thoughts of the child, but they lack the proper verbs to make them standard sentences. This reduced the number of sentences in each response and when compared with the most used complete sentences "That's all" and "I don't know" makes the results on the Average Length of Sentences clearer. A measure of Average Length of Responses, where a response was defined as a complete idea, would possibly have obtained different results.

Differences Between Groups
On Oral Receiving Skills

The Oral Receiving Skills were analyzed with the same analyses as the Oral Transmitting Skills.

An examination of Table 17, Total Receiving Skills, reveals:
1. There is a significant difference between the afternoon experimental group and the afternoon control group at the .01 level.
2. There is no significant difference between any of the other groups.

An examination of Table 19, Listening Behavior, reveals:
1. There is a significant difference at the .05 level between the afternoon experimental group
TABLE 16
TOTAL RECEIVING SKILLS
SUMMARY OF ANALYSIS OF COVARIANCE

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>MS</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Error (Within)</td>
<td>95</td>
<td>8.8099</td>
<td>3.704(^a)</td>
</tr>
<tr>
<td>Treatment + Error (Total)</td>
<td>98</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Difference for Testing Adjusted Means</td>
<td>3</td>
<td>32.6287</td>
<td></td>
</tr>
</tbody>
</table>

\(^a\)Significant at the .05 level.

and the afternoon control group.

2. There is a significant difference at the .05 level between the afternoon experimental group and the morning control group.

3. There is no significant difference between the morning experimental group and either the morning or the afternoon control groups.

An examination of TABLE 20 reveals that there is no significant difference between the groups on the skill of Listening Comprehension.

Discussion of Results

The results of the analyses reveal that the two experimental groups were not significantly higher on any of the Receiving Skills. The afternoon experimental group
TABLE 17
TOTAL RECEIVING SKILLS
TUKEY (b) A POSTERIORI
COMPARISON OF DIFFERENCE BETWEEN MEANS

<table>
<thead>
<tr>
<th>Group</th>
<th>C-2</th>
<th>C-1</th>
<th>E-1</th>
<th>E-2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>9.2113</td>
<td>10.3979</td>
<td>10.5728</td>
<td>12.0040</td>
</tr>
<tr>
<td>C-2</td>
<td>---</td>
<td>1.1866</td>
<td>1.3615</td>
<td>2.7927</td>
</tr>
<tr>
<td>C-1</td>
<td>---</td>
<td>---</td>
<td>0.1749</td>
<td>1.6061</td>
</tr>
<tr>
<td>E-1</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>1.4312</td>
</tr>
<tr>
<td>E-2</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Truncated range r</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>q₉₉ (r, 96)</td>
<td>3.73</td>
<td>4.24</td>
<td>4.55</td>
<td></td>
</tr>
<tr>
<td>q₉₅ (r, 96)</td>
<td>2.815</td>
<td>3.38</td>
<td>3.715</td>
<td></td>
</tr>
<tr>
<td>q₉₉ (r, 96)√MS error/2</td>
<td>2.211</td>
<td>2.514</td>
<td>2.698 (critical)</td>
<td></td>
</tr>
<tr>
<td>q₉₅ (r, 96)√MS error/2</td>
<td>1.669</td>
<td>2.004</td>
<td>2.202 (critical)</td>
<td></td>
</tr>
</tbody>
</table>

was significantly higher than the control groups on both Total Receiving Skills and Listening Behavior. This indicates that this group is different from the other groups in these skills in some respect. The only observable difference noted from the data collected is that of the classroom teacher.

The findings of Ayers and Mason (1969) that the experimental group was significantly higher on listening are not supported by the results of this study. The report
TABLE 18
LISTENING BEHAVIOR
SUMMARY OF ANALYSIS OF COVARIANCE

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>MS</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Error (Within)</td>
<td>95</td>
<td>2.0089</td>
<td>3.141a</td>
</tr>
<tr>
<td>Treatment + Error (Total)</td>
<td>98</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Difference for Testing Adjusted Means</td>
<td>3</td>
<td>6.3100</td>
<td></td>
</tr>
</tbody>
</table>

aSignificant at the .05 level.

of the American Association for the Advancement of Science (1967b) that teachers noted an increase in listening comprehension is not supported by the data of this study.

The Receiving Skills test was administered individually to the children. The attention from the one-to-one relationship could be a contributing factor in the performance of all the groups.

Independent Variables As Predictors of Oral Communication Skills

As a means of ascertaining whether certain variables could be used as predictors of a disadvantaged kindergarten child's oral communication skills as measured by the Test of Oral Communication Skills, a step-wise multiple regression was computed for five independent variables.
Variable 1, I. Q., was subdivided into three parts: total I. Q., language I. Q., and nonlanguage I. Q.

These variables were examined for their predictor value on total scores of the Test of Oral Communication Skills and on the two major skill tests which compose the Test of Oral Communicating Skills, the transmitting skills and the receiving skills. The pretest scores furnished the dependent variable for the analyses. Pretest scores were used because there had been no interference of the treat-
TABLE 20
LISTENING COMPREHENSION
SUMMARY OF ANALYSIS OF COVARIANCE

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>MS</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Error (Within)</td>
<td>95</td>
<td>3.5705</td>
<td>1.468</td>
</tr>
<tr>
<td>Treatment + Error (Total)</td>
<td>98</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Difference for Testing Adjusted Means</td>
<td>3</td>
<td>5.2401</td>
<td></td>
</tr>
</tbody>
</table>

An examination at this point in measurement. Each variable was examined for the proportion of variance in the test score that was dependent upon or predicted by it. This proportion is expressed in percentage and is obtained by multiplying $100 \times$ the increase in $R^2$ (Guilford, 1965, p. 399). The summary tables for the step-wise regression on the three test scores are presented below.

An examination of TABLE 21 reveals that 93 percent of the variance in the total score on the Test of Oral Communication Skills was contributed by chronological age. Total language I. Q. accounted for 1 percent of the variance. The other variables contributed less than 1 percent each to the variance.

The examination of TABLE 22 reveals that 95 percent of the variance in the score on Transmitting Skills was
TABLE 21

INDEPENDENT VARIABLES AS PREDICTORS
OF TOTAL SCORES OF
TEST OF ORAL COMMUNICATION SKILLS
SUMMARY OF REGRESSION ANALYSIS

<table>
<thead>
<tr>
<th>Rank Order Entry of Independent Variables</th>
<th>Multiple R</th>
<th>Multiple R²</th>
<th>Increase R²</th>
<th>df</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>0.9678</td>
<td>0.9366</td>
<td>0.9366</td>
<td>1/99</td>
<td>1463.34&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Total I. Q.</td>
<td>0.9747</td>
<td>0.9501</td>
<td>0.0135</td>
<td>2/98</td>
<td>26.47&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Nonlang I. Q.</td>
<td>0.9772</td>
<td>0.9549</td>
<td>0.0014</td>
<td>3/97</td>
<td>2.82&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Pre-K</td>
<td>0.9761</td>
<td>0.9528</td>
<td>0.0009</td>
<td>4/96</td>
<td>1.90</td>
</tr>
<tr>
<td>Sex</td>
<td>0.9763</td>
<td>0.9531</td>
<td>0.0004</td>
<td>5/95</td>
<td>0.72</td>
</tr>
<tr>
<td>Lang I. Q.</td>
<td>0.9765</td>
<td>0.9536</td>
<td>0.0004</td>
<td>6/94</td>
<td>0.86</td>
</tr>
<tr>
<td>AM/PM</td>
<td>0.9772</td>
<td>0.9550</td>
<td>0.0001</td>
<td>7/93</td>
<td>0.10</td>
</tr>
</tbody>
</table>

<sup>a</sup>Significant at .01 level.
<sup>b</sup>Significant at .05 level.

contributed by chronological age. Nonlanguage I. Q. contributed .7 percent. The remaining 4 percent was contributed by the other 5 variables.

The examination of TABLE 23 reveals that 89 percent of the variance in the score on Receiving Skills was contributed by chronological age. Sex accounted for 1 percent of the variance. Language I. Q. contributed .4 percent to the variance with the remaining variables making up the remaining 8 percent.
TABLE 22
INDEPENDENT VARIABLES AS PREDICTORS OF SCORES OF ORAL TRANSMITTING SKILLS
SUMMARY OF REGRESSION ANALYSIS

<table>
<thead>
<tr>
<th>Rank Order Entry of Independent Variables</th>
<th>Multiple R</th>
<th>Multiple R²</th>
<th>Increase R²</th>
<th>df</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>0.9751</td>
<td>0.9509</td>
<td>0.9509</td>
<td>1/99</td>
<td>1917.39a</td>
</tr>
<tr>
<td>Nonlang I. Q.</td>
<td>0.9788</td>
<td>0.9580</td>
<td>0.0071</td>
<td>2/98</td>
<td>16.45a</td>
</tr>
<tr>
<td>Sex</td>
<td>0.9795</td>
<td>0.9594</td>
<td>0.0014</td>
<td>3/97</td>
<td>3.44b</td>
</tr>
<tr>
<td>Pre-K</td>
<td>0.9801</td>
<td>0.9606</td>
<td>0.0006</td>
<td>4/96</td>
<td>1.37</td>
</tr>
<tr>
<td>AM/PM</td>
<td>0.9802</td>
<td>0.9608</td>
<td>0.0002</td>
<td>5/95</td>
<td>0.51</td>
</tr>
<tr>
<td>Total I. Q.</td>
<td>0.9803</td>
<td>0.9609</td>
<td>0.0001</td>
<td>6/94</td>
<td>0.34</td>
</tr>
<tr>
<td>Lang I. Q.</td>
<td>0.9803</td>
<td>0.9609</td>
<td>0.0000</td>
<td>7/93</td>
<td>0.01</td>
</tr>
</tbody>
</table>

Significant at .01 level.
Significant at .05 level.

Discussion of Results

The high contribution to the variance of all three scores makes age the single most important predictor of oral communication skills ability level. Even though all of the subjects were kindergarten children, the range of age was from 60 months to 83 months with a mean of 70.23 months. This places the subjects of the study between five and seven years of age, a period when much development is occurring. The results support the factor of age in
TABLE 23
INDEPENDENT VARIABLES AS PREDICTORS
OF SCORES OF ORAL RECEIVING SKILLS
SUMMARY OF REGRESSION ANALYSIS

<table>
<thead>
<tr>
<th>Rank Order Entry of Independent Variables</th>
<th>Multiple R</th>
<th>Multiple $R^2$</th>
<th>Increase $R^2$</th>
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<td>0.0001</td>
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</table>

*Significant at .01 level.

development reflected in the stages of Piaget (1959). The kindergarten child is arriving at the transitional point from pre-operational to concrete operational. Consequently, his oral language communication is an indicator of this change by the increase in the complexity of his speech.

The development of language communication is the development of a cognitive skill. Ausubel (1963, p. 29) implies that age is an important factor in development of cognitive skill when he points out in his discussion on readiness that there is existing cognitive equipment or
capacity at a given age level for coping with the demands of specified cognitive tasks.

The use of age to predict scores on the receiving, or listening, test is partially a result of physical maturity. Younger children do not have the attention span to listen and internalize the material they hear. As the physical muscles mature so do the attention span and the ability to take in what is said and to organize this material into ideas and sequences which they can effectively communicate to others.

The contribution of I. Q. to all three scores is supportive of Bromwich (1969, p. 59) and Meier (1968, p. 230) in the postulate that I. Q. is based on the specific and limited areas of the test used and on the ability of the subject to receive spoken words accurately. I. Q. is measured by communication and is reflective of the subject's skill in communication. The test used in this study required the subjects to be able to follow oral directions.

That I. Q. did not contribute a greater proportion to the variance is of interest. An influential factor might be that the I. Q. test was the first test involving a pencil and paper response which had been presented to the subjects. For many of the subjects this was an initial experience using a pencil and responding to printed symbols on a page.
The influence of sex as a predictor in the tests of transmitting and receiving skills supports the findings of Landreth (1967, p. 191) that sex difference is most marked in children of parents engaged in semiskilled and unskilled manual labor. The subjects of this study, disadvantaged kindergarten children, fall into the category of children of unskilled or semiskilled laborers. The sex variable was in favor of girls and supports the findings of Templin (1957, p. 5) that articulation maturity occurs in girls at about 7 and in boys at about 8 years of age. The girls in this study were approaching age 7, hence this maturity.

Summary

This chapter, chapter four, has presented the results of the analyses of the data. The analyses were presented and discussed in three sections: differences between groups on oral transmitting skills, differences between groups on oral receiving skills, and variables as predictors of performance of the Test of Oral Communication Skills. Each section reported on the testing of a major hypothesis.

The next chapter, Chapter five, presents a summary of the study, conclusions based on the data of the study, and implications for education based on the study.
CHAPTER V

SUMMARY, CONCLUSIONS, AND IMPLICATIONS

The summary, conclusions, and implications of the study are presented in this chapter. These are presented in three sections: the summary describes the overview of the study, the conclusions are based on the results of this investigation, and the implications for education are suggested by the study.

Summary

The study investigated the effects of participation in the activities of *Science - A Process Approach* on the oral communication skills of disadvantaged kindergarten children. The subjects were kindergarten children enrolled in four regularly scheduled kindergarten classes in an inner-city school. Two of the classes were assigned to the experimental treatment. The remaining two were designated as control groups. The subjects were administered a pre-test, given twelve weeks of the treatment, and administered a posttest. The test used was the Test of Oral Communication Skills, developed by the investigator. The treatment consisted of twenty-two lessons in the activities of Part

Five independent variables; I. Q., sex, chronological age, pre-kindergarten educational background, and morning or afternoon kindergarten class membership; were examined to determine their predictive value of the pretest scores of oral communication skills.

The data were analyzed to test the three hypotheses of the study.

Conclusions

On the basis of the analyses of the data the following evaluations were made of the hypotheses.

$H_0$ The there is no significant difference at the .05 level between disadvantaged kindergarten subjects (Ss) who have participated in the activities of Science - A Process Approach and those Ss who have not on the Ss total performance in the oral transmitting skills and on the Ss performance on the subtests of oral transmitting skills.

A. There was a significant difference in favor of the morning and afternoon experimental groups at the .01 level on the Total
Transmitting scores. The hypothesis of no significant difference is rejected.

B. Subtests of Oral Transmitting Skills

1. There was a significant difference in favor of the morning and afternoon experimental groups at the .01 level on the subtest of Language Output and Expressiveness. The hypothesis of no significant difference is rejected.

2. There was a significant difference at the .01 level in favor of the morning and afternoon experimental groups on the subtest of Vocabulary. The hypothesis of no significant difference is rejected.

3. There was a significant difference at the .01 level in favor of the morning and the afternoon experimental groups on the subtest of General Meaning and Ideas. The hypothesis of no difference is rejected.

4. There was a significant difference at the .01 level between the afternoon experimental group and both the morning and the afternoon control groups on the subtest of sentence structure. There were no significant differences between
the morning experimental group and the morning or the afternoon control groups. The hypothesis of no difference between the experimental and control groups is not rejected.

5. There was a significant difference at the .05 level in favor of the afternoon experimental group over the morning control group on the subtest of Defining Words. There were no significant differences between any of the other groups. The hypothesis of no difference between the groups is not rejected.

6. There were no significant differences between any of the groups on the subtest Average Length of Sentences. The hypothesis is not rejected.

\( H_o^2 \) There is no significant difference at the .05 level between disadvantaged kindergarten subjects (Ss) who have participated in the activities of **Science - A Process Approach** and those who have not on the Ss total performance in the oral receiving skills and on the Ss performance on the subtests of oral receiving skills.

A. There was a significant difference at the .01 level in favor of the afternoon experi-
mental group over the afternoon control group on the total receiving skills. There were no significant differences between the other groups. The hypothesis is not rejected.

B. Subtests of Oral Receiving Skills

1. There was a difference at the .05 level between the afternoon experimental group and both the morning and afternoon control groups on the subtest Listening Behavior. There was no significant difference between the morning experimental group and either the morning or afternoon control groups. The hypothesis is not rejected.

2. There were no significant differences between the experimental groups and the control groups on the subtest of Listening Comprehension. The hypothesis is not rejected.

$H_0^3$ Of the independent variables; I. Q., sex, chronological age, pre-kindergarten educational experience, and morning or afternoon class membership, there is no one variable or combination of variables that is a predictor of oral communication skills ability in disadvantaged kinder-
A. The most useful predictor of performance on the Test of Oral Communication Skills for disadvantaged kindergarten children is chronological age. Age plus I. Q. and sex, in favor of females, accounted for more than 90% of the variance in the three parts of the test. The hypothesis that there is no one variable or combination of variables useful as predictors is rejected.

Several additional interpretations are indicated by the results of this investigation.

1. Laboratory, experience-centered science activities, such as those of the program Science - A Process Approach, can be used effectively in developing the oral communication transmitting skills of inner-city kindergarten children in language output and expressiveness, vocabulary, and general meaning and ideas.

2. The study suggests that participation in the science activities which tended to increase the amount and complexity of oral language and vocabulary skills and to develop higher levels of meaning and ideas did not necessarily improve the child's use of sentences, either in the structure or in the length, nor the level of word definitions verbalized by the child. The skill of listening, likewise, was not improved by the participation.
3. The kindergarten children in this study were able to transfer the learning in skills of oral communication from the science lessons to the individual testing situation. This was especially reflected in the vocabulary and the defining words subtests in which the children used words encountered in the science activities.

Implications

This investigation suggests several implications to the field of education, especially in the early years of schooling and in regard to the disadvantaged, inner-city children. Questions for further study are also raised by the present investigation.

1. The kindergarten children involved in this study were able to adapt to at least two teachers, the investigator and the regular classroom teacher. This is a departure from the long-held idea that the primary level be self-contained with only one teacher.

2. The children involved in this study, disadvantaged kindergarten children, were able to handle the materials of the science laboratory activities and to use these materials to make discoveries about their environment. These children were also able to work independently in small groups to find solutions to certain problems presented to them. On the basis of these results, it is possible that this type of learning is practical and suc-
cessful with children of lower socio-economic status.

3. If, as concluded in the literature, oral communication skills are the foundation of reading, a follow-up study of success in reading and writing skill development and achievement is necessary to determine the full impact of the type program used in this study. A longitudinal study is needed to determine if the gains in oral communication skills are evident in the beginning reading process.

4. This study identified and tested six transmitting skills and two receiving skills. Language, as it pertains to oral communication, is very complex and consists of many more than these identified skills. Identification of other facets and skills of oral communication are needed to better measure and provide guidelines for the teachers of young children.

5. The program did appear to increase certain oral communication skills in one group of children - the socio-economically disadvantaged who were enrolled in an inner-city school. What would the results show if the same study were conducted with suburban or rural children? These findings would be important to adapting programs to different groups of children.

6. The methodology and materials of *Science - A Process Approach* are unique to most present kindergarten curricula. The present study did not provide for a testing of whether it was methodology or materials, or both, that
was responsible for the outcome. Further study is needed to determine if it is the methodology or the program materials by using the materials of the Science - A Process Approach with the laboratory-centered methodology as presented in the program and with a demonstration-centered approach such as that used with the control groups in this study.

7. Another question relating to methodology and materials is asked when other laboratory centered programs, such as Elementary Science Study (ESS) and the School Curriculum Improvement Study (SCIS), are considered in view of the results of the present investigation. Are these results related only to Science - A Process Approach or might similar results be obtained using one of the above mentioned programs? The answer to this question would also be an important finding in preparing teachers of young children and in preparing curriculum guides for kindergarten and primary children.

8. The results of this study that participation in activities of Science - A Process Approach by disadvantaged kindergarten children does result in improvement in certain skills of oral communication is of importance to the teacher education program. Teacher educators will need to provide more training and experience in teaching an activity centered program, especially for those prospective teachers of inner-city children. These future teachers
will need training in the use of laboratory materials with students and in the methods of such programs as **Science - A Process Approach**.

9. The time of the study was short, twelve weeks, in comparison to the total academic year. This implies that these gains reflected in the short term study might possibly be increased with participation in the program for an entire academic year. The question arising here is, would the use of these activities on a regularly scheduled basis for the entire school year produce more significant results? The answer to this question would be of great importance in planning the overall kindergarten curriculum.

10. The skills related to listening, the receiving skills of listening behavior and listening comprehension, were tested and measured on a one-to-one relationship. This unique approach might be artificial in obtaining an accurate measure of the child's listening in the total learning situation. Some measure of the child's listening in the group situation should be constructed and tested. The results could be correlated with the results on the individual instrument to determine if the individual attention of the one-to-one situation does indeed make a difference in performance.

11. The treatment lessons were taught by the investigator, independent of the classroom teacher's planning. A design employing either cooperative planning by both
teachers or the classroom teacher, with proper training, teaching the science program would possibly produce more accurate results and show the effects of integration of science to the other areas of the curriculum.

12. In this study there were two regular kindergarten teachers. Since the lessons were taught by the investigator, the teacher variable was not a part of the design of the study. However, the results do imply that the teacher's behavior and teaching style make a difference in the performance of the children. This inference is based on the data of the study which reveals that the afternoon experimental group, taught by teacher one (T₁), had consistently higher means than the other groups on all scores of the Test of Oral Communication Skills. Significantly higher scores in favor of the afternoon experimental group as compared with the afternoon control group, taught by teacher two (T₂), were revealed in total transmitting skills and in the subtests of language output and expressiveness, vocabulary, general meaning and ideas, sentence structure, and listening behavior. The afternoon experimental group (T₁) was also significantly higher than the morning experimental group (T₂) on language output and expressiveness and general meaning and ideas. Of further interest is the result that the afternoon experimental group of T₁ was significantly different from the morning control group of the same T₁ in all areas mentioned above.
The investigator tried to provide the open, laboratory, activity-centered environment advocated by the developers of the program, Science - A Process Approach, during the science activities of the experimental groups. However, this was only for two one-half hour periods per week. The atmosphere provided by the regular classroom teacher was a greater influence. The investigator's observations noted a difference in the treatment of the groups. The afternoon experimental group's regular teacher (T₁) provided an informal atmosphere. The children were not assigned specific seats in the classroom as were those in the remaining three groups, including the morning control group of T₁. This teacher made use of many of the learnings gained from the activities completed during the science lessons in other areas of the curriculum with both the morning control group and the afternoon experimental group. None of the four groups were given any time beyond the science period and a 40 minute "free play" period for any verbal interchange among the students.

13. A study of the responses of the children and the results of the data make implications for the instrument. The skill of average length of sentences did not seem to apply to the children of this study in that they do not use standard sentence patterns in the bulk of their everyday speech. Most of their speech pattern involves phrases without complete verbs. These phrases are complete
thoughts and serve to communicate the ideas, but they do not meet the grammatical criterion of sentences. For this reason, perhaps it would be better to measure the average length of response of these children. This measure would give the language output in terms of length of ideas and the length measure could imply the complexity of the response.

The category of the skill defining words did not appear to accurately measure the higher levels of skill displayed by some of the children in the study. An examination of the directions for the instrument reveals that the question asked to elicit the response upon which the rating of skill in this area is made is simply, "What is a ___?" The literature reported that the functional definition or the use of the object was the most common form of defining words in children, especially children of the lower socio-economic group. Perhaps a more open question to stimulate the response might be, "Tell me all you can about a ___." This approach should be tested to determine if it does obtain responses which are more varied and which rank in more levels on the rating scale.

14. Success in present day schools is built on the communication skills, especially as they are related to reading. From this knowledge it would seem that a program, such as Science - A Process Approach, which contributes to development of communication skills would also contribute
to success experiences of children. The framework of the program would enable the children to have more positive feelings about themselves and to feel more secure in the learning situation. The need for this type of development is vital to the disadvantaged children, many of whom have negative self-concepts. By the same token, a program that fosters language communication and increases the chances for success should also provide the child with the experience and atmosphere for creative expression. Study is needed in these areas to determine the contribution that science activities can make to the overall development of children.

Summary

The present investigation has examined what one science program, Science - A Process Approach, can contribute to the total development of children. This chapter, chapter five, has presented the summary of the study, conclusions drawn from the results of the study, and implications suggested by the study. The chapter has also discussed questions which need to be investigated.
TEST OF ORAL COMMUNICATION SKILLS

Selection of Stimulus Pictures

Prior to the testing session, possible stimulus pictures were selected by the following criteria:

1) The pictures contain two or more characters, including animals.
2) There is a clear presence of a central activity or "story".
3) The characters are engaged in several different activities.
4) The setting or background should be appropriate enough to indicate where the action is taking place, but should not contain so many items as to distract from the main theme.

Selection of Stimulus Stories

Prior to the testing session, possible stimulus stories were selected by the following criteria:

1) The subject of the story is at a level suitable for the age group.
2) A sequence of action is a part of the plot of the story.
3) The length of telling time does not exceed 4 minutes.
4) The story lends itself to interpretation in the telling.

The stimulus pictures and stories used in the test were selected by means of a pilot study with kindergarten children.
DESCRIPTION OF STIMULUS PICTURES AND STORIES

The following is a brief description of the stimulus pictures and stories used in this study.

**Picture 1**

**Setting:** an aisle in a supermarket

**Characters:** four girls, two boys, two women, all racially integrated

**Action:** A girl is pushing a basket. A boy is standing by the basket. Boxes are falling from the shelf that he is touching. The women are looking at the shelf. The other four children are in various positions by the fruit and vegetable counter.

**Picture 2**

**Setting:** plain blue background, a basket is in the foreground

**Characters:** two girls and one boy, racially integrated; three cats

**Action:** Each child is holding a cat in a different position. One of the girls is kneeling beside the basket and has one hand outstretched in the basket. The other two are standing.

**Picture 3**

**Setting:** outdoors, lawn chairs are in the foreground and a trailer is partially visible in the background
Characters: a bird, a young child and a man, both white,
The man is in the background.

Action: The bird is on one of the lawn chairs. The child
has one hand out toward the bird and the other is touching
the lower face. The man is sitting down, looking toward
the child.

Picture 4

Setting: outdoors, two boxes, each with a doll are in the
foreground, a wagon is in the background.

Characters: three children, one boy and two girls, all
black

Action: One girl is holding a string attached to a box.
The other girl is touching a doll in the second box. The
boy is kneeling by the second box holding a string in one
hand and touching the box with the other hand.

Story 1

"Angus and the Ducks" by Marjorie Flack as it appears
in May Hill Arbuthnot, ed. The Arbuthnot Anthology of
Children's Literature. (Fair Lawn, N. J.: Scott, Foresman

Story 2

Story Number 1 from Screening Tests For Identifying
Children with Specific Language Disability by Beth H.
Slingerland. (Cambridge, Massachusetts: Educators
TEST OF ORAL COMMUNICATION SKILLS

Directions for Administering

Part A: Transmitting Skills

Select a place for the test which is relatively free from distraction. Have available the 4 stimulus pictures, the 2 stimulus stories, and an audio tape recorder, ready to record. Have the child be seated in a relaxed and comfortable way. Turn on the tape recorder. Open the conversation and establish rapport by using any or all of the following questions (or other appropriate ones). Call the child by name during the interview, but identify him by number for rating purposes.

Questions:

- Do you have any brothers or sisters? Tell me about them.

- What kind of games do you like to play?

- Are there any television programs you like to watch? Why do you like this program?

- Who are some of your special friends?

When it appears the student is ready, move into presenting the pictures to the student with some remark such as, "Today I have something special for you to do. I would like for you to look at some pictures and to tell me some things about them."

Present picture 1. After 5 seconds ask the child

1. What do you see in this picture? (Wait 5 seconds for a reply and 5 seconds at the conclusion of the stu
dent's remark to give time for any additional ideas. If the child responds with a shrug or "I don't know" to a question, proceed immediately to the encouraging remark. If the same behavior occurs here, wait 5 seconds then go on to the next question or the next section of the test.)

*Encouraging remark: (Use if the child has not answered question 1 or if the answer could be expanded.) Do you see anything else? (Wait 5 seconds unless the answer is a definite negative.)

2. What do you think about what you see in the picture? (Wait 5 seconds for response and 5 seconds at the conclusion of the remark unless it is a definite negative.)

*Encouraging remark: (If needed) What is happening in the picture? (Wait 5 seconds for response and 5 seconds at the conclusion of the remark unless it is a definite negative.)

3. What is a box? (Wait 5 seconds for a response and 5 seconds at the conclusion of the remark. If the child does not respond orally, but points to the pictured object, orally acknowledge that he has done so.) Praise the child on his responses.

Picture 2 - Follow the same procedure as for picture 1 on questions 1 and 2.

3. What is a basket? (Wait 5 seconds for response and 5 seconds at the conclusion of remark for added ideas.)

Picture 3 - Follow the directions as for picture 1
on questions 1 and 2.

3. What is a chair? (Wait 5 seconds for response and 5 seconds at the conclusion for added ideas.)

Picture 4 - Follow the same procedure as for picture 1 on questions 1 and 2.

3. What is a wagon? (Wait 5 seconds for response and 5 seconds at the conclusion of child's remark.)

NOTE: Encouragement should be given to the child throughout the interview.

Part B: Receiving Skills

After praising his efforts on the pictures say, "Now I am going to tell you some stories. Listen carefully, because I will ask you some things about these stories." Tell the child story 1. Then ask the following questions:

1. What was the story about? (Wait 5 seconds for a reply and 5 seconds at the end of the child's remark.)

   *Encouraging remark: What was in the story? (Wait 5 seconds.)

2. What happened to (characters named) in the story? (Wait 5 seconds.)

   *Encouraging remark: Anything else happen? (Wait 5 seconds.)

3. What was the best part of the story? (Wait 5 seconds.) Praise the child for his work.
Story 2 - Follow the same procedure as in story 1.

Directions for Rating Conversation

Only those remarks which are audible and understandable are to be rated. Children responding before the questions are asked are to be rated as having answered question 1 if they describe what is in the picture and/or question 2 if they give their interpretation of the picture. If there is no clear category for the rating, use the category just below the evaluated response.

Compound sentences count as two sentences with the conjunction. Each sentence is counted as one response; groups of words or phrases count as a single response, unless divided by a sentence. The definition is not counted as part of the response but is rated by itself. If the child's behavior on any item is below that identified by the level 1, consider his level of performance on this particular item to be 0.
SCALE FOR LEVELS OF ORAL COMMUNICATION ABILITY

A. TRANSMITTING SKILLS

1. Language output and expressiveness

level 1  The child responds to the first question only. He is unable to produce any more even when encouraged.

level 2  The child responds with one or two spontaneous remarks to the first question. After encouragement he may come forth with a single remark and cannot be persuaded to say any more. He does not respond to either part of the second question.

level 3  The child responds with one or more spontaneous remarks to the first question and may or may not respond to encouragement to this question. He responds to either the second question or its encouraging remark.

level 4  The child responds to each question without hesitation or added encouragement.

level 5  The child responds to each as in 3 or 4, but he includes the examiner in the conversation by asking for the examiner's ideas or opinions.

2. Vocabulary

level 1  The child uses few different words, consisting of one or two syllables. The words used are primarily simple nouns and verbs. And is used to connect these words.

level 2  The child has a limited number of words which he must repeat to express his ideas. He hesitates or stumbles when he is not sure of the word. These words are simple one-syllable and common two-syllable words: nouns, verbs, descriptive adjectives and adverbs, and the conjunction and.

level 3  The child has a sufficient variety of words to express himself without hesitation. He uses one and two syllable words; nouns, verbs, adjectives, adverbs, and conjunctions other than and.
level 4 The child has command of many and varied words; one, two, and three syllables. He uses all classes of words with ease and makes use of synonyms for nouns and adjectives.

level 5 The child has a command of many and varied words. He uses multi-syllable words equally as well as mono-syllable words. He uses all words with ease, and unusual descriptive phrases are part of his speech.

3. General meaning and ideas

level 1 The child merely names or enumerates objects in the picture.

level 2 The child not only names the objects, but describes a quality of one or more of the objects or an action taking place in the picture.

level 4 The child infers what has happened before the pictured event or what the outcome will be. He gives at least two steps of a time sequence.

level 5 The child evaluates in terms of a generality or draws a conclusion about the event in the picture.

4. Sentence structure

level 1 The child speaks over 50% of the time is isolated words or phrases. These may be strung together with and.

level 2 A minimum of 50% of the replies are simple sentences with one subject and one verb. These may be joined with and.

level 3 More than 50% of the responses are simple sentences with compound subject, predicate, and/or object.

level 4 More than 50% of the responses are compound sentences containing a conjunction other than and, or complex sentences containing one dependent clause.

level 5 The child responds in sentences of which 50% minimum contain more than one dependent clause.
5. Defining words

level 1  The child is unable either to point to the correct object in the picture or to define the word.

level 2  The child is able to point to the correct object in the picture, but cannot define the word.

level 3  The child defines the words by stating the use of the object.

level 4  The child defines the word by describing an observable property or properties of the object.

level 5  The child defines the word by giving the generic term or class to which the object belongs.

6. Average length of sentences

level 1  Over 50% of the responses are isolated phrases.

level 2  At least 50% of the responses are sentences. The sentences average 2-5 words.

level 3  Same as level 2 except average length is 5 or more words.

level 4  Over 90% of the responses are sentences averaging 3 to 8 words.

level 5  Same as 4, except sentences are longer than an average of 8 words.

B. RECEIVING SKILLS

1. Listening behavior

level 1  The child is easily distracted by the surroundings. He ignores what is being said and cannot repeat any of the story.

level 2  The child half-listens, frequently moving about. He interrupts with his own ideas and cannot repeat any of the story except as it relates to him.
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level 3 The child appears to listen closely, but shows little or no reaction to the story. He is able to repeat the content of the story.

level 4 The child listens to the story and his responses not only repeat the content of the story, but include personal experiences or ideas that the story has brought to mind.

level 5 The child listens intently. He responds to the story with ideas and interpretations beyond the content. He asks questions or offers comments about the story to extend the content.

2. Listening comprehension

level 1 The child is unable to identify characters or setting or to outline the plot.

level 2 The child is able to identify the characters and/or the setting but cannot relate any of the plot.

level 3 The child is able to identify characters and/or setting and to give one item of the plot of the story.

level 4 The child is able to identify characters and setting and to give at least two steps of sequence of the plot.

level 5 The child is able to do 3 and 4 but also describe feelings or emotional involvement of the characters.
Phase one of the pilot study was conducted during October, 1970 for the following purposes:

1. To select the stimulus stories and pictures for the Test of Oral Communication Skills.
2. To refine the technique for use of the instrument with kindergarten children.
3. To refine the structure of the test instrument and the rating scale.
4. To establish validity and reliability for the instrument.

The first step of the study was conducted with kindergarten children in an inner-city school which was classified as disadvantaged under the Title I, ESEA program. The names of the children enrolled in the kindergarten were arranged alphabetically and numbered. The Rand Table of Random Numbers was used to select 6 of these children for participation in the study using the pictures and stories selected from prior criteria. The results of this study were as follows:

1. It was found that the pictures using children as the central theme produced more response than those with either objects (such as flowers), animals, or adults.

2. It was found that pictures of a size about 8" by 11" or smaller could be more easily handled by children and were more stimulus producing. The large, poster size pictures were merely looked at and put aside by the children.

3. Pictures that had some familiar object in them produced more response than those with
uncommon objects, such as fishing tackle or a trampoline.

4. Pictures with not more than 5 central objects produced more response than did those containing more than 5 central objects.

5. Stories which dealt with more realistic plots and characters produced more response than fantasy.

6. Stories which could be told in 3 minutes or less produced more response than longer stories.

As a result of this phase of the pilot study, the four stimulus pictures and the two stimulus stories producing the most positive responses from the children were selected to be used in the study.

The second step of this pilot study was conducted simultaneously with the first. As the children were interviewed, the investigator analyzed the technique of administering the instrument to the children. The results were:

1. It was found that there needed to be a "warmup" period to lead into the testing dialogue. This was accomplished by asking questions about the child's siblings, television preferences, and favorite games. This let the child begin by talking about things in which he had an interest.

2. There was a need for guiding questions with both the pictures and the stories. The children seemed unsure of what was expected without these guidelines.

3. It was found that there needed to be a time for the child to think and to respond. A 5 second interval after each question and child's remark appeared to be an encouragement to talk more and to think about the question.

4. It was found that praise for the child on his
response regardless of the level of ability promoted a better response and a more relaxed, permissive atmosphere.

These findings were also incorporated into the structure of the instrument. The rating scale was refined to state as nearly as possible the behavior expected of the child at each level of development of the skills measured. The levels were defined according to the literature of child development in oral language skills.

The fourth step of the pilot study was for the purpose of establishing validity and reliability for the instrument. The first method used to establish validity was by use of judges' selection of a group which was then assumed to be a known group. The kindergarten teacher, her aide, and the principal of the school together selected the 4 highest and the 4 lowest students in oral communication skills in a kindergarten class. These 8 students were then administered the Test of Oral Communication Skills. One of the children selected at the low end of the scale had a speech impediment so severe that few words of his comments were understandable. It was necessary to discard his remarks for the purpose of evaluation. Of the 7 children remaining, the test results for the identified high group showed a range of 57 to 87 with a mean of 77. The results for the identified low group had a range of 41 to 49 with a mean of 45. These results seem to indicate that the instrument had a discriminating power to separate the high
ability children from the low ability children. The results also indicate that the rating of the instrument did measure the skills in such a way that those whose ability was identified as high scored in the upper three levels, and those whose ability was identified as low scored in the lower three levels of the five levels of ability defined by the test.

A second study of the instrument was made with another kindergarten class in the same urban area but in a different school. The teacher selected 3 children whom she ranked 1, 2, 3 on verbal ability and the test was administered to them by the investigator. The test scores resulted in the children being ranked in the order predicted, a correlation of +1.00.

The test was readministered at a period 3 days later to the same group of 3 children by a different examiner. The ratings of child 2 and 3 were the same as those obtained by the investigator. However, child 1 differed to the extent that the ranking was 2, 1, 3 on the test results obtained by the second examiner. An examination of the typescript of the test interview shows that the second examiner used encouraging and leading questions beyond those specified by the directions for administering the instrument. The specified questions were answered with the same basic vocabulary and main ideas and with only a slight difference in sentence structure for both examiners. The
second examiner's overall rating of the 3 children was in 96% agreement with the ratings of the investigator.

The typescripts of the data obtained by the investigator of these same children were rated by a third rater and the results produced the same ranking order of the three students as those predicted by the teacher and obtained by the investigator.

A study of instrument reliability was made by re-administering the instrument to 4 of the 8 children previously tested at a period 10 to 12 days later. The results were that the children retested obtained scores which ranked in the same order as the first test scores, a correlation of +1.00. The children in the high group scores ranged from 85 to 93, mean = 89. The same results were obtained with those in the lower group, scores 40 to 42, mean = 41.

Investigator rating reliability was established by the method of a repeated rating by the investigator. The rating of 3 children was repeated 10 days later by the investigator without reference to the previous ratings. The results show a 98% agreement on the ratings of each item between the first rating and the second rating by the investigator.

The sequential steps of the ratings were checked using a panel of 15 judges. The description of each item was placed on separate cards and the cards placed in
random order. The judges were then asked to rank the cards for each item in order of performance level from lowest to highest. The results were analyzed for the agreement of the judges with the investigator using Kendall's coefficient of concordance (Ferguson, 1966, p. 225). The results showed the lowest \( S = 1494 \), where critical value of \( S = 475.2 \) at the .01 level of confidence. All eight sub-tests were significant at > .01.

Phase Two

The data obtained from the pretest were analyzed as a further check on validity and reliability. As a check on the investigator's reliability in rating, a second rater was used. A sample of the test responses of 30 children was selected using the Rand Table of Random Numbers. These responses were rated by the second rater using the tapes and written transcripts obtained during the pretest. These results were correlated with those obtained by the investigator using the Pearson Product Moment Coefficient of Correlation. The correlation for Listening Behavior was lowest, at .4543, significant at the .05 level. The correlations on the other nine items measured by the test were significant at the .01 level.

Construct validity was tested by correlating each item with the total score to which it contributed. The Pearson Product Moment Coefficient of Correlation was used. The resulting correlation of the Defining Words
A subtest to the total test was .3705, significant at the .05 level. The remaining items correlated from .8248 to .9546, significant at the .01 level of confidence.

The Hoyt Analysis of Variance was used to obtain a reliability coefficient of .8956 for items - individuals variance.
APPENDIX C
**TABLE 24**
PRETEST: LANGUAGE OUTPUT AND EXPRESSIVENESS
SUMMARY TABLE FOR ANALYSIS OF VARIANCE

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>MS</th>
<th>Fa</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between</td>
<td>3</td>
<td>17.2552</td>
<td>2.6625</td>
</tr>
<tr>
<td>Within</td>
<td>96</td>
<td>6.4807</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>99</td>
<td></td>
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</tbody>
</table>

*a*Critical value of F at .05 level is 2.70.

**TABLE 25**
PRETEST: VOCABULARY
SUMMARY TABLE FOR ANALYSIS OF VARIANCE

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>MS</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between</td>
<td>3</td>
<td>10.0339</td>
<td>2.3844</td>
</tr>
<tr>
<td>Within</td>
<td>96</td>
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<td></td>
</tr>
<tr>
<td>Total</td>
<td>99</td>
<td></td>
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</tbody>
</table>

Critical value of F at .05 level is 2.70.
### TABLE 26

**PRETEST: GENERAL MEANING AND IDEAS**  
**SUMMARY TABLE FOR ANALYSIS OF VARIANCE**

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>MS</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between</td>
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<td>12.0403</td>
<td>1.4394</td>
</tr>
<tr>
<td>Within</td>
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<td>Total</td>
<td>99</td>
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</table>

Critical value of F at .05 level is 2.70.

### TABLE 27

**PRETEST: SENTENCE STRUCTURE**  
**SUMMARY TABLE FOR ANALYSIS OF VARIANCE**

<table>
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<tr>
<th>Source</th>
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<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between</td>
<td>3</td>
<td>10.7842</td>
<td>1.6860</td>
</tr>
<tr>
<td>Within</td>
<td>96</td>
<td>6.3964</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>99</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Critical value of F at .05 level is 2.70.
### TABLE 28
PRETEST: DEFINING WORDS
SUMMARY TABLE FOR ANALYSIS OF VARIANCE

<table>
<thead>
<tr>
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<th>F</th>
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</thead>
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<tr>
<td>Between</td>
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<td>Within</td>
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</table>

Critical value of F at .05 level is 2.70.

### TABLE 29
PRETEST: AVERAGE LENGTH OF SENTENCES
SUMMARY TABLE FOR ANALYSIS OF VARIANCE

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</tr>
</thead>
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<tr>
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<td>1.5243</td>
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<tr>
<td>Within</td>
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<tr>
<td>Total</td>
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</tr>
</tbody>
</table>

Critical value of F at .05 level is 2.70.
### TABLE 30

**PRETEST: LISTENING BEHAVIOR
SUMMARY TABLE FOR ANALYSIS OF VARIANCE**

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<tr>
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<th>MS</th>
<th>F</th>
</tr>
</thead>
<tbody>
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<td>0.5980</td>
</tr>
<tr>
<td>Within</td>
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</tr>
<tr>
<td>Total</td>
<td>99</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Critical value of F at .05 level is 2.70.

### TABLE 31

**PRETEST: LISTENING COMPREHENSION
SUMMARY TABLE FOR ANALYSIS OF VARIANCE**

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>MS</th>
<th>F</th>
</tr>
</thead>
<tbody>
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<td>1.7755</td>
<td>0.5717</td>
</tr>
<tr>
<td>Within</td>
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</tr>
<tr>
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</tr>
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</table>

Critical value of F at .05 level is 2.70.
Experimental Group
Classifying 1
Lesson 1

Objectives
At the end of this exercise the child should be able to construct and demonstrate the use of a classification of the objects according to variations in a single characteristic which has been specified by someone else.

Materials
Assorted loose nuts: walnuts, peanuts, and almonds
A set of three cards for each group of 3 or 4 children with one each of the above nuts glued in the center.

Procedure
Arrange the children in groups of two or three children per group. Place a handful of nuts before each group. Hold up a walnut and ask the children to find a nut like that from their pile of nuts. Ask them to describe the walnut. Secure as many descriptions as possible. Do the same for the other two types of nuts. If the children do not bring up the differences between the three kinds of nuts, use questions that will do so, such as: Are these nuts alike in any way? How are these nuts
different from each other? Pass out the cards with the nuts glued to them. Tell the children to work together in their groups and to put all their nuts with the cards that have the same kind of nuts.

**Evaluation**

Observe the children as they work in groups to see if they are able to place the nuts in the proper places. Ask them why certain nuts are placed in the particular places to determine if they have the concept of likenesses and differences needed to classify. Assist those having difficulty by questioning them about the nuts improperly placed.

**Experimental Group**

**Classifying 1**

**Lesson 2**

**Objectives**

At the end of this lesson the child should be able to construct and demonstrate the use of a classification of the objects according to variations in a single characteristic which he has chosen, and to describe the characteristic he chose for his method of classification.
Materials

Assorted nuts: walnuts, filberts, peanuts, Brazil nuts, pecans, and almonds.

Procedure

Discuss the shapes of the various kinds of nuts. Have the class suggest groupings according to shape. Let each group sort the nuts according to shape. Check with each group as they work on sorting. When all have completed successfully this activity, suggest that they now sort the nuts in a different way into groups. When completed, let the groups describe how they sorted their nuts for the class.

Evaluation

Observe the groups as they classify and as they report to determine if the objective has been met.

Control Group
Activities on Air
Lesson 1

Objectives

At the end of this lesson the children should be able to express that air is all around us.
Materials

- a paper tissue
- a bowl of water
- paper sack
- a drinking glass

Procedure

Show the children the tissue. Place it in the glass and ask the children what would happen if you put the glass in the bowl of water. After ideas are given, place the glass upside down in the bowl and then remove it. Remove the tissue and shake it out. Ask what happened. Is that what you thought would happen? Ask the class if they have any ideas why the tissue did not get wet. Lead to the idea that the air kept the water from touching the tissue. Repeat, only this time tell them to listen carefully. Tilt the glass so that the air escapes and the tissue becomes wet. Ask the class about the noise they heard.

Hold up the paper sack in a closed position. Ask what is it it. Swish the sack through the air. Ask what is in it now. Ask the children to identify places where there is air.

Evaluation

Check the responses of the last item. Determine if the concept that air is present all around us had been achieved.
Control Group
Activities on Air
Lesson 2

Objectives
At the end of this lesson the children should be able to express that air can lift things and that moving air can dry up water faster than still air.

Materials
- paper sack
- cloth to wet board
- heavy book
- paper to fan the board
- long strip of newspaper

Procedure
Ask the children what they know about air. If they do not mention that air can lift things, ask if air can pick up objects. Hold up the strip of paper. Ask if air can lift the paper. Hold the paper over the heater and observe the results. Then hold up the heavy book and ask if air can lift it. Place the book on top of the paper sack and blow into the sack. Ask the children what happened. Ask what lifted the book. Name other things that air can lift.

Wet the board in two spots and ask how one can be dried faster than the other. Have one child fan one spot while the other dries normally. Ask the children which
one dried faster and why they think it did.

**Evaluation**

Observe the remarks of the children in response to the questions asked. Determine if they have the concept that air can lift things and that moving air dries up water faster than still air.
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