DEVELOPMENT OF A MULTI-MEDIA LEARNING ENVIRONMENT FOR YOUNG CHILDREN

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DEVELOPMENT OF A MULTI-MEDIA LEARNING

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CHAPTER I

THE PROBLEM AND ITS IMPORTANCE

Early childhood, the years from two to six, is a very important period for intellectual development of the child. During the years from two to six, children can acquire and learn to process information. Both the information and the processes which are learned are basic to future intellectual development of children. Within the last decade, researchers have been increasingly concerned with the results of a child's encounter with his environment and how these experiences are related to intellectual development. Attempts are being made to apply such research findings to the planning of educational programs. Until 1950, the empirical study of children's learning had been neglected by researchers (Spiker, 1960). Educators, as well as researchers, are becoming more concerned with discovering how young children learn. If a child's future intellectual development is seriously influenced by the experiences he has before age six (Hunt, 1969; Almy, 1964), what indeed are the conditions which can foster learning most effectively in young children?

Children grow and learn at different rates and in different ways. Torkelson (1967) indicates that there is a persistent problem in the classroom of meeting the needs of individual learners in group situations. Foltz (1961) reports a survey showing that the average elementary school pupil is actively engaged or interested in classroom

activity only twenty percent of the time. Robison and Spodek (1965) aver that there is great need for research which would suggest means of encouraging conceptual development for five-year-olds.

Recent research has provided some indication of the effectiveness of programmed instruction in meeting individual needs and providing cognitive stimulation. Programming is basically a "planned sequence of experiences, leading to proficiency, in terms of stimulus-response relationships" according to Espich and Williams (1967). Some workers in the field of child development and early childhood education have felt that programming was basically unsuited to use with young children (Stone and Church, 1968); however, several investigators have reported successful results from the use of certain techniques of programming in specific situations. Moore (1966) helped two- and three-year-old children learn to touch type with the aid of a programmed computerized typewriter. McDowell (1968) taught kindergarten children fourteen selected vocabulary words through the use of programmed instruction. Birch (1963) programmed instruction in written language for ten-year-old deaf children. Although programmed instruction has been used on elementary, secondary and college levels of education, very little research on programmed instruction has been aimed at the preschool child. Most programmed instruction materials have been based on written symbols; thus limiting usefulness for learners with little or no reading vocabulary. The commercial materials currently available were not designed for and generally are not appropriate for use with preschool children. It has been suggested (Miller, 1968) that teachers design and produce multimedia materials to accompany the planned curriculum for a particular group of children. The purposes of this study are to design and

construct a multi-media program appropriate for use with children who are kindergarten age or younger and to develop an evaluative instrument for measuring the effectiveness of the program.

More specifically, the investigator proposes to:

1. Design and construct an automated viewing booth which would appeal to young children and would provide a learning environment in which multi-media programs could be presented.

2. To produce and develop a programmed film sequence and accompanying tapes containing key concepts in a selected subject.

3. To develop an evaluative instrument for measuring the learning of the selected concepts through the use of the film sequence in the automated booth and to establish validity and reliability measurements on the instrument.

Hypotheses related to the reliability of the evaluative instrument are:

1. There will be no significant correlation between ranks on the initial test and the retest of the Programmed Sequence Achievement Gain Test.

2. There will be no significant correlation between the test items and the test as a whole on the Programmed Sequence Achievement Gain Test.

3. There will be no significant difference between the initial test and the retest scores of the Programmed Sequence Achievement Gain Test.

CHAPTER II

RELATED LITERATURE

Influence of Different Variables Upon Programmed Instruction

Several studies have been made in an attempt to determine the effects of selected variables upon programmed instruction. Moosally (1967) used kindergarten children to compare three temporal delays of reinforcement on the learning of associations and found no significant differences between acquisition, retention and transfer, and latency response upon learning, whereas Michael and Maccoby (1953) found substantial evidence for the importance of giving the learner knowledge of his results. Angell (1949) found that freshmen college students who were given immediate knowledge of their scores had significantly higher final examination scores. Similarly, Meyer (1960) concluded that eighth grade students receiving immediate confirmation of scores had significantly higher achievement.

Presence of peers has been used as a variable in studies of programmed instruction. Price (1967) indicates that kindergarten subjects who worked under pressure from peers or with non-interacting peers did not have significantly higher post-test scores during the training session than did those who worked alone. Travers (1966) found that working alone is by far the most efficient way of programming instruction for sixth graders as compared to paired pupils working together.

Sequencing and pacing are two variables that have lent themselves well to instruction of programmed materials and its flexibility. Kress (1967) concludes that the best performance of sixth graders resulted when they were allowed to adapt to their own pace.

Corsini et al. (1969) used both pictures and words as variables in programming and found that preschool children remembered the pictures better than words in recognition memory tasks. According to May and Lumsdaine (1958) in paired associate learning of verbal responses, pictorial representations of objects make better stimulus terms than printed words naming the objects. May and Lumsdaine (1958) also found that printed words are better than pictures as response items in programmed instruction. DeCecco (1964) studied the relative effectiveness of overt and covert responses of first and third graders and found that there was no advantage in overt responding over covert responding among young children.

In the classroom, the teacher often becomes a variable in the learning process. Boitz (1965) found that nonsupervised completion of a programmed textbook in algebra was less effective in terms of achievement than supervised programmed instruction in the college classroom. Ryan (1968) concluded that more effective student learning does take place in the fourth grade classroom when the teacher's role is well defined, the student's role is clear, and when the instructional material is organized.

Selected Concepts Used in Programmed Instruction

Concepts from various subject matter areas have been used in programmed instruction for children. Concepts related to reading and

language skills were some of the first materials used in programmed instruction for children. McNeil (1963) used oral and written forms for student responses in his study with kindergarten children and found that oral responding to stimulus questions was more effective for children with lower IQ scores. McNeil (1963) also found that kindergarten males learned significantly more than kindergarten females through programmed instruction. McDowell (1968) programmed fourteen vocabulary words for kindergarten children and found a significant improvement in the reading ability of the children. A study conducted by Porter (1962) found that spelling could be taught more efficiently by machine than by traditional methods. Fourth, fifth, and sixth grade pupils were taught a German vocabulary task by Travers (1966) and the results showed that the students learned the tasks more effectively alone than in groups. Two- and three-year-old children learned touch typing, sentence structure and spelling with the use of a programmed "Talking" typewriter in a project devised by Moore (1966).

Two unusual subject areas used in recent studies were centered around Japan. Studies of Chinese and Japanese culture were used to assess differences in twelfth grade students' learning abilities according to French (1968) and Japan's geography was used in Ryan's (1968) research with fourth grade children.

Science concepts have been used in several programmed sequences with children. Theofanis (1965) used principles of magnetism and electromagnetism with eighth grade students and found that intelligence is significantly related to the amount of material students learn from programmed instruction.

Suppes and Page (1962) have been able to teach highly sophisticated, mathematical notions in the first few grades. Keisler (1959) was able to explain the phenomenon of dew in terms of molecular attraction to first and second grade students with programmed instruction. Apter and Boorer (1968) presented problems in the geometry of area through a linear program to groups of four-, five-, six-, and seven-year-old children. The groups of seven-, six-, and five-year-old children learned significantly from the programmed instruction but the four-year-olds regarded the materials as a play stimulus, and showed no progress in understanding the concepts presented (Apter and Boorer, 1968).

Comparison of Traditional Instruction With Programmed Instruction

When the merits of programmed instruction are being critically evaluated, a comparison is often made with the advantages of traditional instruction. Smith (1963) found that programmed instruction compared with conventional instruction modified the test performance of fifth graders differently. Zabka (1963) supports the theory that adequately programmed courses would produce satisfactory performance factors when compared to traditional classroom presentation of the material in seventh and eighth grades. DeCecco (1964) used first- and third-graders with IQ scores between 68 and 132 to study the effect of questions and the effect of statements on programming. Results of this study showed no significant differences in the two types of programming as revealed by the scores of the children on achievement tests. Spagnoli (1965) concluded that programmed methods of teaching were as successful as the

conventional teaching methods with sixth grade students and that use of programmed instruction allowed teachers extra time to do other things in the classroom that were not possible when conventional methods were used. Clasen et al. (1969) used three- and five-year-old children from low income families as subjects in an intensive program based on language skills. Both groups of subjects in the study demonstrated superior progress during a short training period, and the advantage persisted over one year of kindergarten instruction.

Audio-Visual Effects Upon Programmed Learning

The single concept film has grown in importance as a supplementary teaching tool (Steen, 1967). Much research has been completed upon the use of audio-visual materials in learning situations.

Multi-sensory modalities of communication may be, under certain conditions, more effective for instructional purposes than single-sensory modality communication (Carpenter, 1953). Hively (1960) taught preschool children simple discrimination and matching tasks with the use of an associative discriminative teaching machine. Roshal (1960) tested a number of film devices and found that a subjective camera angle where the position of the camera angle is at eye level to the viewer, resulted in a more efficient transfer of learning. An evaluation of Project Discovery, a program which provided the use of audio-visual materials in the classroom, revealed that sixty-two percent of the teachers using the materials were able to teach subject matter that was previously unteachable (Burleson, 1968). Day and Beach (1950) in a review of the literature on auditory and visual presentation of educational materials concluded that a combination of auditory and visual

presentations was more effective than a single presentation of auditory media or visual media.

Effect of Programmed Instruction Upon Selected Samples of Children

Programmed instruction has caused learning in children with a variety of backgrounds and abilities. Programmed instruction has proved to be a feasible method of teaching deaf children to write (Birch, 1963). Briggs (1958) concluded that self-instructional methods are especially suitable for superior students when compared with students of equal potential using conventional methods of instruction. Sprigle (1967) found programmed instruction caused significant learning gains in culturally deprived five-year-olds when compared to traditional-trained groups. Programmed instruction has proved to be useful with retarded children (Stolurow, 1968; Gates, 1935). Snelbecker (1967) stated that programming of instruction reduces but does not eliminate the effects of individual ability and personality performance of the child. Experimental work reported by Lysaught (1963) indicated that programmed instruction was applicable at the preverbal level and in such areas as instruction of mentally retarded children.

Nature of Learning in Young Children

The lack of emphasis by researchers on the way children learn has been due to the difficulty encountered in developing appropriate methods and procedures for evaluating young children (Spiker, 1960). Several studies have provided some information on the nature of learning in young children.

Hymes (1968) pointed out that the challenge to good education was to find the content and the method of teaching that fit the young child. Wann, Dorn, and Liddle (1962) stated that concepts are fostered in young children by a process of seeing relationships, categorizing, discriminating and generalizing about those things which the child sees, hears, and feels in his environment. Suchman (1964) supported the theory that the ability of a child to understand and control his environment depends on how well he has conceptualized it. Hymes (1968) claimed that children under six learn at a slow pace and they repeat themselves often. However, children under six are curious and want to learn, and to do this, the child must set his own pace of learning (Hymes, 1968). Bruner (1966) suggested that sequencing of learning can be arranged to optimize the achievement of different objectives in the learning of young children. Bruner (1966) also found that success followed by a strong external reward would have the effect of producing the same kind of performance later in children. Waetjen (1964) found that novelty generally evoked approach behavior in young children with girls showing more rigid and less curious behavior in their approach to novel situations. Hymes (1968) claimed that words alone were not young children's best medium for learning.

The use of special learning booths in research studies with preschool children is limited. Moore (1966) developed the "Responsive Environment" project which was based on the assumption that learning should be exciting for children. Moore's learning environment consisted of a green prefabricated structure with six sound-proof booths equipped with programmed computerized typewriters and a chalkboard. Moore (1966) concentrated his programmed environment on various forms of language

instruction and found that the two- and three-year-old children in his project learned to touch type, spell and effectively use sentence patterns in poems and themes. Moore (1966) also found that the children used the booths consistently when given their choice to use the programmed materials.

Measurement of Young Children

The measurement of young children has proved to be a difficult process because the child's responses to test questions are limited both in written and verbalized forms. Many intelligence tests have been devised to measure the intelligence capabilities of children. There are, however, very few research articles available on tests developed to measure the knowledge of young children in specific subject areas. The investigator was not able to find any test constructed in the field of entomology for use with preschool children.

Achievement test forms have been used to some extent with the preschool child. Achievement tests, in general, appraise a pupil's educational growth and development and measure relative accomplishment in specified areas of work (Remmer, et al., 1965). Spiker (1960) further defined the objective of achievement testing as that of measuring the effects of a course of instruction under partially known and controlled conditions. Katz (1968) stated that the appropriateness of a particular test to a particular program depended upon the pupil population, curriculum, purpose of testing, and the use of test scores. The direction for an achievement test should be simple, concise and contain the necessary information for the student to respond correctly (Gronlund, 1968). Spiker (1960) found that a certain amount of flexibility in the

procedures of achievement testing was necessary with young children because of the possibility of refusal to do the task or the loss of interest in the task by the child. Suggested factors to consider in the construction of achievement tests were listed by Gronlund (1968), and Remmer, et al. (1965). An achievement test should: measure clearly defined learning outcomes; measure an adequate sample of the learning outcomes and subject matter; include the type of test items which are most appropriate for measuring derived learning outcomes; be designed to fit the uses of the results; and be made as reliable as possible and then be interpreted with caution.

Summary

Research findings indicate that immediate reinforcement of student responses in programmed materials has been effective in causing greater learning. Children work better alone than with peers in learning situations. Generally there has been no indication in the literature that overt responses from children are better than covert responses to stimulus materials. The teacher's role with programmed materials may serve as a learning variable in classrooms with young children. Programmed instruction has been an effective cause of learning in young children in various subject matters and disciplines. Male students learn more from programmed instruction than female students. Intelligence of students was related to the amount learned through programmed instruction. In studies comparing traditional and programmed instruction, the programmed instruction was found to be as effective as traditional presentation of materials with children. Multi-sensory methods of communication were more effective than single sensory methods of communication.

With the use of films and filmstrips, teachers were able to teach subjects who were previously unteachable. The research indicates that programmed instruction has been effective with the disadvantaged, deaf, mentally retarded and gifted child.

The research on the nature of learning of young children indicated that the methods of teaching young children should fit the learning mode of young children. Concepts are fostered in young children by seeing relationships, categorizing, generalizing and discriminating about the things in a child's environment. Research indicated that sequencing of learning could optimize achievement in young children. It was stated that children are basically curious and want to learn about the world around them, but they must do so at their own pace. Research indicated that children learn at a slow pace. Children need more than words to learn about their environment. Novelty evoked approach behavior in young children. Learning booths have been used to a limited degree in research with young children and have been effective in causing learning in two- and three-year-old children. There were no achievement tests available in the field of entomology for use with young children. The directions and procedures in achievement tests for young children should be concise, simple, and flexible. The achievement test should be constructed around specified learning outcomes; made reliable and valid as possible; and interpreted with caution.

CHAPTER III

DEVELOPMENT OF VIEWING BOOTH

Criteria for Automated Helicopter Booth

The general criteria for the automated booth's design and construction were suggested by a review of the current literature on the developmental needs of young children and by Moore's "Responsive Environment" project (Pines, 1966) through which two- and three-year-old children were taught to type and spell. The following specific criteria were selected by the investigator from a review of the literature: (1) The booth should be enticing and attractive to children in order to stimulate the children to use the educational materials; (2) The automated booth should allow for the children's physical needs of adequate space, comfort and safety; and should provide an opportunity for individual children to use the materials as well as for groups of children to use the materials in their play; (3) The mechanical operations inside the booth should be very simple so that the children can run the film unaided; (4) The booth should be of multiple use in a preschool program allowing for several different learning opportunities through the child's use of the booth; (5) The booth should allow for the child's autonomous activity to aid in the development of self-concept, decision-making and self-direction; (6) The booth should be of reasonable size and cost for use in a classroom setting; (7) The automated booth should be constructed of durable, lightweight and smooth-surfaced materials,

and (8) The booth should be constructed to allow a safe distance from seat to screen inside the cabin so the child may view the films without excessive eye strain.

Construction of Automated Booth

Description

The booth was constructed to suggest a small red helicopter in appearance, Appendix B. From the outside, the helicopter has a rounded, bubble-shaped front with a small rectangular tail section with a horizontal propeller. An open, rounded door section allows the only physical entrance to the helicopter cabin. The helicopter is supported by four small legs and two wheels under the front cabin of the helicopter which facilitate moving of the vehicle. The helicopter was constructed from molded fiberglass and supported in part by a wooden frame inside the fiberglass tail section. The outside was painted entirely in red enamel and the inside cabin was painted black with a white screen painted in the front inside section of the cabin for viewing the filmed materials. A vinyl padded seat, a control box with a speaker and a mock instrument panel are inside the helicopter. There is, also, a "stick-shift" lever protruding from the control box which serves as a control lever for both the films and sound.

Design Plans

Tentative plans for the automated booth were drawn up. Fiberglass was selected as the material for the booth because it is durable, smooth-surfaced, fire resistant, easy to form to desired shape, lightweight, and comparatively inexpensive. The material and cost list for

the helicopter booth is in Appendix C. After deciding upon the materials to be used in the construction, the final plans for the booth were completed. The working plans for the automated booth are in Appendix F.

Actual Construction

The actual construction of the booth proceeded in four steps. The first step involved the tail section and the propeller. The frame for the tail section was constructed according to specifications of the plans. The form for the cabin section of the helicopter was made from a cardboard box and chicken wire. The form of the cabin was covered with paper maché for shape. The form was then covered with wheat plaster. The dried plaster form was sanded to smooth the edges and entire surface of the cabin to insure release of the fiberglass from the form. The small projector box which was to be connected on the back of the cabin section was constructed from a small cardboard box and fiberglass was applied to the box for strength. The plaster form and the tail section frame of the helicopter were fiberglassed about one-fourth inch thick. The cardboard and chicken-wire form was then removed from the fiberglass cabin.

The third step of the construction involved the floor and the furniture for the cabin of the helicopter. The floor was made from a single piece of three-fourth inch plywood. The furniture included a seat, control box, and the mock instrument panel. The furniture was constructed of a wooden frame and covered with black vinyl upholstery and two-inch foam rubber padding. The furniture was then secured to the floor, and the fiberglass cabin section was attached to the floor

section. The tail section of the helicopter was added to the floor section and connected to the helicopter cabin by corner braces. The plates for attaching the four support legs were bolted on and the two moving wheels were secured underneath the cabin. The fourth and last step of the construction involved the electrical wiring of the booth, the addition of the projector box to the cabin, and the painting of the helicopter. A special lead-free paint was used to paint the inside and outside of the entire helicopter booth.

Recommended Use of Booth

The booth was designed to be placed in a corner of a classroom near an electrical outlet with the door of the helicopter facing out from the wall in order to allow the children plenty of room to move in and out of the booth. The booth was designed to allow a child to either play with the helicopter or watch the films inside the booth. The control lever located at the immediate right hand of the child, is easily reached and manipulated by the child. The film and sound are started by pushing the control lever forward and pulling the lever backwards to turn the film and sound off. The projector lens is located over the child's right shoulder and is aimed at the front of the cabin. The tape recorder and projector are wired to the control lever to allow for simultaneous stopping and starting of the media. The helicopter is supported by four small legs which screw into metal sockets. To move the booth, the two front legs are removed and the booth is lifted by the propeller shaft and pushed forward. The booth can be easily moved by one person.

CHAPTER IV

DEVELOPMENT OF THE PROGRAM

The procedure for the development of the program consisted of the gathering of the factual information on entomology, stating the behavioral objectives for the children, selecting the methods for communicating the entomology concepts to the children and the forming of tests constructed to measure the learning of the children. The program was developed around selected concepts about the grasshopper, butterfly, cicada and dragonfly, for four- and five-year-old children from middle-class socioeconomic levels.

Criteria for Program

The general criteria for the development of the program were suggested by a review of the literature in Early Childhood Education and Educational Psychology and by consultation with specialists in the field of Early Childhood Education. The following specific criteria were selected by the investigator from the review of the literature: (1) The format of the program should take into consideration the different variables involved in programming instructional materials, i.e., student feedback, amount of information; (2) The program outline should be developed according to a modification of the methods being used in research with elementary school aged children; (3) The content selected for the program should contain information unfamiliar to most of the

children who will serve as subjects to use the experimental education materials; (4) The content should be prepared in a form which will be understood by preschool and kindergarten children; (5) The preparation of the program should include short sequences, material interesting to children, humor, and frequent use of related vocabulary; (6) The content of the program should deal with a subject the child can identify with or find in his environment in order to help the child better understand the world around him, and (7) The concepts presented should lend themselves to filming and demonstration through different media.

Preparation of Program

Programmed Instruction principles were used as a basis for organizing and developing the entomology program for this study. Task analysis, behavioral objectives, criterion tests, flow chart, and completed information frames were included in the preparation of this program. The Entomology program was developed from a modified linear pattern because the subjects' responses in the booth were covert and this program is in an experimental stage of development.

Statement of Purpose

The major purpose of the program was to develop an effective method of helping young children learn concepts in a selected subject area. A systematic and subject-analysis approach was used in the preparation of the materials.

Selection of Variables

The next step in the preparation of the program involved the

selection of variables in programming to be used. An extrinsic essentially linear programming approach was used in the sense that the development of the program proceeds in one direction with no branching. No intrinsic reinforcement was used in the program. Covert subjects' responses were stimulated by leading questions inserted in the sound sequence of the program. The amount of information used in the program was sized according to the nature of the concepts selected. Through the use of summary, repetition and the accuracy of the information presented, the investigator aimed at keeping error probability at a minimum. The pacing of the program will be twofold with the film lengths determining the speed at which the child can absorb the information, yet the child has the option to see the film as many times as he chooses. The frames of information will be translated to sequences of films.

Concept Selection

Concepts in entomology were chosen as a basis for the program. The following criteria were used to select the subject content: (1) interest of young children, (2) objective qualities of the information, (3) availability of resource materials and specialists in the field, and (4) the nature of the information in different media to be filmed. A resource unit was developed on entomology containing selected factual information for use with young children.

The selected concepts were submitted to the Head of the Department of Entomology, Oklahoma State University, for evaluation of the accuracy and importance of the concepts. The selected concepts were then submitted to the Director of the Child Development laboratories, for evaluation of the appropriateness of the entomology concepts in an early

childhood education program. The following five entomology concepts were chosen for use in the program: (1) all insects have six legs, (2) all insects have three main body parts, (3) there are many kinds of insects, (4) some insects change form, and (5) insects move in different ways. Four objectives were used to select the insects to illustrate the five entomology concepts: (a) some insects should be familiar to the children and some insects should be unfamiliar to the children; (b) the insects should be available for filming; the insects should clearly illustrate the five concepts; (c) the insects should be large enough to film; (d) and the insects should be of different colors and shapes. A general listing of possible insects was compiled and the following four insects were selected for the entomology program: butterfly, grasshopper, cicada and the dragonfly.

Selection of Behavioral Objectives

The general objective of the program was to present selected concepts in the field of entomology in such a way as to stimulate learning in the young child. Specific behavioral objectives of the program were to have the children: identify and categorize different insects, associate insects with their environments, verbally identify the three body parts of an insect, illustrate the movement of the grasshopper, dragonfly, cicada, and butterfly, assemble separated segments of an insect body into correct order, associate the adult stage of an insect with the same insect at an earlier stage of development, transfer their knowledge of metamorphosis of a familiar insect to the metamorphosis of an unfamiliar insect, recall information presented in the program by drawing an insect on a blank paper, identify harmful and helpful insects

in the environment, categorize the insects by placing the insect in the correct metamorphical stage of growth from the egg to adult, associate the earlier stages of the same adult insect, use the appropriate vocabulary when discussing insects and their growth during the test. The objectives were submitted to the Director of Child Development Laboratories and to the Head Department of Family Relations and Child Development for evaluation and on the basis of their recommendations, the behavioral objectives were accepted.

Selection of Criterion Tests

The criterion tests for each of the objectives of the entomology program were developed. The child will be able to: (1) identify and categorize seven insect pictures and seven animal pictures; (2) associate an insect with its appropriate environment when presented with three flannel board boxes with environmental scenes and four flannel figures of insects; verbally identify the three body parts of an insect when presented with styrofoam replicas of the three insect body parts; (3) demonstrate the movement of the grasshopper, dragonfly, cicada and the butterfly when presented with plastic replicas of the insects; (4) assemble the body parts of an insect when presented with three styrofoam replicas of the insect body parts; (5) associate the adult stage of an insect with the same insect at an earlier stage of development when presented a magnetic board with eight adult insects and eight young insects; (6) transfer knowledge of the metamorphosis of a familiar insect to an unfamiliar insect when presented with the magnetic board with eight insects; (7) recall information presented in the program by drawing an insect on a blank paper and including six legs and

the three body parts of an insect; (8) identify harmful and helpful insects by selecting the harmful insects and helpful insects from a pile of six different insects with three of the insects harmful and three helpful; (9) categorize insects by placing the insects in the correct metamorphical stage of growth when presented with four three-piece puzzles of the stages of growth of the butterfly, dragonfly, cicada and the grasshopper and the child assembles the puzzles two at a time; (10) associate the earlier stages of the same adult insect when presented with four three-piece puzzles, and (11) use the twenty preselected vocabulary words when discussing insects and their growth during the testing procedure. The criterion tests were submitted to two judges in the field of early childhood education for evaluation and comments.

Sequencing of Concepts

The following criteria were used to sequence the selected entomology concepts for the different insects: begin with easy concepts for the children and proceed to the most difficult concept; begin with concepts requiring simple mental processes and develop to the more complex mental processes; begin with the easiest and most realistic concepts to illustrate in the media and end with the more abstract and less realistic illustrations; begin with the specific concepts and proceed to the larger more generalized concepts. The sequence of concepts for the program are listed in the Master Film Chart in Appendix H.

Identification of Materials for Film

The last step in the preparation of the program was the listing of the film shots needed to illustrate the five concepts. The sound script

was tentatively outlined to serve as an indicator of the time length needed for individual sequences in the filming. The Master Film Chart and the Sound Script are in Appendixes G and H.

Judging of Entomology Program

When the foregoing steps were completed, the Entomology Program was submitted to the two specialists in the field of Early Childhood Education for evaluation. Two specialists judged the program in terms of the appropriateness and difficulty of the program for young children, the content selection for use in the Child Development laboratories, and the interest of the children in the program. The program was accepted by the two judges as an appropriate presentation of information for young children.

Production of Audio-Visual Materials

The production of the audio-visual materials consisted of the preparation of the films and sound recordings to be used in the program. The general selection of the criteria for the program production were suggested by a review of the literature and current research on audio-visual techniques.

Criteria for Production of Audio-Visual Materials

The following specific criteria were selected by the investigator from a review of the literature: (1) The film sequences should allow for the short attention span of young children; (2) The film should be illustrated simply and accurately; (3) The film sequences should be colorful and attractive; (4) The length of the films should be long

enough for adequate comprehension of the information; (5) The films should be compact and easy to identify and operate; (6) The film sequence should be developed logically from the child's viewpoint; (7) The sound production should be clear with adequate and varied voice modulations; (8) The sound production should consist of short and simple sentences; (9) The sound production should present an accurate description and coverage of the concepts developed by the program; (10) The materials used in the sound production should be durable and of good reproduction quality.

Preparation of the Audio-Visual Materials

The media used to present the entomology program consisted of a super eight cartridge movie projector, four loop eight cartridge films on the cicada, butterfly, dragonfly, and the grasshopper. A Wollensak 3M Cassette portable tape recorder and four C-60 Cassette sound tapes were used for each film script.

A photographer specialized in the fields of Zoology and Entomology was consulted about the difficulty and reproduction problems in the film script and was employed for the photography of the study.

Photography

The shooting of the film sequences were divided into three main sections: (1) live insect and insect specimen shots, (2) flannel board shots, and (3) puppet and title shots. The live insect and specimen shots were filmed at the Oklahoma State University Entomology Museum. The background for all the specimen shots were four pieces of 9 x 12 inch yellow, green, blue and pink felt. The amount of footage used on

the different sequences was determined by the difficulty and quality of the shots, the difficulty of the concept being illustrated and the sound script. Although each sequence varied as to the length of film footage, the average sequences of moderate difficulty were filmed from six to eight seconds and sequences of greater difficulty were filmed from twelve to fifteen seconds.

The flannel board shots were accomplished with the use of a 3 x 4 foot red flannel board and flannel insects. The flannel shots were developed primarily to illustrate the metamorphical steps in insect growth and to show movement of the insects from the ground to the sky. The flannel insects and scenery were designed, patterned, and constructed from colored felt.

The last section of the filming involved the insect puppets, the puppet theater and the title shots for each of the four films. The puppets were selected for this program for their attraction for young children. The puppets were designed in the shape of a grasshopper, butterfly, cicada and dragonfly, patterned and constructed from colored felt. A small puppet theater was used as the background for the puppet shots. The title shots were completed with the aid of four pieces of 12 x 12 inch yellow illustration board and one-inch black, blocked letters.

Editing of Film Sequence

The editing of the film sequences was accomplished in three steps: categorizing film sequences, completing the Master Film Chart and the splicing of the film sequences together into the four insect films. Each of the reels of film were given a number and a detail record was

recorded of the subjects, concept and length of each sequence. The sequences were then cut into different segments and labeled. From the information recorded on the film sequences the Master Film Chart was completed. The Master Film Chart is in Appendix I. The last step in the editing of the films began with the splicing together of the cut sequences according to the outline on the Master Film Chart. Each of the films was critically evaluated for smooth transitions from concept to concept, length of time of each sequence, logical movement of the film, and the quality of the illustrations of the concepts. The films were then put into loop eight cartridges by the Oklahoma State University Audio-Visual Department. One copy of each film was made. Each film was four minutes long.

Addition of Sound to Film Sequence

The sound reproduction consisted of the four tapes to be used with the four insect films. The sound script was completed after the films had been spliced and put into the cartridges. A script was written for each of the four films and recorded. The sound scripts are in Appendix G.

Recommended Use of Audio-Visual Materials

The films and tapes were designed to be used as supplementary teaching aids in early childhood education programs. The materials were designed to be shown in the helicopter booth for a minimum of two days and a maximum of five days for each film. The four films can be shown consecutively for a two or three week period or they can be shown separately at different times according to the needs of the program. The

films and tapes were developed for easy loading in the projector and the tape recorder. The films should be inserted before the booth is to be used and removed when the booth is not in use. The film and tapes can be used without the aid of the helicopter booth. The films and tape can be stored in the control box inside the cabin of the helicopter.

Evaluation of Audio-Visual Materials and Booth

An evaluation was made of the durability of the booth and films and the children's use of the materials in an unstructured setting. The subjects were four- and five-year-old children attending an early childhood education program. The four-year-old children attended the morning session of the University Child Development Laboratory and the five-year-old children attended the afternoon session of the University Child Development Laboratory. Half of the subjects were boys and half were girls. The subjects numbered thirty-one and were assumed to be from middle class, white families since the subjects' parents were teachers and students at the University and business men in Stillwater.

The booth was put in the laboratory with the films and tapes assembled. The films were shown for a one-hour period, four days a week for two weeks. Each of the four films was shown two days. The children were told that they could use the booth and films in any way except that only one child could be in the booth when the films were running. The investigator kept a daily record of the number of times each child used the films and the way he used the booth in his play. An evaluation score sheet was used to record the data collected during the pilot study. The data from the pilot study were analyzed for patterns of behavior. A child was considered to be "playing with the booth" if he

were near the booth or on the booth and the films were not running. A child's behavior was recorded as "watching the films" only if he were inside the helicopter cabin and the films were running. For each time, each child watched from one minute to four minutes of film one response mark was recorded. If a child watched four minutes of one film and then watched one minute of the film again, two response marks were recorded for the child. The child could not be watching the films and playing with the booth at the same time during the scoring of the child's responses to the materials.

The frequency of "Viewing and Playing" behavior given in Table I represents a comparison of the use of the booth and films according to age and sex. The frequencies recorded were graphed to illustrate the behavioral patterns of the children during the first and second week of the pilot study. See Figure 1. The Response Frequency Chart revealed several patterns of the use of materials by the children. The five-year-old girls viewed the films more than any other group. The four-year-old boys used the booth more than the other groups. The data showed that the younger children tend to play with the booth and the older children tend to watch the films more. The boys as a group played with the booth more than the girls and the girls watched the films more. The films were viewed 187 times during a two-week period by thirty-one children, averaging six times per child. The booth was played with 90 times during the two-week period. The children averaged three encounters with the booth during the testing.

TABLE I

FREQUENCY OF "VIEWING AND PLAYING" BEHAVIOR IN THE USE OF THE HELICOPTER BOOTH AND ENTOMOLOGY FILMS

	Subjects								
	Four-Year-Olds			Five-Year-Olds			Total		
	Girls (N = 8)	Boys (N = 8)	Total (N = 16)	Girls (N = 8)	Boys (N = 7)	Total (N = 15)	Female (N = 16)	Male (N = 15)	Total (N = 31)
Viewing									
1st week	24	41	65	35	26	61	59	67	126
2nd week	13	10	23	22	16	38	35	26	61
Total	37	51	88	57	42	99	94	93	187
Playing									
1st week	12	23	35	10	6	16	22	29	51
2nd week	11	13	24	9	8	17	20	21	41
Total	23	36	59	19	14	31	42	50	92

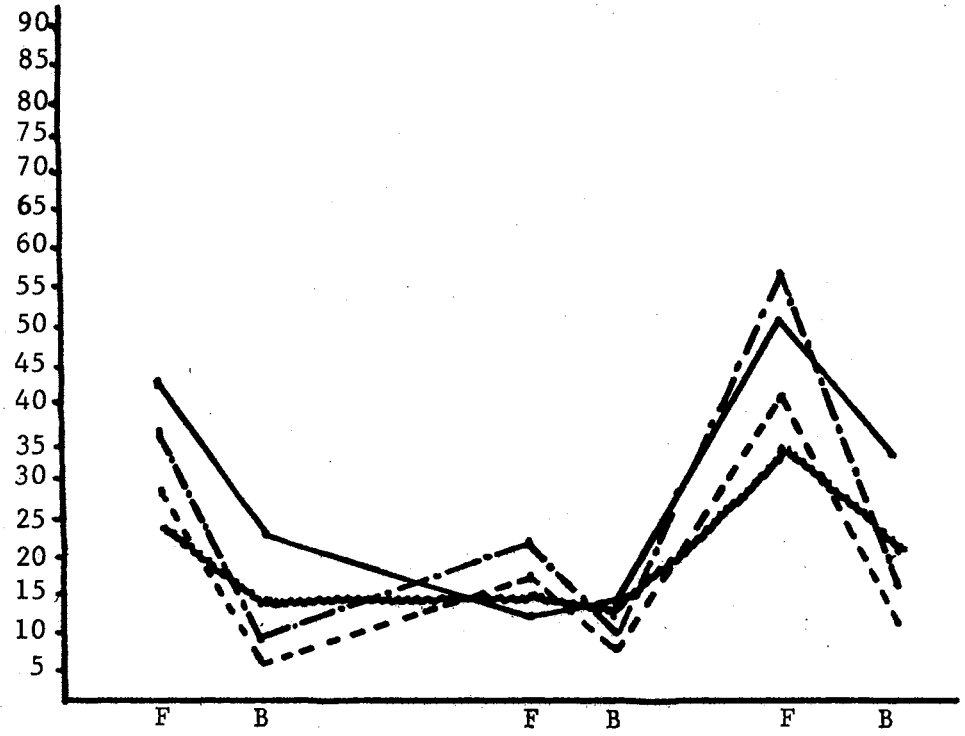


Figure 1. Comparison of the Frequency of "Viewing and Playing" Behavior in the Use of the Helicopter Booth and Entomology Films

CHAPTER V

DEVELOPMENT OF THE INSTRUMENT: PROGRAMMED SEQUENCE ACHIEVEMENT GAIN TEST

The following section will describe the development of the Programmed Sequence Achievement Gain Test for Entomology, hereafter referred to as PSAGT. The PSAGT is an instrument designed to measure knowledge of normal, middle class four-, five-, and six-year-old children on selected concepts in entomology.

Criteria for Instrument

The general criteria for the development of the instrument (PSAGT) were suggested by the literature, by specialists in the field of Early Childhood Education, and from current research on evaluative techniques for young children. The following specific criteria were selected by the investigator from a review of the literature: (1) The instrument should be an effective measure of the children's knowledge in a specified subject area; (2) The length of the instrument should allow for the short attention span of young children; (3) The instrument should be interesting and relevant to young children; (4) The instrument should offer a variety of tasks and opportunity for vocabulary usage; (5) The instrument should allow for different measures of evaluation of each of the test objectives; (6) The instrument should be of sufficient length to provide for a reliable instrument; (7) The directions for the

instrument should be simple and easy for young children to understand; (8) The instrument should be evaluated and revised to meet acceptable validity and reliability standards; (9) The testing materials should be simple, durable and easy for the children to handle; (10) The testing materials should be inexpensive and easy to reproduce; (11) The test items in the instrument should be sequenced from less difficult non-verbal items to more complex verbal responses from the child; (12) The test items should be difficult enough to discriminate learning differences in children; (13) The testing materials should be colorful and attractive; (14) The instrument should be simple to administer and score, and (15) The instrument should be an achievement test based on the construction principles of preparing achievement tests.

Construction of the Instrument

The PSAGT is an achievement test based on the completion of a series of short simple tasks in the field of entomology. The PSAGT was developed specifically to evaluate the knowledge of young children in the area of entomology with reference to five selected concepts. The five concepts were: insects have six legs, insects have three main body parts, some insects are harmful and some insects are helpful, insects move in different ways, and some insects change form. The PSAGT is based on the sequential administration of seven games. The games are listed and identified in the PSAGT Test Description and Procedure Booklet in Appendix A. A portable tape recorder was used to record the child's responses during the testing procedures. The PSAGT Score Sheet was divided into two sections: the information heading and the scoring boxes. The information heading contained the child's name, the school,

the date of the test and the examiner's name. The score boxes were used to record the child's responses to the test items.

Purposes

The general purposes of the PSAGT were to evaluate the knowledge of young children of five basic entomology concepts; to serve as a basis for testing research hypotheses developed with regards to the experimental use of the educational materials; and to measure specifically the effective learning caused by the educational materials in young children.

Behavioral Objectives

The behavioral objectives of the PSAGT were based on a review of the literature, research on the learning processes of young children, and assistance from specialists in the field of Early Childhood Education. The behavioral objectives for the PSAGT are listed sequentially in the PSAGT Test Description and Procedure Booklet in Appendix A.

Criterion Tests

The criterion tests for the PSAGT are in Appendix A. The point distribution chart for the PSAGT was developed from the criterion test and is given in Appendix A. The criterion tests were grouped according to the similarity of objectives measured by the tests, similarity of testing materials used, and similarity in the directions for the tasks in the test items. The sequencing of the test items was based upon the difficulty of the tasks and directions, novelty of the task or material used in the testing, amount of verbal response required from the child,

length of time it would take a child to complete a task, and the logical transitions within the tasks. The criterion tests, and the point distribution chart were submitted to a special panel for evaluation.

Direction for Administration

The development of the PSAGT included the procedure outline, design of the score sheet and the construction of the testing materials. The procedures for the PSAGT were designed to be simple, short, and easy for young children to understand. The directions and procedures may be found in Appendix A. The testing materials were designed for each of the test item questions and constructed. The materials used in the testing procedure are outlined and described in Appendix E. The PSAGT Score Sheet was constructed and tested for ease and accuracy of scoring. The PSAGT Score Sheet may be found in Appendix A.

Judging the Test Items and Materials

The last step in the construction of the instrument involved an evaluation of the PSAGT test items and testing materials and the revisions suggested by the evaluation of the instrument. The PSAGT was evaluated by three specialists in the field of Early Childhood Education. Revisions suggested by judges may be found in Appendix A.

Establishment of Reliability and Validity

To establish the reliability, the PSAGT was presented to twenty-seven children attending either the University Day Care Center or a private day care center. Thirteen of the children were between the ages of three years, ten months and five years, zero months. Fourteen

of the children were between the ages of five years, three months and five years, eleven months. Half of the subjects were boys and half were girls. These children were also assumed to be from white, middle class families since the children's parents were teachers and students at the University or business men in Stillwater. The children had no apparent perceptual handicaps, visual or auditory. The PSAGT was administered to the thirteen children at the University Day Care Center by the investigator and to the children at the private day care center by another investigator during the Fall of 1970. During a one-week period each of the children was given the PSAGT. Seven days after the first testing the PSAGT was re-administered to the same children by the same examiner.

Statistical tests were used to analyze the three hypotheses of this study. Hypothesis I: there will be no significant correlation between the ranks of the initial test and retest of the PSAGT; Hypothesis II: there will be no significant correlation between the test items and the test as a whole of the PSAGT; and Hypothesis III: there will be no significant difference between the scores on the initial test and the retest. The reliability measures for the PSAGT were established during the Fall of 1970. The reliability of the PSAGT was based on a test-retest for internal consistency of the PSAGT. Whole forms of the PSAGT were used for the initial test and the retest during the pilot study.

Hypothesis I: there will be no significant correlation between the ranks of the initial test and the retest of the PSAGT was rejected at the .01 level. The Spearman Rank Correlation Coefficient Test was used to analyze the relationship of the ranks on the initial test and

the retest of the PSAGT. Using a one-tailed test, a positive correlation of .88 significant at the .01 level was found. The significance of the correlation indicated by the Spearman Rank that the test was consistent over a seven-day time period. The children had approximately the same scores on the retest as they had on the initial test.

Hypothesis II: there will be no significant correlation between the test items and the test as a whole was rejected. The Kuder-Richardson Formula 21 indicated a .76 correlation of the items with the test as a whole on the initial test and a .73 correlation of the items with the test as a whole on the retest. According to Gronlund (1968) a correlation between .60 and .80 would imply an acceptable reliability score for a test of this nature. The results of the Kuder-Richardson Test indicated that there was consistency with both the initial test and the retest of the PSAGT. Internal consistency within the two tests indicates that the test is composed of items related to the objectives they were designed to measure.

Hypothesis III: there will be no significant difference between the scores on the initial test and the retest of the PSAGT was retained. Wilcoxon Matched-Pairs Signed-Ranks Test was used to analyze the numerical difference between scores on the initial test and the retest. The Wilcoxon Test indicated that there was no significant difference between the two sets of scores using a one-tailed test for $N = 25$. The null hypothesis that there would be no significant difference between the ranks on the initial and the retest was retained with a T score of 107.5. The Wilcoxon score indicated that the PSAGT was a consistent measure of children's knowledge (Table II).

TABLE II

DISTRIBUTION OF THE RELIABILITY SCORES DERIVED FROM THE KUDER-RICHARDSON FORMULA 21, SPEARMAN RANK CORRELATION COEFFICIENT AND THE WILCOXON MATCHED-PAIRS SIGNED-RANKS TEST ON THE PSAGT (N = 27)

Tests	Subjects		
	Group 1 N = 13	Group 2 N = 14	Combined N = 27
Kuder-Richardson*			
Initial test	.77	.66	.76
Retest	.66	.75	.73
Spearman Rank Correlation Coeff.	.676 (.05)	.94 (.01)	.88 (.01)
Wilcoxon Matched-Pairs Signed-Ranks	T = 26 retained H_o	T = 21.0 rejected H_o (.025)	T = 107.5 retained H_o N = 25

( ) Indicates significance levels

*No significance levels were reported for the Kuder Richardson. Scores between .6 and .8 were accepted as reliable correlations of the items with the test as a whole.

One-tailed tests were used in all cases.

The content validity was established for the PSAGT during the Fall of 1970 at Oklahoma State University by the investigator. The following method was used to measure the validity of the PSAGT (Gronlund, 1968): identify the subject matter topics and behavioral outcomes to be measured, construct a table of specifications which outlines the sample of items to be used, and build the test around the table of specifications. The behavioral outcomes for the PSAGT are in the PSAGT Test Description and Procedure Booklet in Appendix A. The outline for the table of specifications was suggested by Gronlund (1968). Table III shows the table of specifications developed for the PSAGT. The purpose of the specification table was to reveal weaknesses in the PSAGT in the coverage of specific concepts and objectives. The specification table generally revealed that the PSAGT was an adequate test of the five selected concepts and that there was a variety of methods used to test each of the concepts. In Table IV may be found a content analysis chart which was devised by the investigator to further analyze the PSAGT for distribution of the test items because the table of specifications only concerned point distribution. A comparison was made of the different concepts measured by each test item, the percentage of test items in each section of the test and the total number of points in each section of the test. The chart revealed that there was a fairly even distribution of test items measuring each of the concepts. The vocabulary section of the test was the largest section with one-third of the points applying to that section.

TABLE III

TABLE OF SPECIFICATIONS: DISTRIBUTION OF SCORING POINTS ON TEST ITEM QUESTIONS ACCORDING TO CONTENT AREA AND BEHAVIORAL OUTCOMES OF THE PSAGT

CONTENT / OUTCOME	Six Legs	Three Body Parts	Kinds	Change	Movement	Total
Identify	0	3	16	0	6	25
Categorize	0	3	14	12	0	29
Vocabulary	2	12	20	6	0	40
Transfer	0	0	0	4	0	4
Associate	0	0	0	8	9	17
Recall	8	3	0	0	0	11
Total	10	21	50	30	15	126*

*Total possible points on PSAGT

TABLE IV

CONTENT ANALYSIS OF INDIVIDUAL TEST ITEMS IN THE PSAGT

Test Item	Concept*	Total Points	Point Percentage
Identity Group	1,2,3	18	14
Flannel Board	4	9	7
Insect Replica	2,4	12	10
Match Stages	5	8	6
Drawing	1,2	11	9
Environment	3	12	10
Puzzles	5	16	13
Tapes	1,2,3,4,5	40	33

*Concepts:
1. Insects have six legs.
2. There are three main body parts.
3. There are different kinds of insects.
4. Insects move in different ways.
5. Insects change forms.

An item analysis was made on the test items in the PSAGT to determine the quality of each individual test item. The Fisher Exact Probability Test was used to analyze the discriminatory power and difficulty of each of the test items in the PSAGT. The scores of the children were divided into thirds for the initial test and the retest. The upper third and the lower third were then compared with each group containing nine scores. If a test item discriminated significantly on both the initial test and the retest, the test item was accepted as a measure of children's learning. If the test item was significantly discriminatory on either the initial test or the retest, the test item was also accepted as a measure of children's learning. If the test item was not discriminatory on either the initial test or the retest, the test item was further analyzed for the percentage difficulty of the item. A summary of the findings related to item analysis may be found in Table V. From the item analysis, two of the eight sections of test items were further analyzed for difficulty. Test Item Five was a very difficult item for the children. The section involved drawing an insect on a blank paper. This test item was designed to show the children's learning of the concepts insects have six legs and three body parts. The investigator assumed that the children would not have this knowledge about insects and therefore, this test item would be a difficult item without the experience of the programmed films presenting the specific concepts. For this reason, the Test Item Five was left in the PSAGT in its original form. Section VI of the test items was also reviewed and new materials were designed to measure the children's knowledge of helpful and harmful insects and the old testing materials were discarded.

TABLE V

DISTRIBUTION OF DISCRIMINATION AND DIFFICULTY LEVELS OF THE PSAGT TEST ITEMS AS MEASURED BY THE FISHER EXACT PROBABILITY TEST

	Significance Level* of Discrimination		Percentage Difficulty**	
	Pretest	Post-Test	Pretest	Post-Test
Test Item				
1a	NS	.05	39	24
1b	.01	.01	45	61
1c	.05	NS	24	24
1T	.01	.01	61	50
2a	NS	NS	24	38
2b	.01	NS	61	5
2c	-	-	-	-
2d	-	-	-	-
2T	NS	.05	66	72
3a	NS	NS	72	83
3b	.01	.05	33	26
3c	.01	NS	44	83
3T	.01	NS	44	66
4a	NS	.05	33	72
4T	NS	.05	33	72
5a	NS	NS	77	88
5b	NS	NS	100	100
5c	NS	.05	38	24
5T	NS	.05	24	24
6a	NS	NS	38	38
6b	NS	NS	33	33
6c	NS	NS	77	83
7a	NS	NS	66	66
7b	.05	NS	61	66
7T	.05	NS	61	66
8a	.01	.05	50	38
8T	.01	.05	50	38

*Discriminatory power analyzed by The Fisher Exact Probability Test

NS Not significantly discriminatory

**Difficulty in percentage of those subjects who responded incorrectly

CHAPTER VI

SUMMARY AND RECOMMENDATIONS

The purpose of this study was to design and construct a multi-media program appropriate for use with young children and to develop an evaluative instrument to measure the effectiveness of the program with young children. A booth was constructed in the shape of a helicopter, four cartridge films on insects, four tapes were recorded, and a PSAG Test were made as a result of this study.

A helicopter booth was designed and constructed. The booth was tested and found to be durable and usable by children in an early childhood education program. At no time during the testing did the materials in any way prove faulty or need adjustment. The children had no problem in running the equipment. The four- and five-year-old children used the booth in a variety of ways. One major implication of the study was that the materials did serve as an attractive educational setting for the children. The girls as a group tended to be more interested in the films and the boys were more interested in playing with the booth. The younger children played with the booth more than the older children.

Entomology films and audio tapes were developed and produced. The films and tapes were tested and found to be durable over a three-month testing period. The films were attractive to the young children and the films were used twice as much as the booth was played with during

the testing.

The PSAG Test was developed and tested. The test was accepted as a valid and reliable instrument. Hypothesis I: there will be no significant correlation between the ranks on the initial test and the retest of the PSAGT was rejected at the .01 level of significance. Hypothesis II: there will be no significant correlation between test items and the test as a whole was rejected at an accepted level of significance (Gronlund, 1968). Hypothesis III: there will be no significant difference between the scores on the initial test and the retest of the PSAGT was retained. An item analysis was completed to further analyze the test items and the items were found to be discriminatory at the .01 level of significance.

Recommendations for Modifications

Several recommendations are suggested for further use and development of the materials:

1. The tapes used to record the sound portion of the program should be of good quality strength with a maximum time length of 120 minutes.

2. A moveable door should be made in the side of the booth where the control box is located in order to change the tapes easily and efficiently without disturbing the children using the booth.

3. The films should be revised by making the more difficult concepts sequences longer.

4. Other designs for booths may prove to be effective in similar programs with young children.

5. It is suggested that the films be seen for three- to five-day periods. However, the films should not be shown for long time periods without a break of a day or two or a week.

6. A variation of the types and subjects of the films should be used in the programs.

7. The booth and films are not limited to entomology concepts.

Recommendation for Research

Although the children used in the pilot study were middle class white children with no apparent perceptual handicaps, the materials may be of value in special education classes, with the disadvantaged, with slow learners, and with the mentally retarded. It is suggested that longitudinal studies be designed to follow the progress of the children who use the programmed materials at an early age to determine any long range effects on learning the programmed materials may have produced. The educational materials were designed for preschool and kindergarten children but this does not limit the use of these materials as supplementary aids in first and second grade science or math programs. In addition, the developed Entomology Program should meet the needs of several different types of children's programs: preschool programs such as day care nurseries and Head Start Centers where the children are varied and mixed in ages; slow readers or children who find it difficult to stay with materials for a long period of time; selected special education classes; and non-graded kindergarten and first grade classes where the children use the educational materials at their own pace.

Extensive testing and revising of the PSAGT is suggested. If new films are produced to be used with the helicopter booth and used in the manner outlined in this study, new versions of the PSAGT will have to be constructed and tested for reliability and validity. However, it is believed that the style of the PSAGT can be adapted to many different subject areas. The evaluation techniques of the PSAGT are basically task-oriented items and were easy to administer with young children. The helicopter booth has proved to be an attractive educational setting with young children. Data should be collected and compared to determine if the score on the PSAGT is correlated to the frequency of use of the materials by the children. Data should be collected on the scores of four- and five-year-old children to determine if there are any differences in the groups of children. If the children were put in a compulsory program in which the children had to use the materials in a specified manner, would their scores be the same when compared to a program allowing the free use of the materials? The helicopter booth should be used in studies to determine the effect of the unique design of the booth when compared to regular booths or tables with equipment on them.

The educational materials developed in this study are new and the testing completed on these items is limited. However, the preliminary tests have indicated that the materials are attractive to young children, are mechanically sound and functional in early childhood education programs, and have the potential to cause effective learning in young children.

A SELECTED BIBLIOGRAPHY

Almy, M. "New Views on Intellectual Development in Early Childhood Education." Intellectual Development: Another Look. Ed. A. H. Passow. Washington, D.C.: Association for Supervision and Curriculum Development, 1964, 12.

Anastasi, A. Testing Problems in Perspective. Washington, D.C.: American Council on Education, 1966.

Angell, G. W. "The Effect of Immediate Knowledge of Quiz Results on Final Examination Scores in Freshman Chemistry." Journal of Educational Research, XLII (1949), 391-394.

Apter, M. J. and D. Boorer. "Skinner, Piaget and Froebel: A Study of Programed Instruction With Young Children." Programed Learning and Educational Technology, V (1968), 164.

Birch, J. W. and E. R. Stuckless. "Programed Instruction in Written Language for Deaf." American Deaf, CVIII (1963), 317-336.

Boitz, W. "A Study of Supervised and Nonsupervised Programed Instruction in the University Setting." Journal of Educational Research, LVIII (1965), 208-211.

Briggs, L. T. "The Development and Appraisal of Specific Procedure for Superior Students." Dissertation Abstracts, XVIII (1958), 119.

Bruner, J. S. The Process of Education. Cambridge: Harvard University Press, 1960.

Bruner, J. S. Learning About Learning. Washington, D.C.: United States Department of Health, Education and Welfare, 1966, 194.

Burleson, D. L. Ed. "Wide Use of AV Materials Gets High Rating." Scholastic Teacher, XCII (May 9, 1968), 5.

Carpenter, C. R. "A Theoretical Orientation for Instructional Film Research." Audio-Visual Communication Review (Winter, 1953), 45.

Clasen, R. E., J. E. Spear, and M. P. Tomaso. "A Comparison of the Relative Effectiveness of Two Types of Preschool Compensatory Programming." Journal of Educational Research, LXII (1969), 401-405.

Corsini, D. A., K. A. Jacobus, and S. D. Leonard. "Recognition Memory of Preschool Children for Pictures and Words." Psychonomic Science, XVI (1969), 192-193.

Day, W. F. and B. R. Beach. A Survey of the Research Literature Comparing Visual and Auditory Presentations of Information. United States Air Force Technical Report Number 5921 (Wright Patterson Air Force Base, 1950).

DeCecco, J. P. Educational Technology: Readings in Programmed Instruction. New York: Holt, Rinehart and Winston Incorporated, 1964, 209-210.

Espich, J. E. and B. Williams. Developing Programed Instructional Materials. Palo Alto, California: Fearon Publishers, 1967, V.

Fine, B. Teaching Machines. New York: Sterling Publishing Company, 1962, 168.

Foltz, C. I. The World of Teaching Machines. Washington, D.C.: Electronics Teaching Laboratory, 1961.

French, H. "A Study of Differences in Student's Learning of Chinese and Japanese Culture Concepts Using Lecture and Intrinsically Programed Methods." Dissertation Abstracts, XXIX (1968), 1765.

Frost, J. L. Early Childhood Education Rediscovered. New York: Holt, Rinehart and Winston Incorporated, 1968, 8.

Gates, A. I. A Reading Vocabulary for the Primary Grades. New York: Columbia University Press, 1935.

Gronlund, N. E. Constructing Achievement Test. New Jersey: Prentice-Hall Incorporated, 1968.

Gronlund, N. E. Readings in Measurement and Evaluation. New York: Macmillan Company, 1968.

Hively, W. "An Exploratory Investigation of an Apparatus for Studying and Teaching Visual Discrimination Using Pre-School Children." In Teaching Machines and Programmed Learning. Ed. A. A. Lumsdaine. Washington, D.C.: National Education Association, 1960, 247.

Hunt, J. McV. Intelligence and Experience. New York: Ronald Press, 1969.

Hymes, J. L. Teaching the Child Under Six. Ohio: Charles E. Merrill Publishing Company, 1968.

Kanner, J. H., R. P. Runyon, and O. Desiderate. "Television As a Training and Education Medium." Audio-Visual Communication Review, III (Summer, 1955), 163-172.

Katz, M. "Selecting an Achievement Test: Principles and Procedures." In Readings in Measurement and Evaluation. Ed. N. E. Gronlund. New York: Macmillan Company, 1968.

Keislar, E. R. "The Development of Understanding in Arithmetic by a Teaching Machine." Journal of Educational Psychology, L (1959), 425-436.

Kress, G. C. "Effects of Pacing Mode and Administration Setting on Programmed Learning." Proceedings of the 74th Annual Convention of the American Psychological Association, 1967, 261-262.

Lumsdaine, A. A. and R. Glaser. Teaching Machines and Programed Learning. Washington, D.C.: National Education Association, 1960, 586.

Lysaught, J. P. and C. M. Williams. A Guide to Programmed Instruction. New York: John Wiley and Sons Incorporated, 1963.

Markle, S. M. Good Frames and Bad: A Grammar of Frame Writing. New York: John Wiley and Sons Incorporated, 1969.

May, M. A. and A. A. Lumsdaine. Learning From Films. New Haven: Yale University Press, 1958, 146.

McDowell, E. E. "Programed Method of Reading Instruction Use With Kindergarten Children." Psychological Record, XVIII (1968), 233-239.

McNeil, J. D. "Programed Instruction As a Research Tool in Reading: An Annotated Case." Journal of Programed Instruction, I (1963), 37-42.

Meager, R. F. Preparing Instructional Objectives. California: Fearon Publishers Incorporated, 1962.

Meyer, S. R. "A Program in Elementary Arithmetic: Present and Future." In Automatic Teaching: The State of the Art. Ed. E. H. Galanter. New York: John Wiley and Sons, 1959, 83-84.

Meyer, S. R. "Report on the Initial Test of a Junior High Vocabulary Program." In Teaching Machines and Programmed Learning. Ed. A. A. Lumsdaine. Washington, D.C.: National Education Association, 1960, 229-246.

Michael, D. N. and N. Maccoby. "Factors Influencing Verbal Learning From Films Under Conditions of Audience Participation." Journal of Experimental Psychology, XLVII (December, 1953), 411-418.

Miller, D. P. "Making Sound Filmstrips." English Journal, LVII (1968), 223-227.

Moore, O. K. "Talking Typewriter." In Revolution of Learning. Ed. M. Pines. New York: Harper and Row Publishers, 1966, 73-102.

Moosally, B. T. "Effects of Delayed Reinforcement in Programed Instruction With Kindergarten Children." Dissertation Abstracts, XXVIII (1967), 971.

Pines, M. Revolution in Learning. New York: Harper and Row Publishers, 1966.

Pines, M. "The Early Learner." McCall Magazine, XCV (1968), 74.

Porter, D. "A Critical Review of a Portion of the Literature on Teaching Devices." Harvard Educational Review, XXI (1964), 114-132.

Price, A. H. "The Effects of Subjects Response Mode and Peer Social Reinforcement on Children's Learning in Programed Instruction." Dissertation Abstracts, XXVIII (1967), 130-131.

Quackenbush, J. "How Effective Are the New Auto-Instructional Materials and Devices?" IRE Training on Education Number 4 (1964), 144-151.

Remmer, H. H., N. L. Gage, and J. F. Rummel. Practical Introduction to Measurement and Evaluation. New York: Harper and Row Publishing Company, 1965.

Robison, H. F. and B. Spodek. New Directions in the Kindergarten. New York: Teachers College Press, 1965, 162.

Roshal, S. M. "The Instructional Film." USAF-NRC Educational and Training Media: A Symposium. Ed. G. Finch. Washington, D.C.: National Academy of Science, 1960.

Ryan, F. L. "Teachers Inclusion in a Programmed Instructional Sequence Involving Social Studies Content." Journal of Educational Research, LXII (1968), 53.

Schramm, W. Programmed Instruction. Fund for the Advancement of Education, 1962, 27-55

Siegel, S. Nonparametric Statistics for the Behavioral Sciences. New York: McGraw-Hill Book Company, 1956.

Smith, L. M. "Programed Learning in Elementary School: An Experimental Study of Relationship Between Mental Abilities and Performance." Dissertation Abstracts, XXIII (1963), 4231.

Snelbecker, G. E. and R. C. Downer. "Note Concerning Individual Differences in Behavior on Programed Material." Psychological Reports, XXI (1967), 333-335.

Spagnoli, J. "An Experience With Programed Materials." Journal of Educational Research, LVIII (1965), 447-448.

Sprigle, H. A., V. Van DeRoit, and H. A. Van DeRoit. "Sequencial Learning Program for Preschool Children and an Evaluation of Its Effectiveness With Culturally Disadvantaged Children." Journal of Orthopsychiatry, XXXVII (1967), 332-333.

Speen, L. "Lansing Michigan 8mm Film Workshop." Scholastic Teacher (October 26, 1967), 8.

Spiker, C. C. "Research Methods in Children's Learning." In Handbook of Research Methods in Child Development. Ed. P. H. Mussen. New York: John Wiley and Sons Incorporated, 1960.

Stolurow, L. M. "Principles for Programed Learning Materials for Mentally Retarded Children." In Instructional Process and Media Innovation. Ed. R. A. Wiesgerber. Chicago: Rand McNally, 1968, 240.

Stolurow, L. M. "Teaching Machines and Special Education." An unpublished work. U. S. Office of Education Cooperative Research Program. University of Illinois, 1960.

Stone, L. J. and J. Church. Childhood and Adolescence: A Psychology of the Growing Person. New York: Random House, 1968.

Suchman, J. R. "The Child and the Inquiry Process." In Intellectual Development: Another Look. Ed. A. H. Passow. Washington, D.C.: Association for Supervision and Circulation, 1964.

Suppes, A. and B. Page. In Programed Instruction. Ed. W. Schramm. Fund for the Advancement of Education, 1962, 27.

Theofanis, J. C. "An Experimental Investigation of Two Methods of Programing the Principles of Magnetism and Electromagnetism." Dissertation Abstracts, XXV (1965), 7092.

Torkelson, G. M. "How Mechanized Should the Classroom Be?" National Education Association Journal (March, 1967), 28-30.

Travers, R. M. "Efficiency in Rote Learning Under Four Learning Conditions." Journal of Educational Research, LX (1966), 10-12.

Waetjen, W. B. "Curiosity and Exploration: Roles in Intellectual Development and Learning." In Intellectual Development: Another Look. Ed. A. H. Passow. Washington, D.C.: Association for Supervision and Circulation, 1964.

Wann, K. D., M. S. Dorn, and E. A. Liddle. Fostering Intellectual Development in Young Children. New York: Teachers College Press, 1962.

Weisgerber, R. A. Instructional Process and Media Innovation. Chicago: Rand McNally, 1968.

Womer, F. B. Basic Concepts in Testing. Boston: Houghton, Mifflin Company, 1968.

Zabka, R. "A Field Study of Contrasting Programed Instruction and the Traditional Classroom Presentation in Grades Seven and Eight." Dissertation Abstracts, XXIII (1963), 3263.

APPENDIX A

PROGRAMED SEQUENCE ACHIEVEMENT GAIN TEST-ENTOMOLOGY

Test Description and Procedure Booklet

I. Identity Grouping:

A. Objective: To have the children identify and categorize different insects.

B. Material Description: Fourteen 9 x 12 inch color pictures of the following seven insects (cicada, dragonfly, ants, firefly, bees, grasshoppers, and butterfly and the following seven animals (giraffe, fish, squirrel, turtle, rabbit, birds, and a hippopotamus).

C. Procedure:
1. Mix the cards randomly by shuffling.
2. Hold the cards in hand so that child can see the first card only.
3. Tell child: "I'll show you the cards one at a time and when you see an insect, tell me."
4. When the child responds, place the card at the back of the pile.
5. Ask the child to identify the grasshopper, dragonfly, cicada, and butterfly pictures.

D. Scoring: For each insect correctly categorized, give one point; for every animal correctly categorized, give one point; for every correct identification, give one point.

E. Points: Insects - 7 points, animals - 7 points, identity - 4 points, total - 18,

II. Flannel Board:

A. Objective: To have the children associate an insect with its appropriate environment.

B. Material Description: Four felt insects (grasshopper, dragonfly, cicada, and butterfly) and three small flannel covered boxes with scenes of water, flowers, and sky.

C. Procedure:
1. Set all three of the boxes on the table in front of the child.
2. Set the four felt insects in a miscellaneous pile in front of the boxes.
3. Ask the child to put the insect on the box where the insect lives.

D. Scoring: Give one point for having the insect in a correct environmental scene.

E. Points: Total points - 9, butterfly - 2, grasshopper - 2, cicada - 3, dragonfly - 2. (See the point distribution chart for specifics.)

III. Insect Replica:

A. Objectives: To have the children verbally identify the three body parts of the insect, to have the child demonstrate the movement of the grasshopper, dragonfly, cicada and butterfly, and to have the children assemble styrofoam body parts of an insect correctly.

B. Material Description: Three styrofoam oval-shaped parts of an insect body; a plastic cicada, grasshopper, dragonfly, and butterfly.

C. Procedure:
1. Dump the three body parts onto the table.
2. Tell the child to make an insect.
3. Ask the child - Do you know the name of this part of the insect? (point to the part)
4. Put the insect parts away and take one of the plastic insects out and lay it on the table.
5. Tell child - Show me how the insect moves.
6. Repeat the procedure for each of the insects.

D. Scoring: For every correct arrangement of a body part, give one point; for every correct identification of a body part, give one point; and for every correct demonstration of an insect's movement, give one point.

E. Points: Body parts - 3, names - 3, movement - 6, total points - 12.

IV. Match-Stages:

A. Objectives: To have the children associate the adult stage of an insect with the same insect at an earlier stage of development, and to have the children transfer their knowledge of metamorphical stages of familiar insects to unfamiliar insects.

B. Material Description: One magnetic board containing four adult insect pictures on both sides, eight small pictures of young stages of the same insects. The insects are grasshopper, butterfly, dragonfly, cicada, bee, beetle, ladybug, and fly.

C. Procedure:
1. Put the magnetic board on the table in front of the child and place the four matching cards randomly in front of the magnetic board.
2. Tell the child - These are the parent insects on the board and I want you to put the baby insect card next to its mother.
3. Follow same procedure for second side of the magnetic board.

D. Scoring: For every correct matching of a baby insect with its parent, give one point for each.

E. Points: Total - 8.

V. Drawing:

A. Objective: To have the children recall information presented in the program by drawing an insect on a blank paper.

B. Material Description: Back of score sheet and a pencil.

C. Procedure:
1. Put the back of the score sheet in front of the child and a pencil.
2. Tell child - I want you to draw an insect. It can be any insect you want to draw.

D. Scoring: For every leg drawn, give one point; for one set of three legs on each side, give one point; for having wings, give one point.

E. Points: Legs - 6, set of legs - 2, wings - 1, thorax - 1, antennae - 1, total points - 11.

VI. Environment:

A. Objective: To have the children identify harmful and helpful insects in our environment.

B. Material Description: Six plastic coated insects (grasshopper, dragonfly, cicada, butterfly, ladybug, and a housefly.

C. Procedure:
1. Set the insects on the table in front of the child.
2. Tell child to point to the insects that are harmful and the insects that are helpful.

D. Scoring: For every correct identification of harmful insects, give one point and for every correct identification of the harmful insects, give one point, for those insects given both traits, give one point each.

E. Points: Harmful - 3, helpful - 3, both - 6, total points - 12.

VII. Puzzles:

A. Objectives: To have the children categorize the insects by placing the insects in the correct metamorphical stage of growth, to have the children associate the earlier stage of growth of an insect with that insect at a later stage of growth.

B. Material Description: Four three-piece puzzles of the stages of growth of the dragonfly, butterfly, cicada, and grasshopper.

C. Procedure:
1. Take two of the puzzles and dump the pieces out onto the table, placing pictures side up where they lay.
2. Tell child: "These are puzzles of two insects. I want you to put them together the way the insect grows from baby to parent."
3. Do same for the two remaining puzzles.

D. Scoring: Give one point for putting all three pieces of the right puzzle together; give one point for putting a piece in sequence.

E. Points: Similarity - 4, sequence - 12, total - 16.

VIII. Tape Recording:

A. Objective: To have the children use the appropriate vocabulary when discussing insects and their growth during the test procedure.

B. Material Description: One portable cassette tape recorder and blank tape.

C. Procedure: Turn the tape recorder on at the beginning of the test session and turn off at the end. Identify each child's name at beginning.

D. Scoring: Give two points for every preselected vocabulary word used by the child. Do not give a point for repetition of a word used by the child.

E. Total Points - 40.

Administration of the Instrument

The PSAGT was designed for a one-to-one, child-to-administrator testing condition. The testing atmosphere should be friendly and supportive with the use of "OK" when the child completes each section of the test. Verbal transitions are to be used between the different sections of the test. A small table with two chairs are used for the testing. The preparation of the testing materials includes the positioning of the portable tape recorder where the child cannot see the microphone, placing the testing materials in a large box beside the examiner where the child cannot see the materials, and placing the score sheet and a pencil and the first testing item on the table. The directions for the PSAGT include the following: approach the child and ask if he would like to play a game; after the testing has started, no questions are to be answered by the examiner concerning the test items; each section of the test is to be presented in sequence and scored immediately after the child responds to the item; the child is not to be hurried and if the child chooses not to complete an item, that item is skipped and administered at the end of the test.

Revisions of the PSAGT

The following revisions were made in the PSAGT as a result of the testing: Test Item II was changed to three environmental scene boxes instead of four; Test Item II was given a new picture of a cicada; Test Item III, the styrofoam pieces were painted green; a larger fly was added to the magnetic board in Item IV; plastic insects were used instead of pictures in Item VI; and the dragonfly eggs were changed in Item VII.

PROGRAMED SEQUENCE ACHIEVEMENT GAIN TEST-ENTOMOLOGY
SCORE SHEET

Name: _____ PRE or POST Testing Date: _____
First Last

School: _____ Score: _____ Examiner: _____
last

1a___	1. Identity Group: (18 pts)	a. insect (7)	b. animal (7)	c. identity (4)
1b___				
1c___				
1T___				
2a___	2. Flannel Board: (9)	a. B (2)	b. D (2)	c. C (3) d. G (2)
2b___				
2c___				
2d___	3. Insect Replica: (12)	a. styrofoam (3)	b. name (3)	c. movement (6)
2T___				
3a___				
3b___				
3c___	4. Match-Stages: (8)	a. stages (8)		
3T___				
4a___				
4T___	5. Drawing: (11)	a. legs (6)	b. attachment (3)	c. wing-an (2)
5a___				
5b___				
5c___				
5T___	6. Environment: (12)	a. harmful (3)	b. helpful (3)	c. both (6)
6a___				
6b___				
6c___				
6T___	7. Puzzles: (16)	a. similarity (4)	b. sequence (12)	
7a___				
7b___				
7T___				
8a___	8. Tapes: (40)	a. responses x2		
8T___				

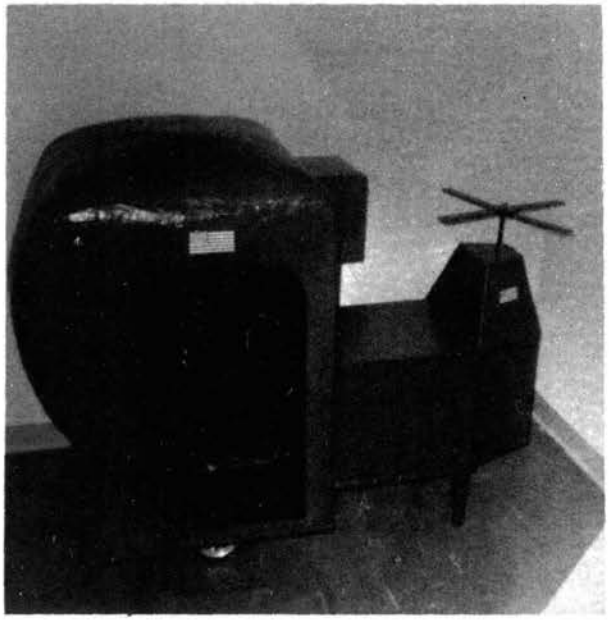
Total _____ 126

Comments:

PROGRAMED SEQUENCE ACHIEVEMENT GAIN TEST-ENTOMOLOGY
Point Distribution Chart

Test Item	Specific Behavior Evaluated	Points	Sub-Total	
Identity Grouping	Sort insect cards into insect pile	1	7	
	Sort animal cards into animal pile	1	7	
	Naming the four insects in study	1	4	18
Flannel Board	Putting butterfly in sky	1	1	
	Putting butterfly on ground	1	1	
	Putting dragonfly on water	1	1	
	Putting dragonfly in sky	1	1	
	Putting cicada in underground	1	1	
	Putting cicada in sky	1	1	
	Putting cicada on the ground	1	1	
	Putting grasshopper on ground	1	1	
	Putting grasshopper in grass	1	1	9
Insect Replica	Placing head at one end of body	1	1	
	Placing thorax in middle of body	1	1	
	Placing the abdomen at one end	1	1	
	Naming each body part	1	3	
	Grasshopper flying	1	1	
	Grasshopper jumping	1	1	
	Butterfly flying	1	1	
	Dragonfly flying	1	1	
	Cicada flying	1	1	
	Cicada sitting on table, trees	1	1	12
Match-Stage	Match butterfly with caterpillar	1	1	
	Match dragonfly with larvae	1	1	
	Match grasshopper with grasshopper	1	1	
	Match cicada with cicada larvae	1	1	
	Match housefly with maggot	1	1	
	Match beetle with nymph	1	1	
	Match ladybug with nymph	1	1	
	Match bee with eggs	1	1	8
Drawing	Drawing legs	1	6	
	Drawing three legs on one side (2)	1	2	
	Drawing legs attached to thorax	1	1	
	Drawing wings	1	1	
	Drawing antennae on head	1	1	11
Environment	Naming each harmful insect	1	3	
	Naming each helpful insect	1	3	
	Naming combinations of help and harm	1	6	12
Puzzles	Put all three pieces of same puzzle	1	4	
	Put a piece in sequence	1	12	16
Tapes	Use of preselected vocabulary	2	40	40

APPENDIX B



Side View of Helicopter

Figure 2. Helicopter Booth

APPENDIX C

MATERIAL LIST FOR HELICOPTER BOOTH

Material	Amount	Cost
Fiberglass	5 gallons	$70.00
Upholstery nails	2 packages	1.00
Electrical wiring cord	1	3.00
Adapter plub	1	.50
Extension cord	8 feet	.60
Sandpaper		3.00
Vinyl upholstery	4 yd x 45"	4.00
Foam padding	2 inch thick	3.00
Wheels and braces	two wagon wheels	.25
Legs	four 6 inch legs	3.00
Reflectors		.50
Bolts	stove and machine	2.00
L braces	nine large and 20 small	8.00
Plywood	3 ft x 54"	4.00
Tempered Masonite	4 x 4 x 2 feet	4.00
Lock and key	small 1	.60
Paint	Leadfree enamel - 5½ qts.	10.00
Wheat plaster	15 pounds	8.00
Nails and washers		2.00
Hinges	two small	.70
Plumbers rod	27 inches	.30
White pine wood	1 x 2 lengths	9.00
Chicken wire	8 feet	2.00
Cardboard box	washing machine size	-
Insulation padding	3 x 3 feet	.50
		TOTAL $142.50

APPENDIX D

MATERIAL LIST FOR FILMS AND TAPES

Material	Amount	Cost
Puppets	4	4.50
Illustration board	1 3 x 3 feet	2.00
Block lettering	2 packages black	2.00
Flannel board	3 x 4 feet red	-
Felt	20 9 x 11 inches	4.00
Black magic marker		.50
Styrofoam	2 x 24 x 12 inches	-
Camera		-
Lights		-
Super 8 movie film	twelve rolls	30.00
Film developing	twelve rolls	21.00
Splicing tape (Baia)	5 packages	2.00
Film cartridges	4	3.00
Putting film into cart.	4	1.50
Film editor		-
Tapes	2 C-90, 2 C-60	6.00
Batteries	six c size	1.20
Adapter	3M Wollensak	-
Tape recorder	3M Wollensak Cassette portable tape recorder	-
Projector	Super 8 cartridge (rental)	9.00

TOTAL $86.50

APPENDIX E

MATERIAL LIST FOR PSAGT

Material	Amount	Cost
Plastic coated insect and animal pictures	14	-
Clear contact paper	four feet	2.50
Felt insects	4	1.50
Flannel covered boxes	3	1.00
Styrofoam oval shapes	6	-
Green paint	one-eighth of a pint	.30
Illustration board	2 pieces 9 x 12 inch	.40
Four small magnets	4	.50
Insect pictures	16 2 x 3 inches	10.00
Pencil	1	.05
Plastic coated insects	12	-
Polyutherine paint	one pint	.65
Illustration board	8 3 x 12 inch pieces	2.00
Insect pictures	twelve 2 x 3 inch	8.00
Blank Cassette tape	two c-60	2.40
Tape recorder	3M Wollensak Cassette portable tape recorder with microphone	-
		TOTAL $29.30

APPENDIX F

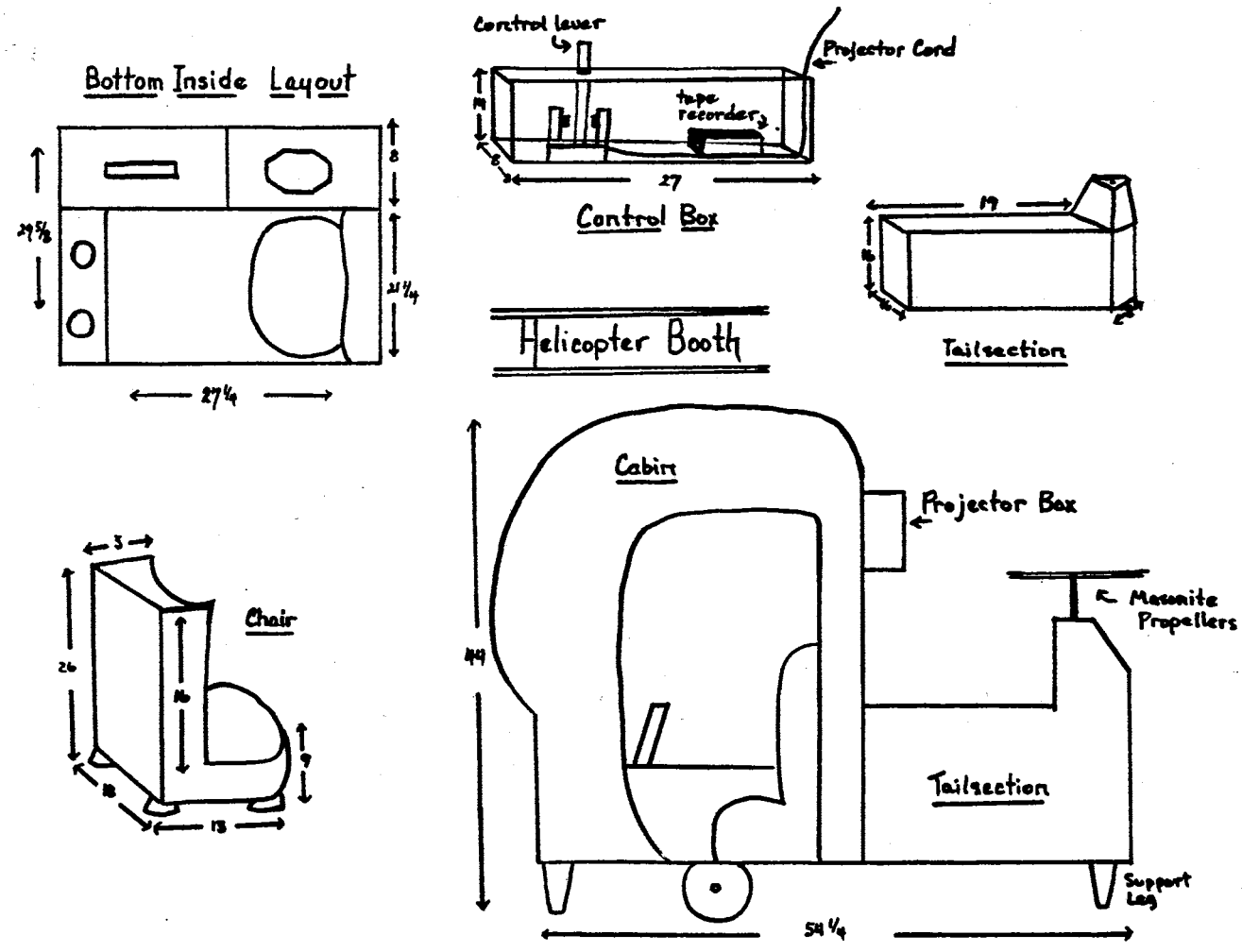


Figure 3. Helicopter Booth Plans

APPENDIX G

ENTOMOLOGY PROGRAM SOUND SCRIPT-DRAGONFLY

Concept 1: Dragonflies are insects.

Concept 3: Dragonflies have four wings. Dragonflies have two antennae and two eyes. Count the four wings. Count the wings.

Concept 4: Dragonflies have six legs.

Concept 5: Dragonflies have three main body parts. Head-thorax-abdomen. The head is first, the thorax is second and the tail is last.

The dragonfly has a very long tail.
Mr. Dragonfly would you like to watch TV?
It looks like the dragonfly is going to have trouble sitting down because of his long tail. There I think he's finally comfortable.

Concept 8: Young dragonflies live under the water.

Concept 7: Young dragonflies are called nymphs.

Concept 9: Dragonflies lay eggs near the water.

Concept 2: Different colors of dragonflies

Dragonflies have two eyes. Some dragonflies are large and some dragonflies are small.

ENTOMOLOGY PROGRAM SOUND SCRIPT-BUTTERFLY

Concept 1:	Programmed Entomology the butterfly. Butterflies are insects. This is a Monarch butterfly. You can hold Monarch butterflies in your hand.
Concept 4:	Butterflies have many colors -- blue, and orange and brown and yellow. Can you see the colors?
Concept 5:	Some butterflies are small and some butterflies are big.
Concept 9:	Butterflies are helpful because they are so pretty. I saw a butterfly one day. And watched it fly around. I crept after the butterfly to catch it but it landed on the ground.
Concept 2:	All butterflies have six legs. Butterflies' legs are small and hard to see. The butterfly has two antennae on the top of his head. Count 1..2.. now let's count the butterfly legs 1... 2...3...4.
Concept 6:	All butterflies have four wings 1..2..3..4 count again. They have two front wings and two back wings.
Concept 3:	Here is a monarch butterfly. Have you seen a monarch butterfly? Every butterfly has three main body parts. The head is first. The thorax is the middle body part and the abdomen or the tail is last.
Concept 7:	These are butterfly eggs. The mother butterfly lays round eggs on leaves.
Concept 8:	This is a caterpillar. Caterpillars are young butterflies. The caterpillar grows into a butterfly. Here are three cocoons. The beautiful butterfly then flies away. Butterflies are our friends. The egg changes into a caterpillar. The caterpillar changes into a cocoon and the cocoon changes into a pretty butterfly.

ENTOMOLOGY PROGRAM SOUND SCRIPT-GRASSHOPPER

Intro. Program Entomology - The Grasshopper
Concept 1: The grasshopper is an insect. Have you ever seen a grasshopper?

Concept 6: There are different colors of grasshoppers.

Concept 7: There are large grasshoppers and smaller grasshoppers - all different sizes and shapes.

Concept 8: Grasshoppers are harmful because they eat leaves.

Concept 9: Grasshoppers have six legs. Grasshoppers have two antennae.

Concept 3: Grasshoppers have long and strong back legs to jump with. Count.

Concept 2: The grasshopper has three main body parts. Count. The head, the thorax, and the abdomen.

Concept 10: Grasshoppers lay long thin eggs underground.

Concept 4: Young grasshoppers are called nymphs. The young grasshoppers do not have wings.

Concept 5: The two baby grasshoppers have no wings. This nymph has no wing. This grasshopper is growing wings. The mother grasshopper has long wings.

Can you point to the grasshopper in the picture? Here is the grasshopper.

ENTOMOLOGY PROGRAM SOUND SCRIPT-CICADA

Intro. Program Entomology-The Cicada
Concept 1: Cicadas are insects. Cicadas are also called locusts.

Concept 5: Cicadas have two eyes. Cicadas make a very loud noise. Some people don't like the loud noise.

Concept 2: Cicadas have six legs. Here is a shell of a cicada--it has six legs.

Concept 3: Cicadas have four wings. Count the four wings 1..2..3..4.. Count again.

Concept 4: Cicadas have three main body parts--head, thorax, and abdomen. 1..2..3..4 Count again.

Concept 6: Cicadas are harmful because they eat trees.

Concept 8: Cicadas lay their eggs on branches.

Concept 7: Young cicadas are called nymphs.

Concept 10: They crawl out of the ground to shed their skins.

Cicadas have large eyes.

Three cicada skins.

A cicada--a cicada skin.

Two cicada skins.

APPENDIX H

MASTER FILM CHART

CICADA

Concepts	Sequence
1. Cicadas are insects.	1
2. Cicadas have six legs.	5
3. Cicadas have four wings to fly.	2
4. Cicadas have three main body parts.	3
5. Cicada is a noisy insect.	4
6. Cicadas are harmful because they ruin trees.	6
7. Young Cicadas are called nymphs.	8
8. Cicadas lay thin eggs on branches of trees.	7
9. Cicadas shed their skins to become adults.	10
10. Young Cicadas come out of the ground.	9

Concept	Film	Footage	Real/Foot	Seconds
	Title shots	2	1	4
1	Insect singles	17	3	12
	Puppets	3	3	12
5	Puppets	30	4	16
2	Puppets	30	10	40
	Single insects	17		
	Flannel	20		
3	Flannel	30	7½	30
	Puppet	20		
4	Flannel-insect	20-17	5½	22
6	Flannel	20	4	16
8	Flannel	20	12	48
7	Flannel	20	5	20
10	Flannel	20	7	28
9	Insect single	17	6	24
		TOTAL	59	236

MASTER FILM CHART

DRAGONFLY

Concepts	Sequence
1. Dragonflies are insects.	1
2. There are many kinds of dragonflies.	2 4
3. Dragonflies have four wings to fly with.	3
4. Dragonflies have six legs.	5 6
5. Dragonflies have three main body parts.	9
6. Dragonflies are helpful because they eat mosquitoes.	8 7
7. Young dragonflies are called nymphs.	
8. Young dragonflies live under the water.	
9. The dragonflies lay their eggs near the water.	

Concept	Film	Footage	Real/Foot	Seconds
	Title shots	2½	1	4
1	Dragon in hand	2	2	8
	Insect singles		1	4
2	Single insects	5	3	12
4	Flannel shoots	20	10	40
3	Flannel, puppet, insect	20-30-17	10	40
5	Flannel, insects, puppets	20-17	10	40
			1½	6
6	Puppets	30	4	16
9	Flannel	20	10	40
8	Flannel	20	2	8
7	Flannel	20	2	8
		TOTAL	58½	234

MASTER FILM CHART

BUTTERFLY

Concepts	Sequence
1. Butterfly is an insect.	1
2. Butterfly has six legs and two feelers.	4
3. Butterfly has three main body parts.	5
4. There are different kinds of butterflies.	9
5. There are different sizes of butterflies.	2
6. Butterflies have four wings to fly with.	6
7. Mother butterflies lay tiny round eggs on leaves.	3
8. Caterpillar is the young butterfly.	7
9. Butterflies are helpful because they are pretty to look at.	8

Concept	Film	Footage	Real/Foot	Seconds
	Title shots	1½	1	4
1	Box collection, live	7	2	8
4	Kinds and colors	18½	4	16
5	Size-single insects	2	2	8
9	Puppet-Monarch-sponge	46	6¼	25
2	Flannel-puppet	34	8 3/4	35
6	Flannel-puppet	42	7	28
3	Flannel-insects	9	8	32
7	Flannel	25	15	60
8	Caterpillar-flannel	10	5	20
		TOTAL	59.2	237

MASTER FILM CHART

GRASSHOPPER

Concepts	Sequence
1. Grasshoppers are insects.	1
2. Grasshoppers have three main body parts.	6
3. Grasshoppers have strong, long back legs to hop with.	7
4. Young grasshoppers are called nymphs.	8
5. Young grasshoppers have no wings.	9
6. There are different kinds of grasshoppers.	3
7. There are different sizes of grasshoppers.	2
8. Grasshoppers are harmful because they eat leaves.	10
9. Grasshoppers have six legs.	4
10. Grasshoppers grow from eggs to adults.	5

Concept	Film	Footage	Real/Foot	Seconds
	Title shots	2½	3/4	3
1	Live grasshopper shoots	3½	3½	14
6	Insect-colors	3	2	8
7	Insect-size	33½	18½	74
8	Puppets	5	2	8
9	Puppets	18	8	32
3	Insect and flannel	27	6	24
2	Body parts-flannel	30	12	48
10	Flannel	15	3½	14
4	Insect single-flannel	4	2½	10
5	Flannel	9	9	36
		TOTAL	59.5	238

APPENDIX I

OPINIONS ON THE PROGRAMED SEQUENCES ACHIEVEMENT GAIN TEST

Read each of the statements of the test and then rate them as follows:

A	a	d	D
strongly agree	mildly agree	mildly disagree	Strongly disagree

Will you please express your opinion and how you feel about the items in this test. Are they appropriate for the nursery school child, age (3.5--5.0) and kindergarten children (5.2--5.11).

Indicate your opinion by drawing a circle around the "A" if you strongly agree, around the "a" if you mildly agree, around the "d" if you mildly disagree, and around the "D" if you strongly disagree.

Test Item #		Choice	Comments
1.	a.	A a d D	
	b.	A a d D	
	c.	A a d D	
2.	a.	A a d D	
	b.	A a d D	
	c.	A a d D	
	d.	A a d D	
3.	a.	A a d D	
	b.	A a d D	
	c.	A a d D	
4.	a.	A a d D	
5.	a.	A a d D	
	b.	A a d D	
	c.	A a d D	
6.	a.	A a d D	
	b.	A a d D	
	c.	A a d D	
7.	a.	A a d D	
	b.	A a d D	
8.	a.	A a d D	

VITA

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