

THE EFFECT OF A PRIOR TWO-DIMENSIONAL EXPERIENCE  
ON THE DRAWING SPATIAL ABILITY  
OF THIRD GRADE PUPILS

by

WARREN C. PRAY

B. A. E., The University of Kansas, 1971

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A MASTER'S THESIS

submitted in partial fulfillment of the

requirements for the degree

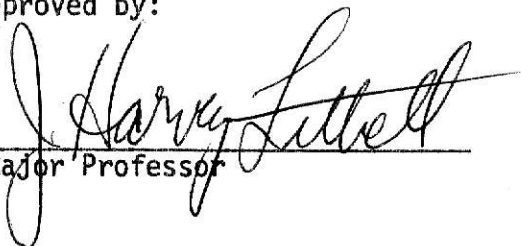
MASTER OF SCIENCE

College of Education

KANSAS STATE UNIVERSITY  
Manhattan, Kansas

1977

Approved by:

  
Major Professor

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## ACKNOWLEDGEMENTS

I wish to express my appreciation to my graduate committee for their guidance during my entire graduation program. The committee members -- Dr. J. Harvey Littrell, Dr. Gerald D. Bailey and Dr. Edward Sturr -- have all been most helpful. Special thanks go to Dr. J. Harvey Littrell, committee chairman, for his encouragement, patience and sacrifice of personal time during this study. Thoughtfulness is also extended to Dr. Michael Lynch for his assistance with statistical analysis.

The research was made possible by cooperation of the Shawnee Mission School District. The administration, Dr. Rex Carr, director of Program Development and Evaluation, the Oak Park Elementary School staff, Kenneth Cheves and Judy Hampton were most helpful. A special thanks goes to Pete Perdaris, Art Curriculum Director, for his personal assistance.

It would have been impossible for me to embark on this graduate program without the support of Kansas State University and the Agricultural Experiment Station. Thanks go to Dr. Floyd W. Smith, director, Kansas Agricultural Experiment Station and Dr. Lowell Brandner, Agricultural Editor, for their encouragement during my studies.

A special thanks goes to my wife, Bea, for her encouragement during my total graduate program. Finally, I thank my typist, Ms. Cynthia Anderson, who has been so diligent and capable in putting this thesis in print.

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## Chapter 1

### INTRODUCTION

The art education curriculum has often been assigned the role of providing students with experiences for children to assist with the development of their spatial perceptual abilities.

Perceptual development has long been an important goal of art education. However, little research has been conducted with learning experiences which may contribute to specific aspects of visual perception. If tasks pertaining to a certain area of perception (spatial drawing ability) are identified and taught, perceptual development may be achieved.

### PURPOSE OF THE STUDY

The purpose of this study was to determine the effect of a prior two-dimensional cut paper spatial experience on the ability of third grade students to draw a group of four bottles in a still life arrangement in the correct spatial relationship to one another.

### STATEMENT OF THE PROBLEM AND HYPOTHESIS

The problem was to determine whether or not two groups of students experiencing a prior two-dimensional cut paper spatial experience would be more successful drawing the still life than a third group of students receiving no prior two-dimensional cut paper

experience. One experimental group received positive reinforcement and the other group no positive reinforcement during this prior experience. The group of students receiving no prior experience was labeled as the control group. The hypothesis was:

There is no significant difference between the spatial drawings of two third grade experimental groups who have had a prior two-dimensional cut paper spatial experience and a control group of third grade pupils without the prior experience.

#### LIMITATIONS OF THE STUDY

1. Prior to the research project, the Oak Park Elementary School administration used a coin toss to determine which of the three classes was to be designated group A, group B, and group C.

2. The normal school schedule was used to conduct the research. Each group was tested at the regular class schedule. This was done to eliminate as many changes in the class pattern as possible.

3. The reader should note that the classroom art teacher was absent due to illness during this study with the exception of the last day when group B experienced their drawing exercise. The presence of the art teacher during group B's drawing experience may have had a positive influence on the results of the drawings.

4. Group C, the control group, had not previously met the facilitator. Groups A and B met him during the prior two-dimensional experience. Unfamiliarity with the facilitator may have affected the performance of group C.

## DEFINITION OF TERMS

The following terms have been used in the discussion according to these definitions,

cut paper spatial experience - a two-dimensional experience using cut paper shapes arranged in a manner to show the placement of an arrangement of three-dimensional shapes placed before the students.

facilitator - the person conducting the lab research, in this case the author.

perception - awareness of what is being experienced through the senses.

perceptual development - the development or refinement of ones perceptual abilities.

spatial perception - perception dealing with objects and their relationship to the space they occupy.



## Chapter 2

### REVIEW OF LITERATURE

A popular area for study in art education has been the process and phenomena of visual spatial perception. Research on perception dates back to Fechner, Wundt and Galton in the 19th Century. Currently Rudolf Arnheim and Viktor Lowenfeld have been conducting research in this area. Rudolf Arnheim, (1954), yielded concepts like perceptual differentiation which stated that children increase their ability to discriminate the qualities of the environment as they mature.

A program of research that made Piaget a famous developmental psychologist, philosopher, and educator began in 1921. Piaget, Lansing, (1966), claimed that perception is learned, occurring in three major stages. Children pass through these stages in the first two years of their lives. From birth to four to five months, the child's vision and grasping are not coordinated. During the second stage of perceptual development, five months to one year, the coordination of vision and grasping are learned. During this same period, increased visual and tactile exploration occur. The third stage lasts from age one to age two. The child begins to learn object relationships as well as shapes and dimensions of single objects. He internalizes and coordinates his sensory impressions and actions. The result is a mental or conceptual image.

Piaget attributed the lack of children drawing until after two

years of age to the absence of a mental image or visual concept. Unlike Arnheim, Piaget does not believe that children draw what they see, but what they know. They do not use linear perspective in drawing until seven to nine years of age; yet they perceive this relationship by the age of two.

Other research in the area of perceptual development has been conducted by McFee, (1970) who argued that artistic development is affected by three major conditions, 1) readiness to perceive the visual world, 2) the impact of the cultural and psychological environment, and 3) the child's handling of the information received. McFee's teaching model drew upon some of the same foundation as Arnheim's work including field psychology, association theory, cognitive style, and upon such thinkers as Piaget and Bruner. Other researchers have concentrated on trying to alter children's perception through various experimental treatments. Brent Wilson, (1966), used vocabulary and discussion building techniques which successfully increased the number of aspects of an art object to which a person attends. Perceptual training has been devised to increase the ability to draw perspective, Kensler, (1965), and to alter the amount of visual information, Salome, (1965).

Research has been conducted with the intent of altering children's perception, but no research was found which was designed to see if the child's drawing spatial ability might be enhanced or improved by participating in a prior two-dimensional cut paper experience.

## Chapter 3

### METHODOLOGY

#### Research Design

The students in three third grade elementary classes at Oak Park Elementary School, Shawnee Mission, Kansas were chosen as the subjects for this study. Oak Park is located in the south area of the Shawnee Mission School District. The student body originates from upper-middle class families and the majority of the parents are first generation business professionals. The parents owe their financial and social status to the educational system and endorse the school and the educational programs. Student involvement is evident in the student orientated programs and the curriculum offered in the school. The Shawnee Mission School District offers students a comprehensive art program, by offering art classes from kindergarten through grade twelve.

The three classes chosen for this study will be referred to as groups A, B, and C. Groups A and B, the experimental groups, received a prior spatial experience and group C, the control group, experienced only the basic drawing experience. Group A was composed of twenty-four students, group B twenty-six students, and group C, twenty-five students for a total population of seventy-five students for the study. Ages of the students ranged from seven to nine years.

### Performance Tasks

A board with drawn outlines of the base shape of each of the four bottles was used. To insure minimal variance of the still life for each of the groups, each of the four bottles was placed on the corresponding base outline.

No measure of drawing ability other than the placement of the drawn bottle shapes was used as a criteria for evaluation. All three groups were allowed equal time to conclude the individual phases of the experiment. The facilitator read typed instructions to all three groups (see Appendix A) to insure identical instructions for all groups during the testing periods.

The only evaluation criteria was that the students must have drawn the four bottles so there was correct placement of the bottles in relation to one another.

### Group A

Each student in group A was given four pieces of colored paper to match the colors of the four bottles. Figure 1 shows the cut out paper shapes of the four bottles in the correct placement as demonstrated by one student. The cut paper experience was done by both groups A and B. In addition, each student was given a pencil and a pair of scissors. The bottles were disassembled from the previously set up still life and placed side-by-side for the students to view, noticing shape, color, and size of each bottle compared to the other bottles. The students then drew the outline shape of each bottle on the appropriate piece of colored paper, e.g., blue bottle shape was drawn on the blue piece of

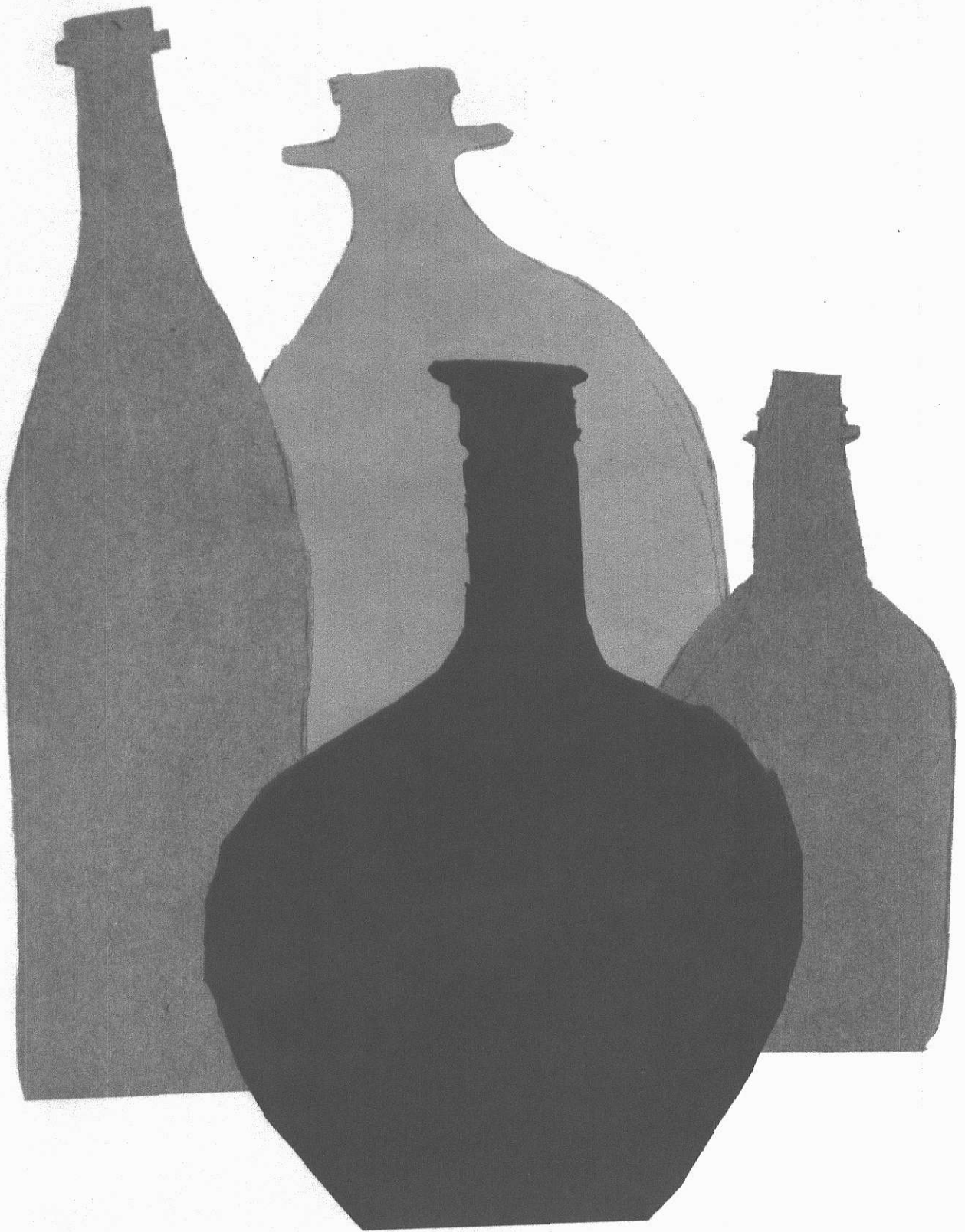


Figure 1. A correct prior two-dimensional cut paper response.

paper. After each of the bottle shapes had been drawn, the students cut the shapes out following the outlines drawn with the scissors provided. During this time the bottles were placed back on the board on their pre-marked base shape outline. Each student received a piece of 11" x 14" white drawing paper and glue. The students were asked to view the still life, noticing placement and arrangement of the four bottles and their relationship to one another. The students were asked to glue their cut out shapes one at a time to the white paper, overlapping the shapes as each student perceived the still life, striving to represent the arrangement of the bottles as they appeared in the still life. The students were instructed not to ask questions and received no positive reinforcement from the facilitator.

#### Group B

The students of group B had an experience identical to group A with two exceptions: (1) Questions could be asked by the students, and (2) positive reinforcement or help was given by the facilitator. Each student worked with the cut paper shapes, moving them around until they were in the correct arrangement. During this time the students were encouraged to ask questions concerning the placement of the bottles and their relationship to one another. After the shapes were examined by the facilitator to see if they were in the proper relationship, the student glued the shapes on the white paper in the correct position.

#### The Drawing Experience

Experimental groups A and B along with control group C were presented a still life consisting of the same four bottles previously

used by groups A and B. However, the bottles were in a different arrangement than the one used in the prior cut paper experience by groups A and B. A board with drawn outlines of the base shape of each bottle was again used to assure minimal variance.

The students of each group were given a piece of 11" x 14" white drawing paper. The students were simply instructed to draw the contour of the four bottle shapes showing their spatial relationship to one another and to pay special attention to how the bottles visually overlapped one another, (Figures 2 and 3). Students were asked not to spend time drawing detail or shading the bottles.

Evaluation was based solely on the placement of the four drawn bottles and their relationship to one another. It was determined prior to the experiment that all four bottles must have been in the proper relationship to one another to be recorded as a correct response on the scoring sheet. Papers on which only two or three bottles were in the proper relationship were scored as not being correct.

Two non-participating art teachers served as judges along with the author. All three judges had to agree on the evaluation of the drawings to be recorded as a correct or incorrect response. Figure 2 illustrates an example of a correct response to the still life for the drawing experience. Note the shape differentiation of the four bottles and their placement in space in comparison to one another. The bottles are tied together visually as a group, whereas in Figure 3 the bottles appear somewhat distorted and separated. Figure 3 is an example of an incorrect drawing response since this drawing has a different overlap of shapes than was present in the actual still life arrangement. All

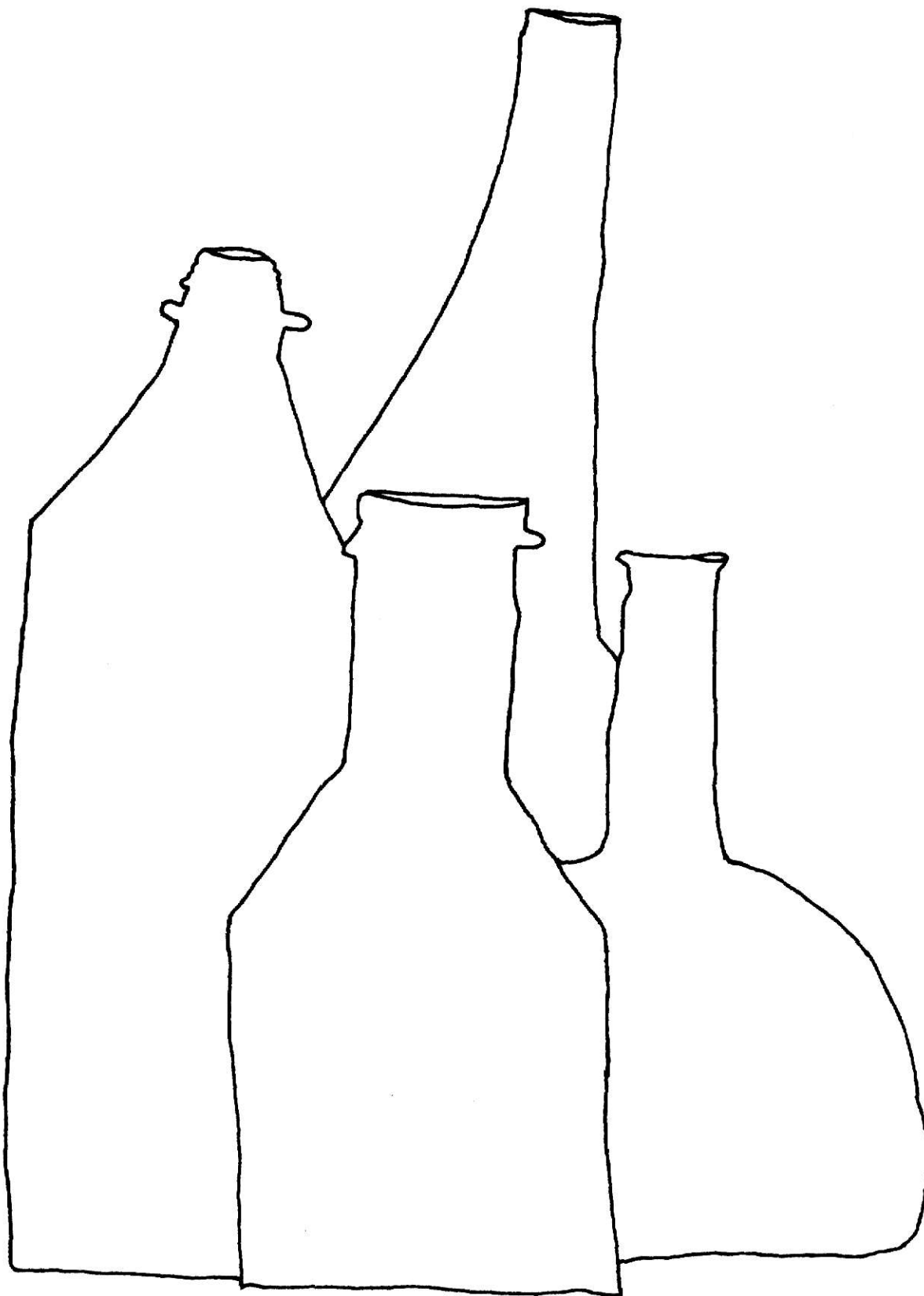


Figure 2. A correct drawing response showing the proper spatial relationship of the four bottles.



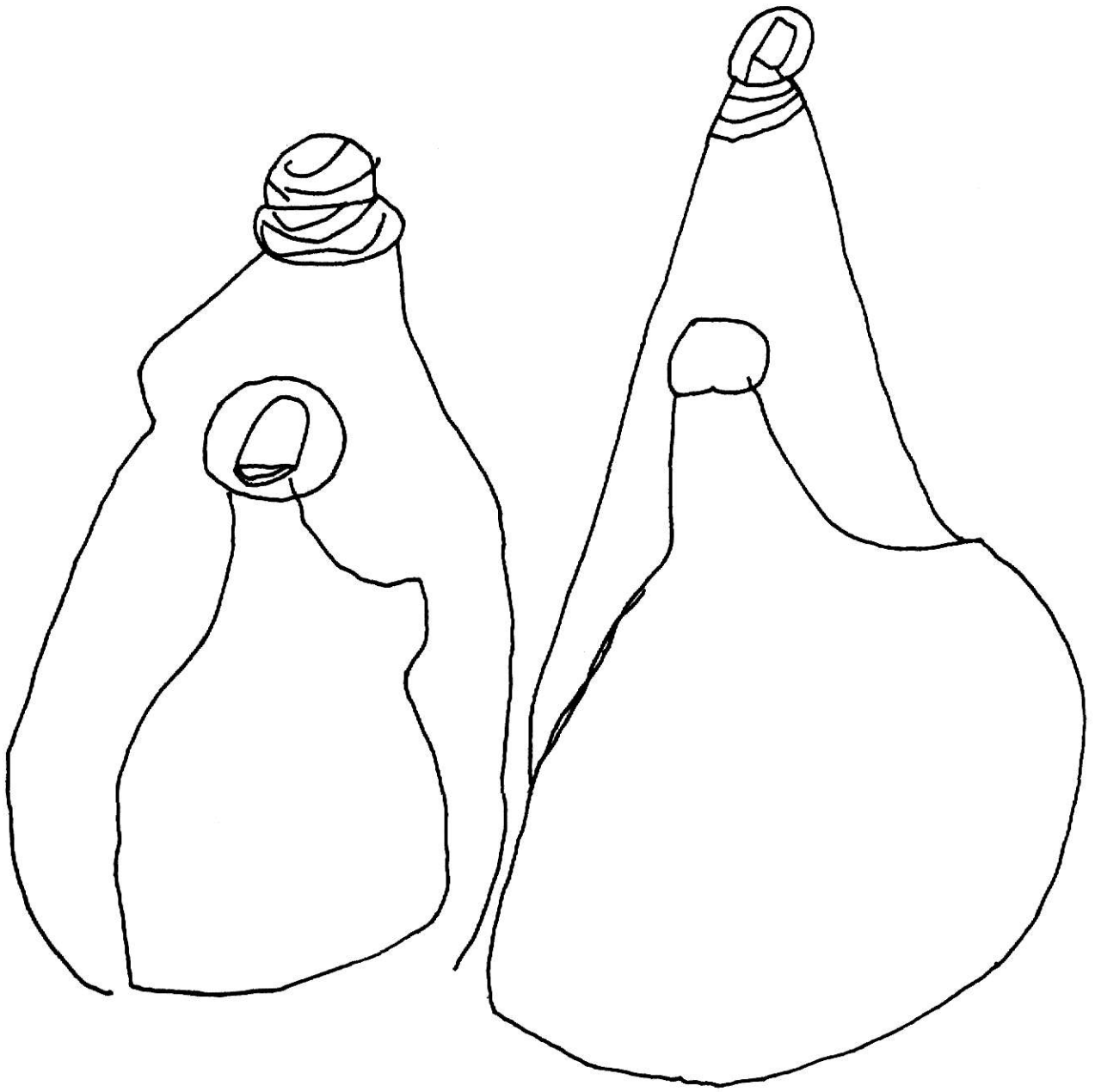


Figure 3. An incorrect drawing response. Notice the placement of the bottles in relationship to one another as well as the lack of overlap.

students were given equal time to view the arrangement of the bottles before drawing. During this experience, none of the three groups received any coaching by the facilitator and questions from the students were not allowed.

## Chapter 4

### RESULTS AND ANALYSIS OF DATA

Non-parametric statistics were utilized to determine the research results. Papers from each of the three classes were judged separately. The drawings were separated for each class into two categories, correct and incorrect. The data were then treated statistically to determine the outcomes of the experiment.

#### Results

Of the twenty-four students in experimental group A who experienced no help during the prior cut paper experience, six correct and eighteen incorrect responses were recorded in the drawing experience, (Table 1). The students of group A were simply given the instructions to the cut paper experience (Appendix A) and were not allowed to ask questions directed toward the facilitator or fellow students.

Experimental group B, composed of twenty-six students, was encouraged to ask questions during the cut paper experience and each student was required to obtain approval of the facilitator concerning the placement of the cut out shapes, (Appendix A). The responses of group B were quite different from group A in that over half of the students (14) had correct responses, (Table 1).

The control group, group C, received no prior cut paper

TABLE 1

	GROUP A	GROUP B	GROUP C	
Number of correct responses	6	14	11	31
Number of incorrect responses	18	12	14	44
	24	26	25	75

Table 1. Number of correct and incorrect responses recorded for groups A, B, and C for the drawing experience.

experience. The responses of group C were comparable to group B in relation to correct and incorrect responses. Of the twenty-five students in group C, eleven correct and fourteen incorrect responses were recorded as compared to fourteen correct and twelve incorrect for group B.

The hypothesis statement was: There is no significant difference between the spatial drawings of two third grade experimental groups who have had a prior cut paper spatial experience and a control group of third graders with no prior experience.

Table 2 shows the chi-square values of the cells of the contingency table. A chi-square of 4.38 was arrived at for this study with a chi-square value of 5.99 or greater needed to attain significance at the .05 level for  $df=2$ .

Utilizing the data that was presented for this test, it can be stated that there was no statistically significant difference in the success of the drawings between the two experimental groups and the control group. The null hypothesis was retained.

Since no statistically significant difference was found for the previously stated hypothesis, a second hypothesis was made: There is no significant difference between the spatial drawings of two third grade experimental groups who have had a prior two-dimensional cut paper spatial paper experience. A statistical analysis was conducted to compare the results of group A and group B. Table 3 shows the number of correct and incorrect responses for groups A and B. A chi-square of 4.32 was arrived at for this analysis with a chi-square value of 3.84 needed to attain significance at the .05 level for  $df=2$ . The null hypothesis

was rejected. With the above results it is clear that group B, the group experiencing coaching along with help from the facilitator, was more successful in the drawing experience than group A, the group receiving only the instructions to the drawing experience.

TABLE 2

Cell values for  
correct responses

Cell values for  
incorrect responses

A	B	C
1.55	0.98	0.04
1.09	0.69	0.03
1.2	1.5	1.4

Chi-square = 4.38

Table 2. Cell values for correct and incorrect responses for groups A, B, and C. Chi-square value of 4.38.

TABLE 3

Number of  
correct responses

Number of  
incorrect responses

A	B	
6	14	20
18	12	30
24	26	50

Chi-square = 4.32

Table 3. Number of correct and incorrect responses for groups A and B. A chi-square value of 4.32 was obtained at for this comparison of the two experimental groups.



## Chapter 5

### SUMMARY AND CONCLUSIONS

Comparing the two experimental groups and a control group in drawing spatial ability, no statistical significant difference was found. However, comparing the success of group A compared to group B a significance was present. It was determined that group B, the group experiencing coaching and help from the facilitator, was more successful in the drawing experience than group A, the group receiving only the instructions to the drawing experience.

Several factors may have had an influence on the research results. These are as follows:

1. One day lapsed between the prior cut paper experience and the drawing experience for groups A and B. This lapse of time might have had an effect on the test responses of the students. This time span may have been too great for a maximum amount of carry over knowledge to be used by the students to increase the number of correct responses on the drawing experience.
2. Each class was also released by their regular classroom teacher and passed directly to the art room. The classroom teacher was in control of the students until they arrived to the art room. It is possible the discipline or lack of it may have played a role in establishing the attitudes the students had at the time they arrived for the testing. The emotional state of the students might have affected

the research. A student-teacher confrontation immediately preceding either testing period might affect the outcome of the students response, which in turn might also affect other student responses.

3. The frustrations of positive reinforcement or questioning experienced by the students of experimental group A probably affected their responses, as two-thirds (18) students responded incorrectly in the drawing experience. The lack of positive reinforcement during the cut paper and drawing experience seemed to be a factor in the responses. Unlike group A, group B received this reassurance during the cut paper experience which may account for the increased number of correct responses during the drawing. The students in group B did ask questions and began to freely question the facilitator concerning the placement of the bottles in the still life. Of group B, fourteen of twenty-six students gave a correct response. The question must be asked at this time whether a greater number of students in group B would have responded correctly if the time period between the cut paper experience and the drawing would have been reduced, possibly having the drawing exercise done the same day following the cut paper experience.

Although there were no statistically significant differences between the two groups experiencing the cut paper experience prior to the drawing and the control group doing only the drawing, the following observations were made which occurred with group A that did not with groups B and C.

- 1) A basic frustration during the cut paper experience due to the lack of opportunity to ask the facilitator questions.
- 2) Students looked to the facilitator for reassurance that

what they were doing was correct. Neither verbal nor non-verbal reassurance was given.

- 3) The students tended to accept the first idea of correct arrangement of the cut-out shapes that came to mind which was evident in the following ways:
  - a) it took about one-half as much time for completion as compared to group B
  - b) the number of correct responses was about one-third of the incorrect responses

The major finding arising from this study is that those students receiving positive reinforcement along with the student/teacher verbal interaction were more understanding of the problem and performed with a greater degree of success. From this finding, the assumption can be made that the cut paper experience with coaching and questioning, as well as a no prior cut paper experience, is better than a cut paper experience with no student/teacher verbal interaction or positive reinforcement by the facilitator.

#### RECOMMENDATION FOR FURTHER STUDY

Several directions for further study became evident and are possibilities to be pursued. This research project opened the door to questions to be answered. Some of these recommendations are as follows:

1. An in-depth study of the research conducted under the basic format with the following changes with an increase in the number of subjects tested. A greater significance might be attained.
2. By revising the rating scale from two response (all correct

or all incorrect) to a four point evaluation based on total number of correct and incorrect responses. Such a method would allow for a wider variance in the correct/incorrect response reliability.

3. Alter the research design and direct it to a group of students with little art background, e.g., an inner city school or a school without a district art program.

4. A change in grade level at which the research is conducted. Visual spatial perception is usually demonstrated at some time between seven and nine years of age. A study could be conducted at a different time during the third grade to check the time of occurrence of this development during this grade level. If a test is done at the beginning of the year, perhaps a second testing could be conducted toward the end of the school year with the same students to check progress, if any. The grade level could also be altered to late second grade or even early fourth grade.

5. It would be appropriate at this time also to consider starting the opportunity for and the testing of drawing spatial ability early in the students educational career (first grade). This experience could be done at the beginning and end of the academic year with continued testing through the ensuing years to pinpoint the time of occurrence of this perceptual change. Spatial perceptual skills could possibly be developed at an earlier time in his life than is considered normal.

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## APPENDIX A

## APPENDIX A

1. Orientation
2. Three third grade classes
3. Procedure

### EXPERIMENTAL GROUP A

- A. Still life set up for student to view.
- B. Students will observe the still life while step "C" is in progress.
- C. Materials are distributed to students.
  1. Each student receives four pieces of colored construction paper. (blue, yellow, green and red)
  2. Scissors
  3. Pencil and glue
- D. Still life is disassembled.
- E. Students will view each bottle separately.
- F. Facilitator asks the students to notice shape, color and size.
  1. Which bottle shpaes do you recognize?
  2. Do you see a ketchup bottle?
  3. Do you see a pepsi bottle?
  4. What other type of bottle?
  5. What color is each bottle?
- G. Students are instructed to draw the outline shape of each bottle on the corresponding piece of colored paper. e.g.; blue bottle shape drawn on blue paper.
- H. Each drawn bottle shpae is cut out.
- I. Each student is given one piece of white drawing paper.
- J. Bottles are placed back in the still life set up on the pre-marked spot.

- K. Students again view the still life, noting the relationship of the bottles to each other.
  - 1. Which bottle is behind the others?
  - 2. Which bottle is in front?
- L. Cut out shapes are glued to the white paper in the relationship that each student perceives the bottles in the still life arrangement.
- M. No questions are to be asked by the students and they receive no positive reinforcement from the facilitator.

#### EXPERIMENTAL GROUP B

- A. - K. (same as group A)
- L. Students move the shapes around, changing the arrangement until they are in proper order.
- M. Arrangements checked by the facilitator to be correct.
- N. Students are encouraged to ask questions and discuss problems encountered.
  - 1. Overlap of shapes
  - 2. Placement of the bottles
- O. The arrangement is checked for accuracy. Each student is then instructed to glue the four shapes on the white paper in the correct arrangement.

#### CONTROL GROUP C

(see below)

Drawing Experience for  
Experimental Groups A & B, Control Group C  
(same for all three groups)

- A. Students are presented a still life consisting of the same four bottles previously used by Experimental Groups A & B, but in a different arrangement.

- B. Students are instructed to view the still life noting the bottle shapes and relationships.
  - 1. Which bottle is in the back?
  - 2. Which bottle is in the front?
- C. Materials distributed.
  - 1. Each student receives one piece of white drawing paper.
  - 2. A drawing pencil.
- D. Students are instructed to draw the shape of the four bottles as they see them in relation to one another.
  - 1. Remember which bottle is in the back and in the front of the other bottles.
- E. Attention should be paid to the visual overlap of the bottles.
  - 1. Look how one bottle visually overlaps another so you can't see the entire bottle shape.
- F. Students are instructed not to spend time drawing the detail of the bottles.
  - 1. Draw only the shape of each bottle.
- G. Student questioning is eliminated and receive no positive reinforcement from the facilitator.

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AN ABSTRACT OF A MASTER'S THESIS

submitted in partial fulfillment of the

requirements for the degree

MASTER OF SCIENCE

College of Education

KANSAS STATE UNIVERSITY  
Manhattan, Kansas

1977

## Abstract

### THE EFFECT OF A PRIOR TWO-DIMENSIONAL EXPERIENCE ON THE DRAWING SPATIAL ABILITY OF THIRD GRADE PUPILS

The art education curriculum has often been assigned the role of providing young school children with the development of their spatial perceptual abilities. Reference to learning experiences which contribute to the development of specific aspects of visual perception have been lacking.

The purpose of this study was to determine the effect of a prior two-dimensional cut paper spatial experience on the ability of third grade students to draw a group of four bottles in a still life arrangement in the correct spatial relationship to one another.

Three third grade classes in the Shawnee Mission, Kansas school district were chosen as subjects for this study. The students had a very comprehensive art program from kindergarten through grade 12.

The three classes chosen for this study were referred to as group A, B, and C. Groups A and B, the experimental groups, received prior two-dimensional cut paper experiences. Group C, the control group, was given only the drawing exercise which followed groups A and B's prior experience. Four bottles of different colors and shapes were used as the still life objects to be drawn.

The students in group A were given four pieces of colored paper to match the color of the bottles. After drawing the outline shape of each bottle on the corresponding piece of colored paper, the shapes were cut out. They were then instructed to view the still life noting place-

ment of the four bottles and their relationship to each other. The students were then instructed to glue the four cut out shapes to a piece of white paper in the arrangement as they perceived the still life. Students in group A were not allowed to ask questions or receive any coaching from the facilitator. Group B, the second experimental group, received the same prior experience as group A with two exceptions: (1) students were encouraged to ask questions and (2) they received coaching from the facilitator and the cut paper arrangement was checked by the facilitator for correctness. The control group, group C, received no prior two-dimensional cut paper experience.

All three groups received the drawing exercise. A board with drawn outlines of the base shape of the bottles was used to assure correct placement of the bottles. The students were instructed to draw the bottle shapes showing their spatial relationship to each other. Students of the three groups received no coaching from the facilitator and were not allowed to ask questions.

Evaluation was based solely on the way students drew the correct spatial relationship of the four bottles to each other. All four bottles must have been in the proper relationship to one another to be recorded as a correct response. Two non-participating art teachers served as judges along with the author. Non-parametric statistics were used to determine whether or not there was a statistically significant difference between the number of correct drawings in the three groups. All groups' were judged separately.

Group A, the group experiencing no coaching, was composed of twenty-four students, six correct and eighteen incorrect responses were

recorded. Group B was encouraged to ask questions and received coaching from the facilitator. This group was composed of twenty-six students. Over one half (14) correct responses were recorded. Group C, experiencing only the drawing, had eleven correct and fourteen incorrect responses recorded.

A chi-square of 4.38 was arrived at for this study with a chi-square value of 5.99 or greater needed to attain significance at the .05 level for  $df=2$ . It can be stated that there was no statistically significant difference in the success of the drawings between the two experimental groups and the control group. However, there was a statistically significant difference comparing group A and group B. A chi-square of 4.32 was obtained with a chi-square of 3.84 needed to attain significance at the .05 level for  $df=2$ . It is clear that group B was more successful in the drawing experience than group A.

The major finding of this study was that those students receiving positive reinforcement, along with student/teacher verbal interaction during the prior two-dimensional cut paper experience, were more understanding of the problem and performed with a greater degree of success during the drawing experience. The assumption might also be made that the cut paper experience with coaching and student/teacher verbal interaction, as well as not experiencing a prior cut paper experience, is better than a cut paper experience when no student questioning or coaching by the facilitator occurs.