THE EFFECT OF NEURO-MUSCULAR ACTIVITY ON ACHIEVEMENT AND INTELLIGENCE OF KINDERGARTEN CHILDREN

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This is to certify that the

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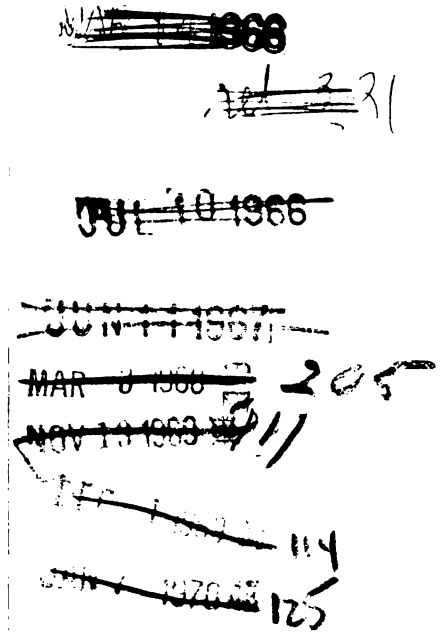

ABSTRACT

THE EFFECT OF NEURO-MUSCULAR
ACTIVITY ON ACHIEVEMENT AND
INTELLIGENCE OF KINDERGARTEN CHILDREN

by Orval M. Conner

This study grew out of an interest in some of the more recent research related to factors in human development believed to be influential in bringing about the fuller release of human potential. The design of this study was structured to examine the contribution and relation of gross and fine neuro-muscular activity to improved functioning of kindergarten children as measured by standardized achievement and intelligence tests.

No statistically significant differences in intelligence and formal school experience existed between the experimental and control groups within the socio-economic levels at the beginning of the study. Statistical evaluation of the differences in gain scores between the experimental and control groups was computed for the Pintner-Cunningham Primary General Ability Test, The Metropolitan Readiness Test, and the Kraus-Weber Physical Fitness Test. From these data it was possible to determine the short-term effects of neuro-muscular, perception, and vision organization activities on kindergarten children.

Standardized test measurements were taken on a pre and post treatment basis to determine the effect of the experimental treatment. The difference in gain scores between the experimental and control groups, both on a total group basis and within socio-economic levels, was computed and tested for statistical significance. Computations were made on the following measures: total achievement, reading readiness, number readiness, intelligence, and physical fitness.

ACHIEVEMENT: The difference in gain scores between the total experimental and total control groups in total achievement as measured by the F Statistic was found to be statistically significant at the .01 level. Comparable significance was shown for the cross-product of the experimental-control and socio-economic factors. Further analysis within socio-economic levels by means of the T Test revealed significance at the .005 level in favor of the lower socio-economic experimental group, and at the .05 level in favor of the middle socio-economic experimental group. The hypothesis regarding total achievement was supported.

Statistical significance was not found in the difference between gain scores of the experimental and control groups on reading readiness. The cross-product of the experimental-control and socio-economic factors was statistically significant. Within the low socio-

economic level the difference in gain scores between the low socio-economic experimental and control groups was statistically significant at the .005 level in favor of the experimental group. Statistical significance was not found for the difference in gain scores for the middle socio-economic group.

The difference in gain scores in number readiness between the total experimental and control groups was statistically significant at the .01 level. Analysis within socio-economic levels indicated experimental group significance at the .0005 level in favor of the lower socio-economic group. Significance was not found for the difference in gain scores within the middle socio-economic group.

INTELLIGENCE: The difference in gain scores between the total experimental and control groups was not statistically significant, and the interaction product of the experimental-control and socio-economic factors was not statistically significant. Socio-economic level analysis did not show statistical significance for the difference in gain scores within the low socio-economic group, but for the middle socio-economic group significance was reflected at the .005 level for the difference in gain scores between the experimental and control group in favor of the experimental group. The hypothesis regarding gains in intelligence was supported by only the middle

socio-economic group.

NEURO-MUSCULAR FITNESS: The difference in gain scores between both experimental and control groups was adequate to meet the .05 level and favored the experimental group gains. The hypothesis regarding gains in neuro-muscular fitness was supported.

The combined influence of fine and gross neuro-muscular activity has been found to be positive as it influences the achievement and intelligence performance as identified. Differences in gain scores between socio-economic groups appear to be attributable to (1) past experience, (2) program emphasis, and (3) the relevancy of the learning experience to the readiness level of the learner.

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By

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CHAPTER I

INTRODUCTION

The fuller development of human potential continues to be one of our basic concerns in education. That man realizes only a fractional portion of his total potential serves as a challenge and concern for all who are engaged in the educational endeavor. The variables which account for this partial development of potential are complex, varied and multiple. This study purports to examine selected variables and their relationship to the intelligence and achievement of kindergarten children.

By identifying those variables which are thought to exert a significant and positive influence on the development of individual potential it should then be in a position to reconstruct curricular experiences so that they will contribute more adequately to the realization of man's potential. It is believed that there may be critical periods which need to be recognized. This study is restricted to kindergarten children and the variables of neuro-muscular coordination, perception training, and vision organization.

A period of five months was selected for measuring the impact of the variables mentioned. During this time the only curricular difference between the experimental

and control groups involved planned experience with the specific variables as listed.

The Problem

Is it possible to alter to a significant degree the chances for greater academic success by providing additional stimulation through the variables listed? Do these variables afford the individual critical experiences in such a way as to modify significantly his behavior as measured by standardized test instruments?

Believing that there does exist a significant interrelationship between the various areas of development -- emotional, physical, intellectual, and social -- and that these areas of development take place to the degree that the cultural environment permits, the problem then becomes one of identifying those kinds of experiences which offer the greatest positive contribution to human development. Once these are identified it would then be possible to apply this knowledge in a prescriptive way to bring about the fuller development of an individual's potential. Such an undertaking will require the interdisciplinary contributions of the behavioral sciences, and it is hoped that this study will demonstrate the value of an interdisciplinary approach.

The variables being considered in this study are

those of vision organization, neuro-muscular coordination, and perception. The question is whether or not additional experience in these areas significantly influences the intellectual and academic performance of kindergarten children. Can these variables be said to possess assistive influence that will enable children to function more adequately in relation to their potential? No inference is intended or made relative to changing human potential. Rather the question is one of seeking out those kinds of activities which will make it possible for the individual to use more effectively his already present potential.

Justification for the Study

The data gathered should provide insight concerning the value of these curricular experiences for kindergarten age children. These experiences, as a part of the developmental sequence, should provide for extending and refining those skills already present and the development of new skills which are within the general maturational level of this age child.

The hypotheses being tested in this study should give indication of the value of the activities as listed, and if they are found to be of a positive significant value then they offer implications for curriculum improvement. They were selected and represent but a

partial scope of what can be referred to as an interdisciplinary approach to the study of human potential. Surely the inclusion of relevant knowledge from all the behavioral sciences will add increased sophistication to such an endeavor, but it remains for this study to review but a part of the whole.

Definition of Terms

Certain terms are defined in order to clarify the concepts represented by these terms as they are used in this study. They are as follows:

Cephalocaudal refers to the development as occurring in a head to tail sequence.

Decrement refers to the process of becoming gradually less; decrease; diminution; loss; waste.

Directionality refers to an organism's external awareness of right, left, front, back, etc.

Embryogenesis refers to formation or development.

Equilibration refers to the process of bringing into balance; internalizing; integrating.

Epistemology refers to the theory or science

of the method or grounds of knowledge, especially with reference to its limits and validity.

Homolateral refers to the same side, e.g., right leg, right arm which characterizes the creeping movement. Homolateral movement precedes ipsilateral movement.

Ipsilateral refers to opposite sides, e.g., right leg, left arm, etc. Physiologically this follows homolateral movement, and can be seen in the proper crawling movement pattern.

Laterality has reference to the awareness of left, right, front, etc., within one's body. This precedes directionality and serves as its underpinning.

Motility refers to specially distinct motor images.

Neuro-muscular refers to the linkage which exists in one's neural-muscular-ligamental system.

Perception refers to the process whereby stimuli are internalized, integrated, and evaluated as they relate to the previously

existent concepts and understandings of the subject.

Proximo-distal refers to development as evolving from the inside or center toward the outer extremities.

Punctum-proximum refers to near-point.

Sight is the ability of the eye to transduce light rays into an "electrical" (neural) energy that can be transmitted to the brain by the optical nervous system.

Veridical indicates accuracy, truthfulness, precision.

Vision is the process of interpreting what is seen. It is what the brain does with the information which comes from the eye.

Population of the Study

This study involves four groups of kindergarten children, two from a middle socio-economic area and two from a lower socio-economic area. In both cases the morning groups served as the control groups and the afternoon groups served as the experimental groups. Each teacher worked with both an experimental and a

control group, thus minimizing the teacher variable. Both teachers are highly regarded for their skill, insight, and effectiveness.

These two schools offered contrasting socio-economic class backgrounds. One is considered to typify the lower socio-economic class and the other typifies a middle socio-economic class. The sample totals roughly one hundred and was equally divided between schools.

The middle socio-economic school neighborhood is comprised primarily of single family dwellings of young families. At the beginning of the study the school enrollment totaled four hundred seventy-one children of whom eighty-three were kindergartners.[1] The lower socio-economic school neighborhood is comprised principally of older homes, many of which are now multiple dwellings. The enrollment at this school was four hundred forty-nine of which seventy-two were kindergartners.[2] There has been the usual rate of transiency in the lower socio-economic area, and a significant number of families lacks one, and in some cases, both parents in the family unit.

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[1]Pupil Personnel Office Report, Battle Creek Public Schools, Battle Creek, Michigan, dated September 17, 1964.

[2]Ibid.

The area picture as surveyed by the 1960 census reflects that the percentage of rantal property is much higher in the lower socio-economic area which, in turn, reflects a higher mobility pattern for the neighborhood. The lower socio-economic school rental property comprises roughly 51 percent of the total property in the area and, of the total, 23 percent is categorized as dilapidated and/or deteriorating. Rental property accounts for only 6 percent of the property in the middle socio-economic area and, of all the property in this area, 13 percent is listed as deteriorating and/or dilapidated. As would be expected, the larger proportion of higher value homes is to be found in the middle class area.

TABLE 1.1 *

Housing Data

School	Total Population	Total Housing	Total Deteriorating	Total Dilapidated	Owner Occupied	Renter Occupied
Lower Socio-Economic School	4178	1619	295	82	616	834
Middle Socio-Economic School	3562	1121	54	17	915	150

			Average Dollar Value of Homes			
School	Non White Occupied	1.01 or more per room	Up to $7500	$7501 to $13,000	$13,001 to $20,000	Over $20,000
Lower Socio-Economic School	104	140	300	834	32	---
Middle Socio-Economic School	8	82	32	845	239	---

* U. S. Bureau of the Census. *U. S. Census of Housing: 1960.* Vol. III, City Blocks. *Series HC (3), No. 201, U. S. Government* Printing Office, Washington, D. C., 1961.

Design of the Study

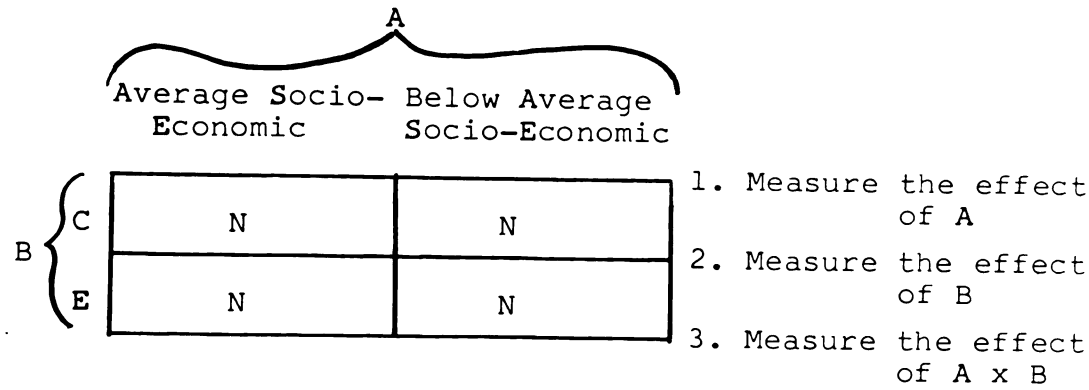
Pre and post measures were taken to gain knowledge of the effect of the experimental program. These included the Metropolitan Readiness Test, the Pintner-Cunningham Intelligence Test, Kraus-Weber Physical Fitness Test, and the Perception Forms Achievement Test. The family data gathered reflected the number of siblings, mother's education, father's education, occupation, subject's age, and sex.

E^1 and C^1, representing experimental one and control one, and E^2 and C^2, representing experimental two and control two, indicate the study sample and refer to the lower socio-economic and average socio-economic areas respectively.

Analysis of variance was used to evaluate the significance of the measures, and this was computed at the .05 level of significance. The diagram presented on page eleven illustrates the dimensions of the analysis as envisioned. The analysis shows the existent variance between (1) socio-economic levels (A), (2) between control and experimental groups (B), and (3) the effects of the cross products of these factors or (A x B). Significance was determined by use of the F. table for the F. values as determined by computer analysis.

Where interaction was identified the next procedure

involved an analysis of the data within socio-economic groups. The following diagramatic representation reflects the kinds of evaluations which are envisioned:



The form shown as Appendix I served to aid in collecting and assembling the data on the subjects of the study.

Statement of Hypotheses

First, it is hypothesized that there will be a significant difference in the gain scores of the experimental and control groups in favor of the experimental groups in the following areas: (1) Reading Readiness; (2) Number Readiness; (3) Total Readiness.

Second, it is hypothesized that (1) there will be a significant difference in gain scores of the experimental and control groups in intelligence, and they will favor the experimental groups.

Third, it is hypothesized that the improvement in the neuro-muscular skills will be significantly higher with the experimental than with the control group.

Curriculum Modifications

The curriculum experiences of the experimental and control groups are to be as much alike as possible with the exception of the experimental variables as identified. The following schedule of activities was developed to be used by the teachers so as to provide for variety and scope in the experimental program. The activities listed were selected after reviewing relevant literature and consulting with specialists in physical education and vision. It is assumed that the selected activities will contribute positively to the physiological development of the children.

The neuro-muscular activities were carried on during the regular physical education period in place of the social games and rhythm activities which characterized the control program. These activities were outlined as follows:

I. Neuro-muscular Skill Activities

  A. Even Days

    1. Balance Beam

    2. Angels in the Snow

    3. Stomach Roll

4. Rolling Sit-up

5. Bent Knee Sit-up

B. Odd Days

1. Feet Lift

2. Sit-up

3. Roll from Back to Hands & Knees

4. Roll from Back to Hands & Feet

5. Toe Touch

6. Creeping & Crawling

II. Vision Organization

Vision organization activities were chosen to develop motility and a smooth neuro-muscular response. They were carried on twice a week, Tuesdays and Thursdays, for approximately ten minutes per day. Special emphasis was placed on vision fixation in each of the activities which was carried on during the physical education period. The classroom activities used were as follows:

1. Horizontal Eye Movements

This activity involved the child holding his arms extended to the front of his body with forefingers on each hand raised. The child would then focus on the left forefinger and then sweep smoothly to the right, then back to the left. This was repeated several times

with emphasis on smooth sweeping movements and clear focus at each terminal point.

2. Space Perception

This activity involved having the subjects hold a pencil or some such object approximately 10 to 12 inches in front of his nose. He was then directed to focus on the end of the pencil and then out to some point across the room, then back to the near point object. This was repeated with emphasis on smooth coordinated movements and clear focus at both near and far point locations.

3. Circular Rotation

This activity involved the child standing erect. Without moving the head the eyes followed the circular path of the subject's arm as he moved it in a circular pattern in front of the body. The same activity was carried on with the child balancing on one foot and using the other leg to form the circular pattern.

4. Bimanual Circles

This procedure involved children using both hands to form circles in the air or on chalkboard. These movements should be free flowing, smooth, and coordinated. They are varied from clockwise to counterclockwise.

5. Bimanual Straight Lines

This activity involved the child working on a series of straight line patterns. He used both hands and began at two points, one to the right and the other to the left of his body. From these points he drew lines in to the center at which point they met. This was repeated at successive distances up and down the board so long as they could be reached comfortably by the child. An alternate pattern used involved starting at the same midpoint and drawing out in a straight line which was parallel to the bottom edge of the board.

Another pattern involved working from a diagram outline resembling the hour positions on the face of a clock. In this pattern the individual would begin at the mid-point or distant points such as six and twelve and draw in or out depending on the starting point.

III. Perception Training

This work was carried on three times a week, Monday, Wednesday and Friday, for approximately ten minutes per period. It usually was a part of the writing readiness period, and contrasted to the crayon work experienced by the control group.

This skill was developed through the use of commercial geometric form templates.[3] The children first traced the form with their index finger in a directed pattern which corresponded with writing strokes. Following this the template was placed on unlined newsprint and a pencil was used to trace the pattern. This was retraced ten times, the template was then removed, retraced again after which the child made another pattern of this size and shape on the same paper without the aid of the pattern or template.

The five geometric shapes used included the circle, square, rectangle, triangle, horizontal diamond, and vertical ciamond. These were introduced in this sequence in the frequency deemed acceptable to the teacher in light of the observed progress. Periodic review of previous forms was included throughout the entire sequence.

These variables -- neuro-muscular coordination, vision organization, and perception training -- will be analyzed according to the design presented. This should determine whether or not they offer significant assistive influence

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[3]Appendix C - The templates were cut from 1/4" cardboard, and were obtained from the Winter Haven Lions Club, P.O. Box 1049, Winter Haven, Florida.

relevant to the fuller development of human potential. If it is found that this influence is statistically significant, then this information will be of epistemological relevance. If these variables can be effectively implemented to the advantage of children as hypothesized and tested then it would seem that such advantages might well be provided as a basic and systematic part of the regular program.

CHAPTER II

REVIEW OF THE LITERATURE

Research and literature related to neuro-muscular coordination, vision organization, and perception as they influence the development of individual potential will be reviewed in this chapter. Within these areas the review seeks to present representative views drawn from an inter-disciplinary base.

Since the relationship between human potential and neuro-muscular coordination has received relatively recent attention no comparable studies were found. The major amount of material was drawn eclectically from the behavioral sciences. For this study the variables of vision organization, neuro-muscular coordination, and perception were introduced together and no attempt was made to evaluate the independent effect of any one variable in isolation.

The fuller development of human potential is of interest to many who work in the behavioral sciences. There is a perceptible and growing acceptance of that point of view which suggests an interdisciplinary approach as answers are sought. Hence, the eclectic choosing from the several relevant disciplines should bring into sharper focus the interrelated dimensions of this problem. From this there may then emerge a new depth of insight and understanding

which will make possible a more prescriptive approach to the process of education.

Philosophical Perspectives

The differences which separate the schools of thought regarding growth and development are ones of degree rather than kind. One school of thought holds closely to the maturation theory. This view can be likened to what has been called the biological clock; and according to this view, development takes place according to some pre-ordained time sequence. The other school of thought, while recognizing basic maturational principles, sees development as dynamic and subject to assistive environmental influence.

Both schools would claim to offer activities which are assistive to development. The essential point of disagreement centers on what is more relevant for a given period in the child's life. One school would select a less formal and less structured approach. The other would seek to provide in a carefully structured setting those sequential experiences which are related to skill mastery.

This latter school of thought has been gaining increasing prominence. It has long been associated with Piaget, and has recently been brought into focus and summarized by Gloria F. Wolinsky.[4]

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[4]Wolinsky, Gloria F., "Jean Piaget's Theory of Perception", Science Education, III, (February, 1964).

> Piaget's major contribution is his addition of fuel to the always smoldering fire of thought that believes that children are more than simply their biological heritage. His work extends further than classical developmental theory; for, rather than waiting for this biological heritage to unfold, Piaget's work on perception, as well as most of his observations on cognitive development, leads us to the point where we can begin to examine the assistive aspects that an environment can afford to its children as they proceed through life.[5]

One of Piaget's former students, Eleanor Duckworth[6], summarized her perceptions of his beliefs. She states that Piaget sees intellectual development as taking place in a developmental sequence and subject to the influence of pedagogical practice. Four factors contribute to this development. These include nervous maturation, encounters with experience, social transmission, and equilibration. With the first three of these factors the individual plays a passive role; but in the fourth, that of equilibration, the individual is actively engaged in the process of internalizing, integrating, and coordinating. It is from this process that intellect is generated, and it is of necessity an active process.

When the proper recognition is afforded these factors then the basic purpose of education, as viewed by Piaget,

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[5] Ibid., p. 27.

[6] Duckworth, Eleanor, "Piaget Rediscovered," Journal of Research in Science Teaching, (John Wiley and Sons, Inc., New York: 1964) II, p. 172.

will be achieved.

> The principle goal of education is to create men who are capable of doing new things, not simply repeating what other generations have done -- men who are creators, inventors, and discoverers. The second goal of education is to form minds which can be critical, can verify and do not accept everything they are offered.[7]

Such a goal can best be achieved in an academic climate where differences can be exposed and challenged responsibly and without threat or emotional involvement.

Such a perspective offers both hope and challenge to the teacher. It provides hope by freeing the teacher from having to sit back and wait for this maturation or biological unfolding to occur, and it offers her the challenge to create the appropriate learning environment which will make available those kinds of learning experiences which are believed to be most appropriate.

> In effect, what Piaget is saying is that the complex of operations which have the characteristic of a Gestalt or 'structure d'ensemble' are not preformed or innate in an individual. They actually evolve out of a history of a person's interactions with the environment . . .[8]

The acceptance of this philosophy on the process of development opens whole new arenas of opportunity to both the home and the school.

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[7] Ibid., p. 175.

[8] Wolinsky, op. cit., p. 26.

Another equally dynamic theory regarding growth is expressed by Combs.[9] His thesis emphasizes the importance of how the individual is presently perceiving things. While he does not discount the relevance of what has happened in the past, he points out that this is something about which we can do very little. However, we can greatly influence the present; and it is to this period, the present, that our efforts can most fruitfully be directed.

An additional philosophical perspective needs to be viewed, and as in the case of the preceding ones, it too holds much in common with that expressed by Piaget. Yet there are distinct and unresolved differences.

> Experience over the past decade points to the fact that our schools may be wasting precious years by postponing the teaching of many important subjects on the ground that they are too difficult.10

The case is considerably broader than one of mere difficulty, and this is not offered as necessarily a point of difference with the author. The question is one of what are the experiences which are most relevant and appropriate to the child and when can and should these be presented?

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[9]Combs, Arthur W., "Seeing is Behaving," Educational Leadership, XVI, (October, 1958), pp. 21-26.

[10]Bruner, Jerome S., The Process of Education, (Harvard University Press, Cambridge: 1961), p. 12.

In support of his expressed concern over the factors of time and experience Bruner points out that

> ...there is evidence to indicate that such rigorous and relevant early training has the effect of making later learning easier. Indeed the experiments on 'learning set' seem to indicate just that -- that one not only learns specifics but in so doing learns how to learn. So important is learning per se that monkeys who have been given extensive training on problem solving suffer considerably less loss and recover more quickly after induced brain damage than animals who had not been previously thus educated. But the effect of such early training may be that it has the effect of training out original but deviant ideas. There is no evidence available on the subject, and much is needed. [11]

Another dimension of the problem is discussed by Maslow. This involves the individual and his role in the self-actualization process. "The sources of growth and of humanness are essentially within the human person . ."[12] Yet the maximal positive effect will only be achieved when there is effected an orchestration between the multiple influences of society, the home, school, and the individual.

Perception

The literature regarding perception is filled with commentary which appears, while relevant, yet incomplete.

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[11] Ibid., p. 47-48.

[12] Combs, Kelley, Maslow, Perceiving, Behaving, Becoming, (Yearbook: ASCD, 1962), p. 46.

> Nowhere in the literature can we find in concise and adequate form a well-rounded account of what perception is, what its characteristics are, and/or how it relates to other aspects of behavior . . . Most workers in the area of perception have been preoccupied with refining some quantative detail, or investigating some single aspect of behavior, and have not devoted themselves to rounding out a statement of perception. 13

Perception, as used in this study, is that which occurs when an individual enters purposefully into thought and/or motor processes which result in experiences fostering internalization and integration of ideas into the visual structure of the subject.

This definition draws from several writers, especially from Piaget.[14] He views cognitive development as an embryogenetic process where learning is limited to a single structure and is atomistic. Knowledge comes about in a spontaneous process in which the subject is operational and active. Four main factors serve to explain this process of development. These include (1) maturation, (2) experience, (3) social transmission, and (4) equilibration. All are structure based, and it is at this juncture where divergence emerges. Can this structural base be developed

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[13]Bartley, S. Howard, Principles of Perception, (Harper and Brothers, New York: 1958), p. 449.

[14]Piaget, Jean, "Cognitive Development in Children", Journal of Research In Science Teaching, (John Wiley and Sons, Inc., New York: 1964), II, pp. 176-186.

in such a way that it possesses a lasting value and relevance to the individual?

While Piaget expresses doubt regarding this point, Bruner and others would agree that the question can be answered in the affirmative. In fact Davis states that

> . . . the cardinal principle of social psychology would indicate that basic learning can and does appear at any age level, provided that society or the physical environment changes the organization of its basic rewards and punishments for the individual. 15

This would assume that the maturational level of the individual is in keeping with the task requirements.

There is within the literature a growing acceptance of the idea that while man may have a genetically inherited potential he falls far short of developing it to any maximal degree. There are multiple and interrelated variables which are suggested as relevant to this problem. These include time and experience.

> These studies suggest the following conclusions. Early in the life of mammals, including humans, certain critical stimuli must be encountered for normal development and normal adult behavior to occur. If such stimuli are lacking in the environment, or if they are presented to the animal at inappropriate times in his life, non-normal behavior will occur . . . The generalization might be made that, in certain instances, the failure of 'Johnny' to show normal advances in intellectual functions might not be due to any inadequacies of educational

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[15] Davis, Allison, Social Class Influence on Learning, (Harvard University Press, Cambridge: 1948), p. 32.

> principles or native endowment. Rather such deficiencies might occur as the result of failure to experience critical stimuli and to make critical responses at appropriate times during early learning and experience. 16

This would suggest that our culture has not actively recognized and placed the proper emphasis on the importance and role of parenthood, and it appears that the consequences of this are especially critical during the child's early developmental years. Montessori, in commenting on human development, stresses that "the period of infancy is undoubtedly the richest . . . the waste of this period of life can never be compensated." [17] Perhaps our trial and error approach to parenthood has been more costly than we have realized. Indeed, it may well account for one of the variables which has served to preclude the fuller development of human potential. The early years are crucial, and she emphasizes that "to this period, more than any other, it is imperative to give active care."[18]

The resulting decrement to the child from society's insensitivity to the crucial importance of these early

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[16] Sackett, Gene P., "How Much of Reading is Readily Learned?", 1963 Claremont Reading Conference, Twenty-Seventh Yearbook of the Claremont Reading Conference, Claremont, California: Claremont Graduate School Curriculum Laboratory, 1963, pp. 112-113.

[17] Montessori, Marie, The Absorbent Mind, (Adyar, Madras 20, India: The Theosophical Publishing House, 1961), p. 3.

[18] Ibid., p. 2.

years has bearing on the development of the total being. "It happens that if a child is prevented from using his powers of movement as soon as they are ready, the child's mental development is obstructed."[19] Yet it is relatively recently that we have been alerted to the existing linkage between the several developmental areas and stages. This was expressed in a specific sense when Montessori wrote that "no sooner has an organ evolved than it must immediately begin to act in its proper sphere . . . If such experiences be not obtained, the organ fails to develop normally."[20]

One must conclude that this development takes place only to the extent that the child experiences the proper stimuli. Therefore, by providing for a more adequate childhood, a more "complete" adulthood can be achieved.

The effects of early experience are commented on by Penfield[21], a neurosurgeon.

> But there is a large area of cortex underneath the temples and covering a given part of each of the two temporal lobes that is uncommitted at birth. This uncommitted cortex will in time be used for language and for perception. It will make possible the memory and use of words, as well as the memory and interpretation of experiences.

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[19] Ibid., p. 76.

[20] Ibid., p. 90.

[21] Penfield, Wilder, M. D., "The Uncommitted Cortex," The Atlantic Monthly, July, 1964.

> As the child begins to understand, electric currents must pass in corresponding patterns through this cortex. After each time of passage, it is easier for the later currents to follow the same trail. This tendency toward facilitation of electric passage results in man's amazingly permanent records of the auditory and visual stream of his conscious life...."[22]

The question of what experiences and to what degree for a given stage of development remain to be answered. Yet they are essential, fundamental, and basic questions if imbalance is to be avoided; and perhaps such a condition already exists. "We have gone too far in stressing the psychological needs. A parent will worry about frustrating his or her child lest it develop emotional trouble. But this same parent does not hesitate to inflict upon the child the physical frustration of playpen and stroller, thereby causing physical as well as emotional damage."[23] Such is the view of Kraus, and it parallels that expressed by Montessori whose many faceted background includes medicine, psychiatry, and education.

Kraus reports that "clinical studies over the years have convinced us there is a minimum of muscular strength and flexibility below which the individual must not drop if normal healthful living is to be enjoyed."[24] He goes

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[22] Ibid., p. 78.

[23] Prudden, Bonnie, Is Your Child Really Fit?, (Harper and Brothers, New York: 1956), p. ix.

[24] Ibid., p. vii.

on to report that despite this evidence it is reported that "more than half of our boys and girls -- four out of every seven between the ages of six and sixteen -- are today unable to measure up to the simplest basic standards of muscular strength and flexibility."[25]

Lackmann[26] studied the perceptual-motor development in children retarded in reading ability. While he found a decreasing frequency of difficulty with increasing age he concluded that although perceptual-motor problems cannot claim to explain fully the presence of reading disorders the distortions were indeed offered more frequently by the reading disability children than by the normal children.

Kephart[27], who directs the Achievement Center for Children at Purdue University, attaches great importance to perceptual-motor development. He contends,

> . . . in a significant percentage of children, accidents occur during the developmental period. The accident may be any one of a large number of events. Its effect is to interfere with the establishment of a stable perceptual-motor world. As a result children come into our school systems lacking the fundamental assumptions which underlie so much of the material which we present... Consistent and efficient motor patterns

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[25] Ibid., p. 1.

[26] Lackmann, Frank M., "Perceptual-Motor Development in Children Retarded in Reading Ability," Journal of Consulting Psychology, XXIV, No. V, pp. 427-431.

[27] Kephart, Newell C., "Perceptual-Motor Aspects of Learning Disabilities," Exceptional Children, Dec., 1964.

> permit the child to explore his environment and systematize his relationships to it. Perceptual data are similarly systematized by comparing them with this motoric system. Through such perceptual-motor matching, the perceptual world of the child and his behavior world come to coincide. It is with this organized system of perceptual input and behavioral output that the child attacks and manipulates symbolic and conceptual material in a veridical fashion. 28

Developmental differences between the sexes have long been recognized. Occasionally one sees the point of view advanced that possibly our female dominated child rearing practices may, at least in part, account for this. Nevertheless these differences are generally accepted as existent, and they continue to be studied.

The research in the area of self-esteem and self-concept would indicate support for the belief that by effecting a more positive personal image regarding personal competency the individual is able to utilize more effectively his intellectual resources. This would seem to indicate the existence of linkage between the use of intellectual potential and adequacy in such areas as neuro-muscular coordination, etc. In a study of self-esteem as developed through school success and failure it was found by Lowther[29] that pupils are strongly

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[28] Ibid., p. 201.

[29] Lowther, Malcolm A., "Academic Achievement and Self-Esteem," University of Michigan School of Education Bulletin, XXXV, No. 1, October, 1963, pp. 8-11.

influenced by school success and failure.

The compounding consequences of insufficient successful experience are sobering, and in a sense they are hereditary in nature. That is to say, they are cumulative and transferable through the process of social transmission and acculturation.

One recent study showed a rather interesting and somewhat questionable finding regarding sex differences.

> An analysis of difference scores indicated a significant decrement in coding performance under high frustration when compared to no frustration conditions only for boys . . . Although the main effect of frustration was not significant for girls, they tended to respond in a direction opposite to that of boys. Under high frustration conditions, males showed a significantly greater decrement in performance than did females, whereas in the no frustration group, performance of girls showed a decrement, while boys improved. 30

Many practices persist because of misunderstood theories and thereby impede progress. Lynn[31] lists three. These include (1) the maturation theory of delayed perceptual power in infants, (2) the widely-held belief that early cognitive stimulation has undesirable emotional effects on children, and (3) the belief that intelligence

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[30]Solkoff, Norman, et al, "Effects of Frustration on Perceptual-Motor Performance," Child Development, June, 1964, p. 569.

[31]Lynn, R., "Reading Readiness and the Perceptual Abilities of Young Children," Educational Research, (Newnes Educational Publishing Co., Ltd., London: November, 1963) p. 14.

is largely determined by inheritance.

Cultural factors also affect perception. Riessman emphasizes that in our culture we reward speed; yet this is not characteristic of all cultures. "The teacher should know that pupils may be slow for reasons other than being stupid . . . The assumption that a slow pupil is not bright, I think, functions as a self-fulfilling prophecy."[32]

The need for a balance and interweaving between the many aspects of development is becoming increasingly recognized. Illustrative of this is the book How to Develop Your Child's Intelligence.[33] In this book the author specifically discusses the importance of neuro-muscular and vision organization activity, and he outlines basic motor patterns which are designed to effect this coordination. The importance of this is basic for it has been said, "Thoughts which do not get into the muscles never fully possess the mind."[34]

The laboratory research of psychologists has led to many insights which offer implications for the fuller understanding of man. We cannot assume that because a

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[32]Riessman, Frank, The Culturally Deprived Child, (Harper, New York, 1962).

[33]Getman, G. N., O. D., How to Develop Your Child's Intelligence, (Luverne, Minnesota, by the author, 1962).

[34]Ibid., p. 39.

certain thing happens consistently with a particular animal form that this has relevance to man, but by the same reasoning it cannot be assumed with certainty that there is no such existent relationship.

> The child is father to the man in a manner that may be irreversibly one-directional, for to make up for a bland impoverishment of experience early in life may be too great an obstacle for most organisms. Indeed, recent work indicates that for at least one species, the utilitarian rat, too much gray homogeneity in infancy may produce chemical changes in the brain that seem to be associated with dullness. One wonders, then, about the issue of appropriate exercise of the mind early in life as a condition for fullness later. 35

Can it be that the inability of man to develop more fully his innate potential is in part attributable to the variable of color?

Possibly the perceptual development of children has been unconsciously impeded by teachers. This could result from their failing to provide opportunity for the child to use the skills which he has already gained. Montessori, in commenting on human development, summarizes by stating, "this philosophy teaches us never to give more help than is absolutely necessary."[36] She goes on to stress the importance of the teacher creating a learning environment which is emotionally and intellectually stimulating. From her perspective as an educator and psychiatrist she suggests

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[35]Bruner, Jerome S., On Knowing, (The Belknap Press of Harvard University Press, Cambridge: 1962), p. 7.

[36]Montessori, op. cit., p. 154.

that when we persist in giving more help than is needed we undermine the development of self-confidence and the emotional maturity of the child.

The consequences of adult imposition on the child when he is striving to gain independence and self-actualization tends to weaken rather than strengthen the child's perception of himself. "Psychologists in these days are convinced that help of this kind, interrupting, as it does, the child's self-chosen activity, is one of the most harmful forms of repressive action we can take. The nervous troubles of many (difficult) children can be traced back to this kind of interference."[37]

What is the relatedness of readiness to perception? Is our understanding of this concept in keeping with the literature and research?

In commenting on readiness Bruner writes that " . . . readiness . . . is a function not so much of maturation as it is of our intentions and our skill at translating ideas into the language and concepts of the age level we are teaching."[38]

This would suggest at least two dimensions to the problem of perception. The first involves the mind-set of the individual teacher who is in the position to design

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[37] Ibid., p. 159.

[38] Bruner, On Knowing, op. cit., p. 108.

and to some considerable degree control the curricular experiences which will be afforded the child. The second is one of communication or language, and this should be considered as inclusive of both verbal and nonverbal language.

One of the conclusions which emerged as an outgrowth of the 1959 Woods Hole Conference of the National Academy of Science on curriculum in science has specific bearing on the relationship between perception and readiness. "We begin with the hypothesis that any subject can be taught effectively in some intellectually honest form to any child at any stage of development. It is a bold hypothesis and an essential one in thinking about the nature of curriculum. No evidence exists to contradict it; considerable evidence is being amassed to support it."[39]

If this statement is accepted then the question which emerges is one of what are the most appropriate learning experiences for a given stage of development. Although one may not be able to answer the question in total, considerable evidence does exist and is too often ignored. For example consider the previously cited work of Penfield[40] where he speaks regarding language development and the crucial importance of early exposure for natural mastery.

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[39] Bruner, The Process of Education, op. cit., p. 33.

[40] Op. cit., p. 22.

Yet the preponderance of foreign language instruction is programmed far after these years of maximal perceptual receptivity.

This raises the question of the consequences of limitation of opportunity. There is amassed evidence regarding this variable, and it is of such a nature as to command serious attention. The data covers both laboratory experimentation with animals and literature relating to educational deprivation among humans. In the case of laboratory experimentation the work dealt with sensory deprivation, and the subjects were mostly dogs. "Raising a dog in a highly impoverished environment, where there is little variety and no challenge to problem solving, produces a seemingly irreversible stupidity in the adult animal."[41]

The implications from this would lend support to the growing concern that the early exposure be such as to provide the child with a rich perceptual base. In the case of the educationally deprived this may make necessary the establishment of formal settings wherein and through which these experiences can be provided if perceptual deprivation is to be avoided.

When such experience is provided, demonstrable gains in favor of this kind of program can be shown. A research-

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[41]Bruner, On Knowing, op. cit., p. 142.

demonstration experiment in nursery education described by Silberman[42] stresses the importance of getting across the notion that every object has a name, sometimes many names. A teacher may use puppets or other replicas of people, animals, and objects to illustrate the story she is reading to drive home the relation between people and things. To help develop a sense of self, the room contains a great many mirrors; many children have never seen themselves in one. The author concludes that "schools which wait until kindergarten or first grade will need to employ many, many more resources to do what they might do with comparative ease for children at age three or four."[43] Bruner summarizes the case with the conclusion that "early sensory and intellectual deprivation prevents the kind of intellectual and emotional unfolding that nourishes early learning and makes later learning possible."[44]

Neuro-Muscular Fitness

Recognition of the linkage between the various areas of development has existed for some time, and substantiating data continues to be amassed. Gesell noted that

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[42] Silberman, Charles E., "Give Slum Children a Chance", Harpers, May, 1964.

[43] Ibid., pp. 27-42.

[44] Bruner, On Knowing, op. cit., p. 144.

> . . . experimental biology and experimental medicine are gradually placing the phenomena of growth on a firm basis of fact, and at the same time they are dissolving the ancient distinction between mind and body by bringing the functional and structural aspects of growth into integrated relation. Growth is a unifying concept. 45

Sensing the pervasive influence of this concept, Gesell states

> . . . but one cannot make a frontal attack upon the psychology of personality; because personality is really the sum and result of all possible forms of behavior. So one must approach the subject from several angles . . . . Naturally, we begin with the child's motor characteristics, because the very core of his physical and practical self is muscular. 46

Other writers, sensing this importance, have ascribed substantial weight to the importance of the child developing proper and adequate motor patterns. These patterns are basic and follow a common developmental sequence.

Many of the cases with which some of the writers deal have experienced some form of developmental anomalie resulting in inadequate neurological organization. Some of them speak of remedial therapy and of its benefit to specific areas such as reading. Others point out that

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[45] Gesell, Arnold, Infancy and Human Growth, (MacMillan, New York: 1928), p. vii.

[46] Gesell, Arnold, and Ilg, Frances L., The Child From Five to Ten, (Harper and Brothers, New York: 1946), p.224.

actually this is much too restrictive, and that the benefit is much more pervasive in scope. The approach used has many common features, and "because of the myriad of nerve connections the muscular system is really a neuro-muscular system."[47]

Curricular experiences should be in keeping with neuro-muscular development of the child. Many have commonly verbalized the cephalocaudal, proximo-distal, gross-fine, homo-lateral ipsilateral principles of development, but we need to ask whether or not our program actually makes adequate provision for this kind of development. Again, Gesell reminds us that "nature cannot wait until birth of the child to lay down the primary networks for the coordination of the neuro-muscular system . . . Even the unborn body is capable of making movements and of striking attitudes. Some of these movements involve gross muscles, many involve the fine."[48]

The importance of recognizing and providing opportunities where these muscles can be used has previously been cited through the work of Montessori.

> The basic premise of the neuro-psychological approach . . . is that if man does not follow this schema he exhibits problems of mobility and communication. To overcome

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[47] Ibid., p. 225.

[48] Ibid., p. 225.

> such problems one evaluates the subject via the neurological schema . . . Those areas of neurological organization which have not been completed or are absent are overcome by passively imposing them upon the nervous system of those with problems of mobility and are taught to those with problems of speech or reading. When neurological organization is complete the problem is overcome. 49

It should be noted that this approach, bold as it is, suggests that by proper diagnosis we can identify existent developmental voids or inadequacies, and then proceed to develop a program which will "fill in" these deficiencies in the individual's neurological organization. "If one is not afforded the opportunity to develop this total neurological organization, he cannot become totally human, and as a result, cannot communicate at the level at which he might have been able to had his neurological organization been complete."[50]

This is basically the same position which characterizes the work carried on by Dr. Kephart at Purdue University. He advocates the development of an adequate perceptual base, which is dependent on sound neurological organization. "Form perception develops out of the more fundamental motor skills including posture, laterality, and directionality.

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[49] Delacato, Carl H., The Diagnosis and Treatment of Speech and Reading Problems, (Charles C. Thomas, Springfield, Illinois, 1963), p. 7.

[50] Delacato, Carl H., "The Ontogeny of Reading Problems", 1963 Claremont Reading Confereace, Conference, 27th Yearbook, Claremont Graduate School Curriculum Laboratory, Claremont, California, 1963, p. 124.

These motor skills can be easily and quickly taught."[51]

In another study Kephart[52] and Kagerer evaluated the posture of a group of first grade children, and then compared their ratings, very rigid to very flexible, with the children's school achievement. They found that those with rigid posture were academically at the bottom of the class while those who were rated as having loose, comfortable posture were at the top.

Rhythmic training and motor activity are an integral part of the Winter Haven, Florida program [53] which fosters perceptual development. Special template forms have been developed to aid in developing basic form perception, and a perception form test has been standardized to measure perceptual difficulty.

One of the particularly interesting features of this project has been its interdisciplinary staff, and the evolutionary development and interest it has sustained. Specialists from architecture, engineering, education, medicine, psychology, and vision comprise the team.

In a recent study of motor achievement of some forty-three underachieving boys who came from middle and upper

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[51]Kephart, Newell C., Success Through Play, (Harper and Brothers, New York: 1960), p. 49.

[52]Ibid., p. 33.

[53]Rice, Arthur H., "Rhythmic Training and Body Balancing", The Nation's Schools, February, 1962.

class families, the following findings were reported.

> Age was an important differential in describing the motor characteristics of the Clinic School boys. The Clinic School boys cannot be characterized as deficient in motor skills, but a substantial number in the younger age group have serious remedial needs in terms of motor performance. If generalized failure is a central problem in children with learning disorders, one-half of the younger boys seem destined to compound and support their learning disorders, by problems which they have in terms of physical performance. 54

The existent evidence which relates to the development of self-concept would clearly support the belief that linkage does exist between these various areas of function.

Few would argue that motor deficiency cannot be identified and that programs cannot be designed to bring about improvement in performance. Many are not convinced concerning the linkage between this kind of neuro-muscular organization and improvement in other areas outside of those of self-concept and self-esteem. Does a linkage exist between neuro-muscular organization and other areas of performance aside from self-concept and self-esteem, or is this only myth?

This neuro-muscular approach is not offered as a panacea for all educational ills, but its proponents suggest that it has far greater value than is commonly

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[54] Keogh, Jack, et al., "Motor Achievement of Underachieving Boys," Journal of Educational Research, LVII, No. 7, March, 1964, p. 342.

recognized. The major features of this approach can be found in some form in the work being carried on at the Gesell Institute of Child Growth and Development, at Winter Haven, Florida under Dr. Harmon, at Purdue University under Dr. Kephart, and at the Institute of Language Disability in Philadelphia under Dr. Delacato. From each center one gets impressive reports of great progress resulting from this approach. In reviewing the literature regarding these projects one finds a surprisingly parallel approach being followed.

A recent study, which is yet to be published, was made by Ball and Edgar in California regarding the benefit of sensory-motor training for kindergarten children. This matter holds both therapeutic and theoretical interest. Their findings are summarized below and are based on a study involving control, experimental, and placebo groups.

> Kindergarten children were given three and one-half months of intensive sensory-motor training following Kephart's procedure. At the end of training, their gains on non-practiced measures of generalization exceeded those of the control group that received individualized attention but no training and a second control group that received neither training nor attention. 55

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[55] Ball, Thomas S. and Edgar, Clara Lee, "The Effectiveness of Sensory-Motor Training in Promoting Generalized Body Image Development", Research Report, (Supported by Research Grant No. 62-14-36 from the California State Department of Mental Hygiene), Pacific State Hospital, Pomona, California.

The research team goes on to recommend that the competing, and sometimes contradictory, approaches in this area need to be evaluated. Some of the approaches reflect a considerably more sophisticated procedure than others. These should be evaluated, but separate research would hardly seem warranted in all cases.

The importance and value of good neurological organization has been recognized by some of the world's most profound thinkers.

> For example, Socrates stressed that poor health can contribute to grave mistakes in thinking. Comenius noted, 'Intellectual progress is conditioned at every step by bodily vigor. To attain the best results, physical exercise must accompany and condition mental training.' Rousseau observed that 'an enfeebled body enervates the mind' and included a rich program of physical activities for Emile." 56

Vision Organization

Vision, in the sense used here, involves the process of interpreting what is seen. It is what the brain does with the information which comes from the eye. Hence sight, which is the ability to transduce light rays into the electrical energy which can then be conducted to the brain, is a component of the visual process.

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[56] Bucher, Charles A., "Health, Physical Education, and Academic Achievement," N.E.A. Journal, May, 1965, p. 38.

Ames[57] pioneered in the study of vision and perception. He says

> . . . the visual impression is a sensation, and is derived from past experiences, i.e., it is the significance of past experience. From one aspect, past experience is more truly the source of visual expression than the object. It would be nearer the truth to consider the significance of past experience as the source of impression and the immediate situation as the catalytic agent which is responsible for the particular significance sensually experienced. 58

Bartley, in his discussion of Psychology and the Healing Arts, states "Professional optometry has come to conceive its work as one of providing visual skill to young and old. The focus of attention in this profession has left the eye and reaches the whole person as he operates in a space world."[59] In effect their concern is now one of vision rather than just sight. The prescribing of eye glasses is but one component in the vision analysis. "Professions providing this comprehensive care train visual skills in their patients, for they realize that vision is a learned achievement."[60]

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[57]Cantril, Hadley, The Morning Papers of Adelbert Ames, Jr., (Rutgers University Press, New Brunswick: 1960).

[58]Ibid., p. 3.

[59]Bartley, Op. cit., p. 457.

[60]Ibid.

A recent study conducted at the Medical School of the University of California by Dayton and Jones of the Pediatrics Department, indicates that the eyesight of newborn babies is much better developed than previously thought. Their study indicated that

> . . . instead of having poor vision, babies can actually see most objects quite distinctly and are able to use the two eyes together to a remarkable extent.
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> . . . These former concepts held that the use of the eyes together (binocular vision) and the ability to see small objects were not present in the first six weeks of life . . . There is no need to delay therapy for conditions such as cross-eyes (strobismus) until the child is several years old, Dr. Dayton said. Early diagnosis and prompt treatment will speed correction and prevent the harmful effects of vision disorganization in the young. 61

Eames, Ophthalmologist and Professor of Education at Boston University, offers data which is significant for those who are concerned with providing developmentally appropriate experiences for children.

> Recently there has appeared among educators a theory that children enter school before their eyes are mature enough to cope with the demands made on them by the curriculum. This is important if true. Since the major first grade subject is reading, which requires sustained accommodative effort, the literature was consulted with respect to this function at early school ages. No data were found below the eight year level.

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[61] "Babies Eyes Not So Bad After All", Enquirer and News, (Battle Creek, Michigan: December 8, 1964), p.6.

> Children enter school below this and their accommodative ability is of consequent interest. Have they enough accommodation to do the work easily or are they overtaxed? 62

After studying some 899 children Eames concluded:

> No five-year-old children in any category and no suburban children at any age fell below the minimum deemed necessary for sustained effort bookwork. Urban, (and consequently composite groups) presented a gradually increasing frequency with increasing age from five through seven years. This ranged from four percent among six-year-old urban girls to seven percent at the age of seven years. So far as accommodation, as evidenced by punctum proximum, is concerned this study does not support the recent educational contentions that reading and book work impose too great a task for the relatively immature eyes of school entrants and that such work should be deferred. 63

What are the resultant consequences on the emotional development and self-concept of children when they are deprived of experiences for which they are ready? If they are not "ready" then can we influence in a positive way the development of a state of readiness?

In reviewing Olson's views one senses that his use of the term vision is more closely parallel to the term sight as earlier defined. He states that the literature

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[62] Eames, Thomas H., "Accommodation in School Children", American Journal of Ophthalmology, LI, No. 6, June, 1961, pp. 1255-1257.

[63] Ibid.

on visual factors in reading is a welter of conflicting findings and claims. Perhaps this difference in meaning associated with the term vision accounts for part of this confusion. He does state "it seems clear that eye movements are perfected by some combination of maturation and learning."[64] The problem then is one of identifying what learning experiences are appropriate and positively significant in influencing healthy development.

Vision, in the sense used here, has multiple dimensions. One of these, accommodation, has already been reviewed. Another is reported on by Gibson and Walk and is based on their research which was carried on at Cornell University. They concluded, after studying several forms of animal life including humans, "we are ready to venture the rather broad conclusion that a seeing animal will be able to discriminate depth when its locomotion is adequate, even when locomotion begins at birth."[65] This would seem to infer a possible linkage between neuro-muscular organization and the visual process.

Apell, Director of Vision Department at Gesell Institute of Child Development, states that "the vast majority of young children, even though they are healthy, happy, and

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[64]Olson, Willard C., Child Development, (Heath, Boston: 1949), p. 137.

[65]Gibson, Eleanor J. and Walk, Richard D., "The Visual Cliff," Scientific American, April, 1960, p. 71.

normal, could get a great deal more out of their initial school experience if their basic skills were better developed."[66] Hence, while these procedures are especially vital to the needs of neurologically disorganized children they also benefit normal children to a significant degree. "Optometrists and psychologists tested 2200 children in grades three through twelve, and they found that four out of every ten have visual skills below the level required to do good school work."[67] They go on to point out the direct relationship between good vision and school achievement.

Lowder[68] studied every child in the first three grades in Winter Haven, Florida. The total sample was 1510 subjects, and he concluded that the Perception Form Achievement Test provides results which are more closely associated with academic achievement than is the standard intelligence test. In addition it should be noted that the test serves diagnostically to identify cases of perceptual weakness, and through training these can be corrected.

In addition to the literature and research reports concerning visual organization, perception and neuromuscular coordination inquiry was directed to the Gesell

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[66] Radler and Kephart, Success Through Play, op.cit., p. xv.

[67] Ibid., p. 13.

[68] Lowder, Robert Glenn, Perceptual Ability and School Achievement, Dissertation Study, Purdue University, 1956.

Institute of Child Development concerning this type of activity and their opinion regarding it. Their reply follows:

> We in the visual department do use gross motor activities in our therapy. The purpose of these is to build better visual posture-body matching. Our goal is to get better visual performance in terms of the individual being able to better understand what he sees and be able to act more effectively with less effort in a shorter time:
>
> 1. Being able to see the greatest number of possibilities in any situation and thus arriving at a higher prediction of probability.
>
> 2. To make an act in accordance with the predictability with the least amount of effort in the shortest time.
>
> When we assume one of the greater values of vision is to direct actions, and thus direct our therapy in accordance with the previous total directions, there comes a time in therapy, when general motor activity does become involved to a high degree. 69

Summary

The literature offers support for the use of these activities which are designed to bring about improved neuro-muscular, perceptual, and visual organization. The activities are already being used by individuals over a

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69 Streff, John W., O.D., Director of Visual Research, Gesell Institute of Child Development. (Letter in the writer's file).

wide geographic area; yet their dissemination and acceptance within the professional ranks remains to be accomplished. One of the strengths of this approach probably comes from its having evolved from an inter-disciplinary base of concern and interest.

These activities are not offered as a cure-all; yet the literature suggests that even most normal children would function more effectively if they were to be afforded more of this type of experience.

The approaches reviewed are strikingly similar and are designed to promote neurological organization. Philosophically they present a dynamic and developmental approach to growth and development. The child is viewed as a wholistic entity, and his many stages of development are evaluated. Through an individual program of activities, improved linkage is established within and between the systems of the child.

The reports are encouraging, and offer new insight into the development of human potential. Indeed, this may come to be recognized as one of the greatest contributions to the field of epistemology. It serves to focus new light on what can be done.

While this approach claims to hold value and relevance for all youth it should also help us to better individualize our program to meet the needs of the individual. It takes us beyond the maturation or wait and see approach. This offers a specific and individualized approach which affects the development of the individual.

CHAPTER III

PROCEDURE AND SOURCES OF DATA

The review of literature in Chapter II supports the belief that a linkage does exist between the areas of achievement, intelligence, neuro-muscular fitness, vision, and perception. In this chapter the sample will be described and the instrumentation will be specified in accordance with the design of the study as proposed in Chapter I. The hypotheses will then be related to the test findings, and the discussion of administrative procedures will be followed by delimitations and a summary.

Sample

The subjects for the study were drawn from two schools, one in an average socio-economic area and the other in a lower socio-economic area. Two teachers and four classroom groups made up the composite sample. Each teacher had both an experimental and a control group. Both teachers had experienced excellent success with the regular school program.

Because of the population mobility pattern which had been characteristic in the lower socio-economic school it was decided that the period for data collection and

experimentation should run from November through March. It was believed that this period of five months would be adequate to gain a sensing on the impact of this program. Also, this period would probably be characterized by a lower rate of mobility than either the earlier or later parts of the school year.

The initial enrollment in these four kindergarten sessions totaled one hundred and sixteen children. At the conclusion of the study one class group had dropped to a total of twenty-two of the original beginning sample which totaled approximately thirty children. At this point the study was over, and the other class groups were then reduced to an equal number of twenty-two children by using the Table of Random Numbers. The data were then assembled on the total sample of eighty-eight children.

No special shifting of children was possible because of the administrative problems this would involve. At the outset of the study it was the opinion of both teachers that their morning groups of children were "sharper" than the afternoon groups. In view of this the morning groups were chosen to serve as the control groups and the afternoon groups were selected as the experimental groups. If an unidentified advantage did exist then this would be in favor of the control groups.

The subjects in the control and experimental groups were assigned randomly at the time of their enrollment,

and there is no reason to believe that they were not representative of the general population in their school areas. The sex distribution included forty-one boys and forty-seven girls. In the experimental group there were nineteen boys and twenty-five girls, and in the control group the distribution was twenty-two boys and twenty-two girls.

Instrumentation

Three pre and post test measurements were taken on the subjects in the study. These measures included tests for physical fitness, achievement, and intelligence.

The pretesting was accomplished during the month of October and the posttesting was done during the first weeks of April. Individual measures were taken on all students with the following tests (1) Kraus-Weber Physical Fitness Test, (2) Metropolitan Readiness Test, and (3) the Pintner-Cunningham Intelligence Test. Following the five month period the same measures were again taken using parallel forms of the Metropolitan Readiness Test and the Pintner-Cunningham Intelligence Test.

Metropolitan Readiness Test

First grade norms were used in the scoring of the Metropolitan Readiness Test because of the increased ceiling which this provided.

While the Metropolitan Readiness Test itself is relatively old it is widely used by many school systems. The new standardization of this instrument was not available until the spring of 1965; therefore this could not be used. Despite the age of the test it is generally considered as possessing "a general high level of excellence and careful workmanship both with respect to item construction and statistical analysis. From the technical point of view the Metropolitan Readiness Tests are among the superior readiness tests now available."[70]

Pintner-Cunningham Intelligence Tests

Parallel forms of the intelligence test were used for the pre and post measures, and scores were computed by the deviation method as recommended in the manual. Analysis of these data indicate comparability of the experimental and control groups on the variable of intelligence.

Kraus-Weber Physical Fitness Tests

The Kraus-Weber physical fitness test provided information regarding the neuro-muscular flexibility of the subjects. Pre and post measures were taken. The test itself indicates only a general category of failure or

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[70]Gardner, Eric F., "Metropolitan Readiness Test Evaluation," The Fourth Mental Measurements Yearbook, (Oscar K. Buros, Editor) Gryphon Press, Highland Park, New Jersey, 1953, p. 571.

passing, and an individual is considered to have failed if he fails any one of the six components of the test. Individual records were kept indicating the specific test items failed by the subjects. Comparative analysis of these data was made.

Statistical Evaluation

Analysis of variance was computed on the difference in gain scores of intelligence, reading readiness, number readiness and total readiness. This yielded an F score which could then be checked for significance at the .05 level.

Analysis of differences in gain scores within the socio-economic levels was made on intelligence, reading, number and total achievement using the T Test as outlined by Helen M. Walker[71] and Joseph Lev.

The significance of the Kraus-Weber results was subjected to statistical evaluation by using the non-parametric Mann-Whitney U test as outlined by Siegel.[72]

Statistical Hypotheses

The alternates of the hypotheses as stated in Chapter I

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[71]Walker, Helen M., and Lev. Joseph, Statistical Inference, Holt, Rinehart, and Winston, New York: 1953, p.156.

[72]Siegel, Sidney, Nonparametric Statistics, McGraw-Hill, Inc., New York, 1956.

would be that there should be no difference in gain scores which would be significant between the experimental and control groups on the measures of intelligence, physical fitness, and achievement. Assuming the significance of the treatment to be positive, the hypotheses were stated to favor the gains made by the experimental groups. Symbolically this would be represented as follows:

Beginning of the Study:

Ho: $C = E$

Legend: C = Control Group Mean

E = Experimental Group Mean

Termination of the Study: $C < E$

$C^1 < E^1$

$C^2 < E^2$

Legend: C = Control Group Mean Gain

E = Experimental Group Mean Gain

C^1 = Lower Socio-Economic Control Group

E^1 = Lower Socio-Economic Experimental Group

C^2 = Middle Socio-Economic Control Group

E^2 = Middle Socio-Economic Experimental Group

Delimitations

The time dimension chosen for the study was five months. Although this period is relatively short it was believed that the essential value readings could be obtained in this length of time. Ideally, this kind of study should be programmed over a several year span. However, assuming that the teacher recognizes and provides for individual differences, it seems reasonable to assume that any initial gains should be maintained and extended. A longer period of time would require a considerably larger sample because of mobility.

It is recognized that the final sample of eighty-eight subjects is somewhat limited in size. Nevertheless, it might be argued that on an experimental study one must introduce change in amounts that can and will be accepted. If significance is found, then the study can be expanded with the benefit of the earlier experience.

Reference has been made to the fact that the Metropolitan and the Pintner Tests are relatively old, but because of the time table for the study the new revision of the Metropolitan Test was not available. Both of these tests are group tests, and had money and personnel been available, the sophistication of the study would have been enhanced if trained psychometrists could have been employed to administer individual tests. Since this was neither practical nor possible, group measures were used in accordance

with the directions accompanying the tests. As was previously mentioned, the Metropolitan tests were scored against the first grade norms.

The teachers carried on the experimental treatment with a minimal background of understanding concerning the philosophy underlying the program. This was partially met through in-service sessions, but much more time and exposure is required if real understanding and internalization is to result. Despite this, these teachers carried on exceptionally well and it is believed that basic sensings can be made from the study as conducted. If significance is found it should be interpreted as all the more powerful because of this factor.

No attempt has been made to evaluate the relative weight of any one variable. Rather, and in keeping with the design, the study seeks to evaluate the collective influence of the total treatment.

It is recognized that there are multiple variables which have bearing on any methods study, and it is quite possible that in the field of education there are existent variables which are yet to be identified. For example, the importance of self-concept, as pointed out by Brookover[73], and its influence on achievement can hardly be ignored. Brookover cites a specific case dealing with mathematics;

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[73]Brookover, W. B., Sociology of Education, (American Book Company, New York: 1964).

the same applies to other areas as well. Comparable results were reported by Wilste[74] in a study of a middle-sized Mid-western community where the reading scores of a school system's secondary student body were improved through a similar approach.

Summary

Statistical evaluation of the differences in gains scores between the experimental and control groups indicate the significance of the treatment. By further socio-economic group comparison the locus of this significance can be fixed. This will apply to the comparisons made on intelligence, physical fitness, and achievement.

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[74]Wilste, Earle W., Administration and Evaluation of Reading Program of a Small High School, Unpublished Doctoral Dissertation, University of Nebraska, 1942.

CHAPTER IV

PRESENTATION OF DATA

In this chapter the data regarding intelligence, achievement, and neuro-muscular coordination will be presented. The difference between pretest and posttest results will be reflected as gain scores. The difference between gain scores of the experimental and control groups were tested for statistical significance, and this is considered attained when the .05 level has been satisfied. This level was used in determining significance for both the **F**, T, and U test statistics.

The individual gain scores in intelligence are reported on four children of one experimental group who were identified as having specific vision organization difficulty. These resultant changes were not analyzed for statistical significance, but are presented because of their relevance to the central concern regarding the fuller release of human potential.

Previously stated hypotheses were analyzed against the data gathered. These are analyzed for over-all significance and also by separate socio-economic levels.

Intelligence

The control and experimental groups in both schools were matched on the basis of intelligence. No significant differences existed between the control and experimental groups within the schools with respect to this variable, and all individuals were just beginning their formal school experience. In each case the teacher worked with both an experimental and a control group. The pre and post intelligence measures are reflected in Table 2.4 together with the sex distribution and chronological age means. The standard deviation is reflected for the pretreatment intelligence test scores.

TABLE 2.4

AGE, SEX, AND MEAN INTELLIGENCE OF THE SAMPLE

N = 88

Group	Sex M	Sex F	Age in Months Mean	Standard Deviation	Intelligence Score Mean Pre	Intelligence Score Mean Post
C^1 N = 22	12	10	65.0	10.01	103	111
E^1 N = 22	8	14	65.12	9.46	101	109
C^2 N = 22	10	12	65.05	10.42	111	123
E^2 N = 22	11	11	65.19	10.58	112	131

In analyzing the data in Table 2.4 it is noted that in the sample of subjects the sex ratio was 41 boys to 47 girls. The mean pretest intelligence test scores for the C^1* group was 102 and for the E^1 group it was 101. This would indicate a slight advantage for the control group. In reviewing the posttest scores the mean intelligence score for the C^1 group was 111 and for the E^1 group it was 109. Hence both groups made a comparable mean gain of 8 points, and therefore the difference between gain scores of the two groups was not statistically significant.

For the E^2 and C^2 groups the mean pretest intelligence score was 111 for the C^2 group and 112 for the E^2 group. In the posttest results it is noted that the C^2 mean score was 123 which represents a net gain of 12 points. The E^2 mean score was 131 which represents a net gain of 19 points. The difference between the gain scores of experimental and control groups was found to be statistically significant at the .005 level.

The F Statistic analysis indicates the existence of significant differences between the middle and lower socio-economic groups. The differences between the experimental

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*Hereafter C^1 will be used to refer to Control Group One, C^2 to Control Group Two, E^1 to Experimental Group One, and E^2 to Experimental Group Two. C^1 and E^1 represent the lower socio-economic group, and C^2 and E^2 represent the middle socio-economic group.

and control groups were not statistically significant, and the interaction product of the intelligence and socio-economic factors was not significant.

Achievement Pattern

Reading Readiness Achievement -- In this area of measured achievement, as reflected by the Metropolitan Readiness Test in which case first grade norms were used, it is noted that the C^1 group's initial mean reading readiness score was 37 and that the E^1 group's score was 32. Both of these would be classified as low normal or in the "D"[75] range. The initial mean score here is five points higher for the control group than for the experimental group. The C^2 initial mean group score was 48, and the corresponding E^2 group score was 50. These scores would both be classified as in the "C" or average achievement range.

Posttest results indicate a mean score of 48 for the C^1 group. This represents a net mean gain of 11 points. For the E^1 group the mean posttest score was also 48, and this represented a net mean gain of 16 points for the E^1 group. This yielded a mean net gain of 16 points for the E^1 group as compared to the 11 point gain for the C^1 group, and it is noted that the E^1 group's initial mean score was 5 points lower than that of the C^1 group. When

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[75] Metropolitan Readiness Tests, Form B., Directions for Administering and Key for Scoring, Harcourt, Brace & World, Inc., 1949, p. 25.

the difference between the gains of the experimental group and the control group was tested the gain was found to be statistically significant at the .005 level of significance in favor of the experimental group.

The C^2 initial mean score was 48 and the posttest score was 57 which represented a net gain of 9 points. In the case of the E^2 group the initial mean score was 50 and the posttest score was 58. This represented a mean net gain of 8 points for the E^2 group. Thus there was no statistical significance found in the difference between the gain scores of these two groups.

The **F** Statistical significance indicates decided socio-economic differences, and this would be expected. The total experimental-control group differences were not found to be significant. When analysis is made of the differences in gain scores between the experimental and control groups the results by socio-economic levels indicate a high significance found in favor of the low socio-economic experimental group over the low socio-economic control group, but significance is not present in the differences between the middle socio-economic experimental and control groups. In fact the mean gain of the middle socio-economic experimental group was slightly less than the gain of this control group. Yet the total experimental-control group **F** Statistic was <u>almost</u> great enough to indicate total experimental group significance over the control group.

This was the direct result of the power of the low socio-economic experimental group's gain score.

When the interaction product of the socio-economic and experimental-control factors was analyzed this was found to be statistically significant at the .05 level.

Number Achievement -- A mean net score of 6 points represents the C^1 group's initial number score, and in the posttest measure this rose to 12. This represented a net gain of 6 points. For the E^1 group the initial score was 5, one point less than the C^1 group. On the posttest measure the E^1 group's mean score rose to 17 points which represented a net mean gain of 12 points as compared to 6 points for the control group. The difference between gain scores was found to be highly significant and to the favor of the E^1 group at the .0005 level of significance.

In the case of the C^2 group the mean net score at the initial testing was 11, and this rose to 19 on the post-test measure. Hence a net mean gain of 8 points was achieved. With the E^2 group the initial measure reflected a mean net score of 11 and a posttest score of 19. Hence, there was no measured difference in either the initial or post-test gain scores between the C^2 and E^2 groups. The greatest net mean gain in achievement was reflected in the area of number readiness with the E^1 group.

Socio-economic differences were not found to be

statistically significant in the area of number readiness; yet they were found in the areas of reading, intelligence and total readiness. Strong statistical significance was found in favor of the difference in the experimental group gains over those of the control group. This was also true of the interaction product of the socio-economic and experimental-control factors. Statistical significance was found to be attributable to the gain scores made by the low socio-economic group.

Total Achievement -- The total score is composed of the reading score, the numbers score, and the score from a geometric form copying task. The total mean score for the C^1 group on the pretest was 46, and on the posttest the score was 66 which represents a net mean increase of 20 points.

In the case of the E^1 group the mean initial score was 39, and it should be noted that this is 7 points under the initial mean score for the C^1 group. The posttest score for the E^1 group was 73 which represents a mean net gain of 34 points. This would indicate that even though the E^1 group's initial score was lower than that of the C^1 group they exceeded this group in total achievement by 14 points. The difference in the gain scores between these groups was found to be statistically significant at the .005 level.

The initial mean total score for the C^2 group was 63, and their posttest mean score was 84. This represents a mean net gain of 21 points. For the E^2 group the initial mean total score was 65 and the posttest mean score was 87. This yielded a net mean gain of 22 points which exceeded that of the C^2 group, but the difference between the gain scores was not statistically significant.

In the area of total achievement the previously existent differences between socio-economic levels was found to be significant at the .01 level. The gains of the experimental group over those of the control group were found to be statistically significant, and the cross product of the socio-economic and experimental-control factors were likewise statistically significant.

Percentile Pattern

The total picture of achievement is summarized by the percentile scores of the various groups. C^1's mean initial percentile score was 16 and the posttest score was 48. This represented a mean percentile increase of 32 points. E^1's initial mean percentile score was 11, and this was 5 points lower than that of the C^1 group. Their posttest score was 57, and this represented a net mean gain of 46 points.

In the case of the C^2 group the initial mean percentile

score was 39 and the posttest score was 80 which represents a net mean gain of 41 points. For the E^2 group the initial mean percentile score was also 39, and the posttest score was 84 which represented a net mean gain of 45 points.

In both cases the experimental groups excelled the control groups, and in the case of the C^1 and E^1 groups this was by a substantial amount. These data are reflected in Table 3.4.

TABLE 3.4

MEAN ACHIEVEMENT TEST SCORES

N = 88

Group		Reading Score	Gain	Number Score	Gain	Total Score	Gain	Percentile Score	Gain
C^1	Pre	37		6		46		16	
	Post	48	11	12	6	66	20	48	32
E^1	Pre	32		5		39		11	
	Post	48	16	17	12	73	34	57	46
C^2	Pre	48		11		63		39	
	Post	57	9	19	8	84	21	80	41
E^2	Pre	50		11		65		39	
	Post	58	8	19	8	87	22	84	45

Neuro-Muscular Fitness

Group Test Data -- Pretest and posttest Kraus-Weber measures were taken on all individuals in the groups. The test itself is composed of six parts as shown in Appendix B. Although an individual is considered to have failed the test if he fails any one of the six test items, a further analysis of the results can be made by analyzing the specific items missed. Such an analysis will be made after first looking at the gross results.

Thirteen subjects in the C^1 group failed the Kraus-Weber test on the pretest check. Nine of these individuals failed this same test on the posttest measure, and this represented a reduction of four subjects over the pretest reading.

In the E^1 group 17 subjects failed the pretest, and this was reduced to 3 on the posttest measure. Hence, in the E^1 group, the reduction amounted to a net improvement of 14 as contrasted to 4 for the C^1 group.

Results of this initial testing in the C^2 group showed 8 subjects as failing the test, and on the posttest measure this number had increased to 13, an increase of 5 subjects over the pretest measure. In the E^2 group the initial number who failed the test was 11, and at the posttest session this number was found to have decreased to 9, yielding a net reduction of 2 over the pretest measure.

In both cases the pattern of the experimental groups showed greater improvement and growth than did that of the control groups. The most marked improvement is noted in the C^1 and E^1 groups.

In analyzing the groups on the basis of the gross number of test items failed it is found that the C^1 group failed a total of 21 tasks on the pretest and a total of 13 tasks on the posttest measure. The E^1 group failed a total of 26 tasks on the pretest and a total of 4 on the posttest measure. In the case of the C^2 group they failed a total of 12 tasks on the pretest measure and a total of 17 tasks on the posttest measure. The E^2 group failed a total of 25 pretest tasks, and this number was reduced to 12 on the posttest measure.

The frequency distribution for each test item for all groups is reflected in Table 4.4, and it points out the higher level of growth achieved by the experimental group when compared to the control group.

TABLE 4.4

KRAUS-WEBER FAILURES

N = 88

	TEST ITEM NUMBER						Total Items Failed	Number of Individuals Who Failed
	#1	#2	#3	#4	#5	#6		
C^1 Pre	2	9	3	0	3	4	21	13
Post	4	7	0	1	0	1	13	9
E^1 Pre	5	12	0	1	6	2	26	17
Post	2	2	0	0	0	0	4	3
C^2 Pre	4	6	1	0	0	1	12	8
Post	3	8	0	1	3	2	17	13
E^2 Pre	8	10	1	2	0	4	25	11
Post	3	8	0	0	0	1	12	9
Sum of each	31	62	5	5	12	15	130	

Statistical Evaluation -- Since it was desirable that no assumptions be made regarding the normality of the distribution of scores in the population and also considering that the data were of an ordinal type, a nonparametric test was chosen to evaluate the data. One of the most powerful nonparametric tests, which is a useful alternative to the parametric T test, is the Mann-Whitney U test.[76] This test involves basically a rank ordering of the scores

[76] Siegel, Op. cit.

and in this case the rank order of differences between pre and post measures.

The rationale is that if the two samples did not differ and were from the same or identical population then one would expect each group to have approximately the same frequency of scores in test achievement. If the populations do differ then the sum of the ranks of one group should be greater than the sum of the ranks of the other. (In this case the hypothesis would predict that the sum of the ranks of controls would be greater than the sum of the ranks of experimental groups, since the fewer the tests missed the lower the assigned rank.)

In the low socio-economic group the computation of the Mann-Whitney test resulted in a Z of 1.81 (P = .0359). For the middle socio-economic group the computation of the Mann-Whitney test resulted in a Z = 2.852 (P = .0022). Both these probabilities satisfy for the preset .05 level of significance.

Vision Organization

Vision organization work was carried on principally on a total group basis, and no pre or post measures were taken to gain data regarding the impact of the activities as previously outlined. The value of this type of activity is supported in the literature; and vision, in the sense as here defined, is subject to environmental influence.

In one of the schools concern arose over some observed vision organization problems. A vision specialist was called in to observe and consult with the teacher. The activities as previously outlined were continued, and he was able to assist the teacher in the area of skill and technique. The individual cases were followed; one was a boy and three were girls. Their pre and post intelligence measures would indicate that in their cases something significant happened, but the study was not designed to provide control over enough variables to permit or warrant specific conclusions relative to the gains which these children showed. Their mean intelligence score gain was 24 points as contrasted to a gain of 18 points for the other children in their group. These data are reflected in Table 5.4.

TABLE 5.4

INTELLIGENCE MEASURES ON CHILDREN NOTED AS HAVING PARTICULAR VISION ORGANIZATION PROBLEMS

Subject	Sex	Pretreatment Intelligence	Posttreatment Intelligence	Change
A	M	98	127	29
B	F	91	124	33
C	F	98	122	24
D	F	104	114	10

Hypotheses

Hypothesis I

Hypothesis I stated that there would be a demonstrable gain in favor of the experimental groups in the following areas: (1) Reading Readiness, (2) Number Readiness, and (3) Total Readiness. Symbolically this was represented as follows regarding the differences in gain scores in achievement. Ho = $C<E$, Ho = $C^1<E^1$, and Ho = $C^2<E^2$.

Part 1 - Reading Readiness

Computation of the **F** Statistic revealed highly significant differences between the socio-economic levels, but significance in the difference between the experimental and control group gain scores was not statistically significant at the .05 level. Significance was registered when the cross product of experimental-control and socio-economic factors was computed.

Further analysis was made by using the T test as outlined by Walker[77] and Lev to measure and identify the locus of significance. This revealed that the difference in gain scores between the experimental and control groups of the low socio-economic area was significant at the .005 level, but that this difference between the scores of the middle socio-economic group was not statistically significant.

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[77]Walker, Op. cit., p. 159.

The hypothesis was supported for the low socio-economic group, but not for the middle socio-economic group in the area of reading readiness.

Part 2 - Number Readiness

There was negligible difference between socio-economic levels in the area of number readiness as computed by the F Statistic. This is difficult to explain since significance was registered on all other achievement variables. There was pronounced statistical significance registered in the difference in gain scores of the experimental group over those of the control group as measured by the F Statistic. Statistical significance was also found when the cross product of the socio-economic factors and the experimental-control factors were analyzed.

Analysis of the differences in control and experimental gains by socio-economic levels revealed that for the lower socio-economic level significance was prevalent to the .0005 level and favored the experimental group. Significance was not found to be existent with the middle socio-economic level.

Although the second part of the hypothesis was supported by the F Statistic test, when socio-economic analyses were made the second part of the hypothesis was supported by the gain scores of the lower socio-economic groups but not by the middle socio-economic group.

Part 3 - Total Readiness

Statistically significant socio-economic differences were indicated in the F Statistical analysis. The statistical significance of the difference in gain scores of the experimental group over those of the control group was found to be present at the .05 level and to favor the experimental group gains and the cross product of the socio-economic and experimental-control factors were found to be statistically significant. In fact the F Statistic for all factors was found to be significant at the .01 level.

Further analysis within the socio-economic levels, using the T test as previously identified, indicates significance again for only the lower socio-economic group. This was existent at the .005 level. Hence the hypothesis regarding total achievement is supported by the F Statistic analysis, and further analysis by use of the T test reveals that the source of significance was primarily attributable to the gain scores of the low socio-economic experimental group.

Hypothesis 2

Hypothesis 2 states that there will be a demonstrable difference in the gain score in intelligence in favor of the experimental group over that achieved by the control group. Symbolically this is symbolized as follows regarding intelligence: Ho = E>C.

F Statistic computations indicated statistically significant socio-economic differences, and the initial differences between the experimental and control group within a socio-economic level were not found to be statistically significant. Neither was the cross product of the socio-economic and the experimental control factors of the difference in gain scores of the experimental group over those of the control group.

Individual analysis of the difference in experimental and control group gain scores in the area of intelligence reveals no statistical significance for the low socio-economic group's gain scores. Significance at the .005 level was found for the difference in gain scores of the middle socio-economic experimental group over those of the control group.

Hypothesis 3

Hypothesis 3 states that the gain or improvement in neuro-muscular skill will be significantly higher with the experimental than with the control group. Symbolically this would be symbolized as follows: Ho = E>C.

To compute the statistical significance of these data the nonparametric Mann-Whitney U test as outlined by Seigel[78] was employed. The difference in gain scores of

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[78]Seigel, Op. cit.

both experimental groups over their control counterparts was adequate to satisfy the preset .05 level of significance. Hypothesis 3 was supported.

Summary

No significant differences in intelligence existed between the experimental and control groups within socio-economic levels when the study began and all students were just beginning their formal school experience. Within each group, and on all measures, one notes the existence of a considerable range of differences from the outset of the formal school experience. The children were assigned randomly upon enrolling in school, and no shifting within groups was effected to accommodate the study. In fact, grouping had been accomplished prior to contacting teachers and principals regarding the study.

It was the subjective opinion of both teachers that their morning kindergarten group was their more able and mature group. Test evidence and age data did not indicate the existence of statistically significant differences. Nevertheless it was believed that the morning groups should be used as the control group since the teachers' judgments were based on the gestalt of multiple variables.

The expected differences in socio-economic groups were evident when the reading readiness factor was evaluated. Over-all significance of the difference between experimental

and control group gains in favor of the experimental group was not found, but when this difference was evaluated on a socio-economic class basis significance was found to exist within the low socio-economic group and in favor of the experimental group gains. The level of significance for this group was found to be present at the .005 level.

In the area of number readiness, socio-economic differences were not found to be significant. The difference in the gain scores of the experimental groups over those of the control group was found to be statistically significant, and the major degree of significance was attributable to the gains made by the low socio-economic experimental group.

The total readiness profile revealed significant socio-economic differences, and the difference in the gain scores of the experimental group over those of the control group was adequate to meet the established .05 level. Class level analysis again revealed the major gains to be existent with the lower socio-economic group in favor of the experimental group gains.

Analysis of the statistical data regarding gain scores in intelligence reveal significance only when evaluation is made within socio-economic class groups. In this case the gain scores of the middle socio-economic group revealed significance to the .005 level.

Both socio-economic experimental groups satisfied the .05 level of significance for their gain scores in neuro-

muscular improvement. The most significant gains were made by the middle socio-economic experimental group.

These data are summarized and reflected in Table 6.4, Summary of Hypotheses, Findings Regarding Significance.

TABLE 6.4
SUMMARY OF HYPOTHESES
FINDINGS REGARDING SIGNIFICANCE

Group and/ or Factors	Hypothesis #1 Achievement			Hypothesis #2--Intel-ligence	Hypothesis #3--Neuro-Muscular Coordination
	Reading	Numbers	Total		
Socio-Economic Differences	.01	no	.01	.01	
Cross Product, Socio-Economic & Experimental Control Factors	.05	.01	.01	no	
Total Experimental	no	.01	.01	no	.05
E^1	.005	.0005	.005	no	.03
E^2	no	no	no	.005	.002

CHAPTER V

CONCLUSIONS AND IMPLICATIONS

This study grew out of an interest in some of the more recent research related to human development. More specifically, concern and interest in this case was focused on identifying certain factors believed to be influential in bringing about the fuller release of human potential. The design of this study was structured to examine the contribution of gross and fine neuro-muscular activity to the improved functioning of kindergarten children as measured by standardized intelligence and achievement tests.

Statistical evaluations of the difference in gain scores between experimental groups and control groups were computed for the Pintner-Cunningham Primary General Ability Test, The Metropolitan Readiness Test, and the Kraus-Weber Physical Fitness Test to determine the short-term cumulative effect of neuro-muscular, perception, and vision organization activities on kindergarten children. Four groups of children, two each from lower socio-economic and middle socio-economic areas, comprised the subjects for the study. Two teachers were involved, and each worked with both an experimental and control group. The time duration for the experimental phase of the study was five months, from November through March.

The treatment used in the study with the experimental group is based on the philosophy which views development as dynamic and subject to assistive influence. While maturational principles are recognized and taken into account, the school's role is seen primarily as one of providing a setting wherein those experiences will be provided which are assistive to development. The specific activities chosen are believed to offer assistive influence to aid in bringing about the fuller development of human potential.

Summary of the Study

Standardized test measurements were taken on a pre and post treatment basis to determine the effect of the experimental treatment. The difference in the gain scores between the experimental and control groups was computed and tested for statistical significance. These data are reported for intelligence, total achievement, reading readiness, number readiness, and physical fitness.

Intelligence -- Significant differences between socio-economic levels were apparent on the variable of intelligence, but within the socio-economic levels this initial difference between the experimental and control group was not significant. The difference between the total experimental group gain score and the total control group

gain score was not statistically significant. The interaction product of the experimental-control factor and the socio-economic factor was not found to be significant.

Both experimental and control groups made gain scores in the area of intelligence. In the low socio-economic group the difference between the scores of the experimental and control groups was not statistically significant, but in the case of the middle socio-economic group this difference was found to be statistically significant at the .005 level in favor of the experimental group.

Total Achievement -- The existence of statistically significant differences between socio-economic levels was apparent in the area of total achievement. The F Statistic computation indicated significance at the .01 level on all factors, socio-economic, experimental-control, and their interaction product. The hypothesis which stated that the gains of the experimental group would be greater than the gains of the control group was supported in the area of total achievement since the difference between the gain scores of the experimental and control groups was adequate to meet the preestablished .05 level of significance. Further analysis revealed that this difference was significant at the .005 level with the lower socio-economic group and at the .05 level with the middle socio-economic group.

Reading Readiness -- F Statistic computations indicate statistically significant socio-economic differences. The total difference in gain scores between the experimental and control groups was not found to be statistically significant. The interaction product of the socio-economic and experimental control factors was statistically significant at the .05 level.

Analysis of the difference in gain scores between experimental and control groups by socio-economic level reveals that significance exists at the .005 level within the lower socio-economic group in favor of the experimental group gains. The difference in gain scores within the middle socio-economic group was not statistically significant.

Number Readiness -- The F Statistic computation did not reveal statistically significant differences on a socio-economic basis. This is surprising and difficult to understand since socio-economic differences were found in reading readiness, total readiness, and intelligence. The difference in gain scores between the total experimental and control groups was statistically significant at the .01 level, and in favor of the experimental group. This was also true for the interaction product of the control-experimental and socio-economic factors.

Socio-economic level analysis reveals that the difference between the gain scores of the experimental and control group was in favor of the lower socio-economic experimental

group and was statistically significant at the .0005 level. Significance was not found for this difference in the gain scores of the middle socio-economic experimental group.

Kraus-Weber Fitness Results -- The gains scores of the total experimental group over those of the total control group were adequate to meet the established .05 level of significance. This significance was also characteristic of both experimental groups, but in reviewing the results of socio-economic levels it was noted that the number of individuals failing the test in the low socio-economic group changed from seventeen to three whereas in the middle socio-economic group the number changed from eleven to nine. Further analysis of the number of test items failed by each group indicates significance to the .03 level for the E^1 group and to the .002 level for the E^2 group.

Socio-Economic Differences

With the exception of the variable of intelligence, the gain scores were more pronounced with the lower socio-economic group than with the middle socio-economic group. Socio-economic differences were noted in reading readiness, intelligence, and total readiness. In the area of neuro-muscular coordination the Kraus-Weber results indicated a total of thirty children as failing the pretest in the lower socio-economic group. Nineteen children in the

middle socio-economic group failed the pretest. Posttest results showed twelve of the children in the lower socio-economic group as failing, and with the middle socio-economic group twenty-two were categorized as failing. Within the lower socio-economic group eighteen fewer children failed the Kraus-Weber posttest, but within the middle socio-economic group three more children failed the post-test than failed the pretest.

The demographic data regarding housing provides indication of a number of factors which would have an adverse effect on the children from the low socio-economic area. These children came from homes which were more frequently rental property than was the case with children from the middle class area. A much higher proportion of the property in the lower socio-economic area has been categorized as dilapidated and deteriorating. The average value of the homes was markedly lower and the population density per room was higher among the low socio-economic families.

Family data revealed a much higher incidence of broken homes or one-parent households among the lower socio-economic group. The educational level of the parents was lower, and the frequency of unemployment was higher. The number of families dependent on some form of welfare assistance was also higher, and health needs went unattended more frequently among these families.

It should be noted that within the lower socio-economic

area there existed a considerable range of variance regarding all these factors. Nevertheless the impact of the general pattern of the lower socio-economic culture prevailed. The deprivation in evidence was fundamentally of an economic and experiential nature, yet, as shown by the results of this study, these children can and do respond when appropriate experiences are made available to them.

Comparison with Related Research

The results of this study would indicate that kindergarten age children are receptive to and benefit from the kinds of experiences which were programmed. The differences in total experimental group gains over the control group gains in total readiness, number readiness, and neuro-muscular coordination were found to be statistically significant. This was also true of the middle socio-economic group in the area of intelligence, and for the lower socio-economic group in the area of reading readiness.

These activities of neuro-muscular coordination, perception, and vision organization training, as programmed for the experimental group, provided assistive influence for these children, and this was in keeping with the findings in the literature. This should involve a balance between gross and fine motor activity. The question has not been answered by this study as to the relative impact of these variables in isolation.

The strong achievement responses registered by the lower socio-economic group were not paralleled by the middle socio-economic group. The lower socio-economic group started at a lower point and therefore had more range in which to register achievement than did the middle socio-economic group. There was nothing found in the review of literature which would indicate that this should be expected.

Conclusion

The question of whether or not kindergarten age children are significantly and positively influenced by these kinds of activities has been established. They are. Whether they should spend time on these activities in another question. In this study the impact of the experimental program was generally found to be statistically significant over the regular program. It would seem that on the basis of this finding that these activities should be included in the regular program until such time as other experiences of greater demonstrated worth are found to replace them.

Discussion

While not supported by the results of this study, it seems appropriate to question whether or not the treatment in the experimental program was more appropriate for one socio-economic group than for the other. Was the difference in

program emphasis responsible for the increase in intelligence scores in the one case and achievement in the other? Were there other factors operative which might account for these differences?

Repeated observations of the two teachers' programs would lead one to conclude that there was a stronger emphasis on gross neuro-muscular activity with the lower socio-economic group, and that with the middle socio-economic group the greater emphasis was placed on vision organization work, which is a fine neuro-muscular activity. The results of the Kraus-Weber testing would support this observation, and no empirical evaluation of the vision organization work was made to determine its effects.

Perhaps the program within these separate classrooms was too much alike to recognize adequately the existent differences between these groups. The formal work in both cases did adhere largely to prepared materials, and possibly inadequate differentiation was made in the use of these materials with respect to the instructional needs and levels of the group.

In recognition of the literature and research which indicate a relationship and linkage between development and early experience it appears that school personnel need to identify experiential deficiency and then plan and provide those curricular experiences which will be assistive in reducing such deficiency. This will necessitate a more

individualized type of planned curricular program.

This more sophisticated approach should be guided by school personnel who recognize and draw counsel from an interdisciplinary base. Once reasonable expertise has been developed with this approach it should be expanded to include a higher level of work with the primary social unit, the family.

One variable which seems of crucial importance, and this could account for significant gain score differences in any area, is that of involvement. To what degree do the children really participate actively in the program? Is the experience one in which one is actively involved while the others watch passively or can the class group be organized so as to make possible a major degree of involvement for all the children? The control of this variable of involvement would seem to affect to a very significant degree the results of any study.

Recommendations for Further Research

No attempt was made in this study to analyze the relative value of any one of the variables of vision organization, neuro-muscular coordination, or perception training. Each should be evaluated to determine its individual merit and its relative contribution when used in both a total group situation and on an individual basis. Such an analysis

should then lead to curricular modifications which incorporate those variables which are found to have a significant demonstrated value.

The norm levels of gross and fine motor development should be reexamined for this age child. While the general pattern of development procedes from gross to fine motor skills and will vary with the individual, there is a need for up-to-date research findings regarding the norms for motor development. Until such findings are available and until we have tools and skill in assessing this development doubt and question will exist as to the proper programming of appropriate developmental motor activities.

The merit of using the perceptual form templates as an aid in establishing fine neuro-muscular control should be evaluated. The subjective opinion of the teachers was that these did aid their experimental groups in developing form perception and fine neuro-muscular control. This should be evaluated empirically to determine the statistical relevancy of this activity.

But basic to such a move would be one which would seek to resolve the question of what ought to be included in the curriculum at a given age level. The fact that something can be done at a given age level does not mean nor imply that it should be done then, and by the same reasoning it does not mean that the experience should therefore be delayed. There is need for a study to determine if there are critical periods

for learning particular skills, and if they are found to exist, then when do they occur and what are the resultant consequences of ignoring this period of receptivity.

Assuming that the variables of perception training, vision organization, and neuro-muscular coordination are found to have significant value, then how does this value compare with that of the already existent activities which comprise the curriculum? These need to be reevaluated, especially in light of the impact of modern technology and change.

Supplementing the study of the value or weight of the individual variables we need to conduct research to determine whether these variables possess a different power when used in combined form. Is there an interaction effect? What are the possible combinations and what are the weights attributable to each?

The study should be replicated on a larger sample involving all socio-economic levels, and should include an intensive in-service program for the teachers involved in the study. This program should be such that the teacher comes to understand the underlying philosophy and basis for each aspect of the program. This should involve interdisciplinary specialists, but the actual translation of the program should be left to the teacher.

A parallel study to this should be made to determine, under carefully controlled conditions, whether or not

significantly greater effect can be gained using specialists as compared to the regular teacher. In such an approach it would be well to include the provision for evaluating the emotional reaction of the children in each approach.

The use of competent experienced psychometrists to measure and evaluate change would enhance the sophistication of the study, and if possible this should be characteristic of the future studies if such service is proven to be of significant value.

Research studies should be made to determine the comparative value of the different or modified approaches which are advocated by Delacatto, Getman, Kephart, et al. Is there a best approach or are there factors where one approach should be recommended over another? If so what are they and which technique is to be recommended?

BIBLIOGRAPHY

BOOKS

Bartley, S. Howard, Principles of Perception, (Harper and Brothers, New York: 1958).

Brookover, Wilbur B., Sociology of Education, (American Book Company, 1964).

Bruner, Jerome S., On Knowing, (The Belknap Press of Harvard University Press, Cambridge: 1962).

_____, The Process of Education, (Harvard University Press, Cambridge: 1961).

Cantril, Hadley, The Morning Papers of Adelbert Ames, Jr., (Rutgers University Press, New Brunswick: 1960).

Combs, Kelley, Maslow, Perceiving, Behaving, Becoming, (Yearbook, ASCD, 1962).

Davis, Allison, Social Class Influence on Learning, (Harvard University Press, Cambridge: 1943).

Delacato, Carl H., The Diagnosis and Treatment of Speech and Reading Problems, (Charles C. Thomas, Springfield, Illinois, 1963).

Gesell, Arnold, Infancy and Human Growth, (MacMillan, New York, 1928).

_____ and Ilg, Frances L., The Child From Five to Ten, (Harper and Brothers, New York: 1946).

Kephart, Newell C., Success Through Play, (Harper and Brothers, New York: 1960).

Montessori, Marie, The Absorbent Mind, (Adyar, Madras 20, India: The Theosophical Publishing House, 1961).

Olson, Willard C., Child Development, (Heath, Boston: 1949).

Prudden, Bonnie, Is Your Child Really Fit? (Harper and Brothers, New York: 1956).

Riessman, Frank, The Culturally Deprived Child, (Harper, New York: 1962).

Seigel, Sidney, Non-Parametric Statistics, (McGraw-Hill, Inc., New York: 1956).

Walker, Helen M. and Lev. Joseph, Statistical Inference, (Holt, Rinehart, and Winston, New York: 1953).

ARTICLES

Bucher, Charles A., "Health, Physical Education, and Academic Achievement," NEA Journal, LIV (May, 1965), p.38.

Combs, Arthur W., "Seeing is Behaving," Educational Leadership, XVI (October, 1958), pp. 21-26.

Delacato, Carl H., "The Ontogeny of Reading Problems," (Yearbook: Claremont Reading Conference, 1963), p. 124.

Duckworth, Eleanor, "Piaget Rediscovered," Journal of Research in Science Teaching, II (John Wiley and Sons, Inc., New York: 1964) pp. 172-174.

Eames, Thomas H., "Accommodation in School Children," American Journal of Opthamology, LI, No. 6. June, 1961, pp. 1255-1257.

Gibson, Eleanor J., and Walk, Richard D., "The Visual Cliff," Scientific American, CCII, No. 4, April, 1960, p.71.

Kephart, Newell C., "Perceptual-Motor Aspects of Learning Disabilities," Exceptional Children, XXXI, December, 1964, pp. 201-206.

Keogh, Jack., et al., "Motor Achievement of Underachieving Boys," Journal of Educational Research, LVII, No. 7, March, 1964, p. 342.

Lackmann, Frank M., "Perceptual-Motor Development in Children Retarded in Reading Ability," Journal of Consulting Psychology, XXIV, No. 5, pp. 427-431.

Lowther, Malcolm A., "Academic Achievement and Self-Esteem," University of Michigan School of Education Bulletin, XXXV, No. 1, October, 1963, pp. 8-11.

Lynn, R., "Reading Readiness and the Perceptual Abilities of Young Children," Educational Research, VI, No. 1, (Newnes Educational Publishing Company, Ltd., London: November, 1963) p. 14.

Penfield, Wilder, "The Uncommitted Cortex," The Atlantic Monthly, CCXIV, July, 1964, pp. 77-81.

Piaget, Jean, "Cognitive Development in Children," Journal of Research in Science Teaching, II, No. 3, (John Wiley and Sons, New York: 1964), pp. 176-186.

Rice, Arthur H., "Rhythmic Training and Body Balancing," The Nation's Schools, LXIX, February, 1962, pp. 72-81.

Sackett, Gene P., "How Much of Reading is Really Learned?" (Yearbook, Claremont Reading Conference: 1963), pp. 110-113.

Silberman, Charles E., "Give Slum Children A Chance," Harper's, CCVIII, No. 1368, May, 1964, pp. 37-42.

Solkoff, Norman, et al., "Effects of Frustration on Perceptual-Motor Performance," Child Development, XXXV, No.2, June, 1964, pp. 569-575.

Wolinsky, Gloria F., "Jean Piaget's Theory of Perception," Science Education, XLVII, No. 1, February, 1964, pp. 24-27.

UNPUBLISHED MATERIAL

Ball, Thomas S., and Edgar, Clara Lee, "The Effectiveness of Sensory-Motor Training in Promoting Generalized Body Image Development," Research Report, Pacific State Hospital, Pamona, California.

Getman, Gerald N., How to Develop your Child's Intelligence, Luverne, Minnesota, 1962.

Lowder, Robert Glenn, "Perceptual Ability and School Achievement", Dissertation Study, Purdue University, 1956.

Wiltse, Earle W., "Administration and Evaluation of Reading Program of a Small High School," Unpublished Doctoral Dissertation, University of Nebraska, 1942.

OTHER SOURCES

Enquirer and News, "Babies Eyes Not So Bad After All," Battle Creek, Michigan: December 8, 1964, p. 6.

Metropolitan Readiness Tests, Form B., Directions for Administering and Key for Scoring, Harcourt, Brace, and World, Inc., 1949.

Pupil Personnel Office Report, Battle Creek Public Schools, Battle Creek, Michigan: September 17, 1964.

Streff, John W., Director of Visual Research, Gesell Institute of Child Development. (Letter in the writer's file).

U. S. Bureau of the Census. U. S. Census of Housing: 1960. Vol. III, City Blocks. Series HC (3), No. 201, U. S. Government Printing Office, Washington, D. C., 1961.

APPENDICES

APPENDIX A

School

Test Data - (Control or Experimental)

Name	Pintner-Cunningham Form A - Pre-Test	Pintner-Cunningham Form B - Post-Test	Metropolitan Readiness Form R - Pre-Reading	Metropolitan Readiness Form S - Post-Reading	Metropolitan Readiness Form R - Pre-Numbers	Metropolitan Readiness Form S - Post-Numbers	Metropolitan Readiness Form R - Pre-Total	Metropolitan Readiness Form S - Post-Total	Kraus-Weber Pre-Test	Kraus-Weber Post-Test	P.F.A.T. Pre-Test	P.F.A.T. Post-Test	

School

Family Data - (Control or Experimental)

Name	Date of Birth	Age in Months at Pre-Test	Sex	Siblings	Mother's Education	Father's Education	Marital Status	Occupation	

APPENDIX B

Kraus-Weber Tests for Minimum Muscular Fitness[79]

Test #1 -- Sit-Up:

Determines condition of the abdominal muscles.
Subject lies flat on his back, legs outstretched, hands placed behind head.
Examiner holds feet to the floor. Subject is directed to "roll up into a sitting position." Just sit up once, without using hands to help.

Test #2 -- Sit-Up (Knees Bent):

Subject takes same position as in Test #1, but with knees bent. Sit up without using hands.
(If child fails in either or both of these tests, it means his abdominal muscles are dangerously weak. Unable to lift own weight -- weight with which he must live, work and play).

Test #3 -- Leg Lift: (Weakness of lower abdominals and hip flexors)

Subject lies flat on back, legs outstretched, hands behind head. He is directed to raise his feet, keeping legs straight, about 10 inches. Must hold this position for ten-second count. Failure shows deficiency in hip flexors. Muscles used for running, jumping and standing erect.

Test #4 -- Test of Upper Back:

Subject lies prone (on stomach). A pillow is placed directly under the hips. Feet held down, subject is directed to raise trunk and hold steady for ten seconds.

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[79] Prudden, Bonnie, "Is Your Child Really Fit?", (New York: Harper and Brothers, 1956), pp. 19-24.

Test #5 -- Test of Lower Back:

Prone position. Subject raises legs, keeping knees straight, and holds for ten seconds. Examiner holds the upper body down.

Few should fail tests #4 and #5, but failure shows that the motor-ability of the body is under-developed.

Test #6 -- Toe Touch:

Floor touch. Bend from hips, knees straight and feet together, touch finger tips to floor. Must keep finger tips to floor for three counts.

Failure indicates emotional imbalance as much as muscular inadequacy.

APPENDIX C

PERCEPTION FORM TEMPLATES

Plate 1 - Circle

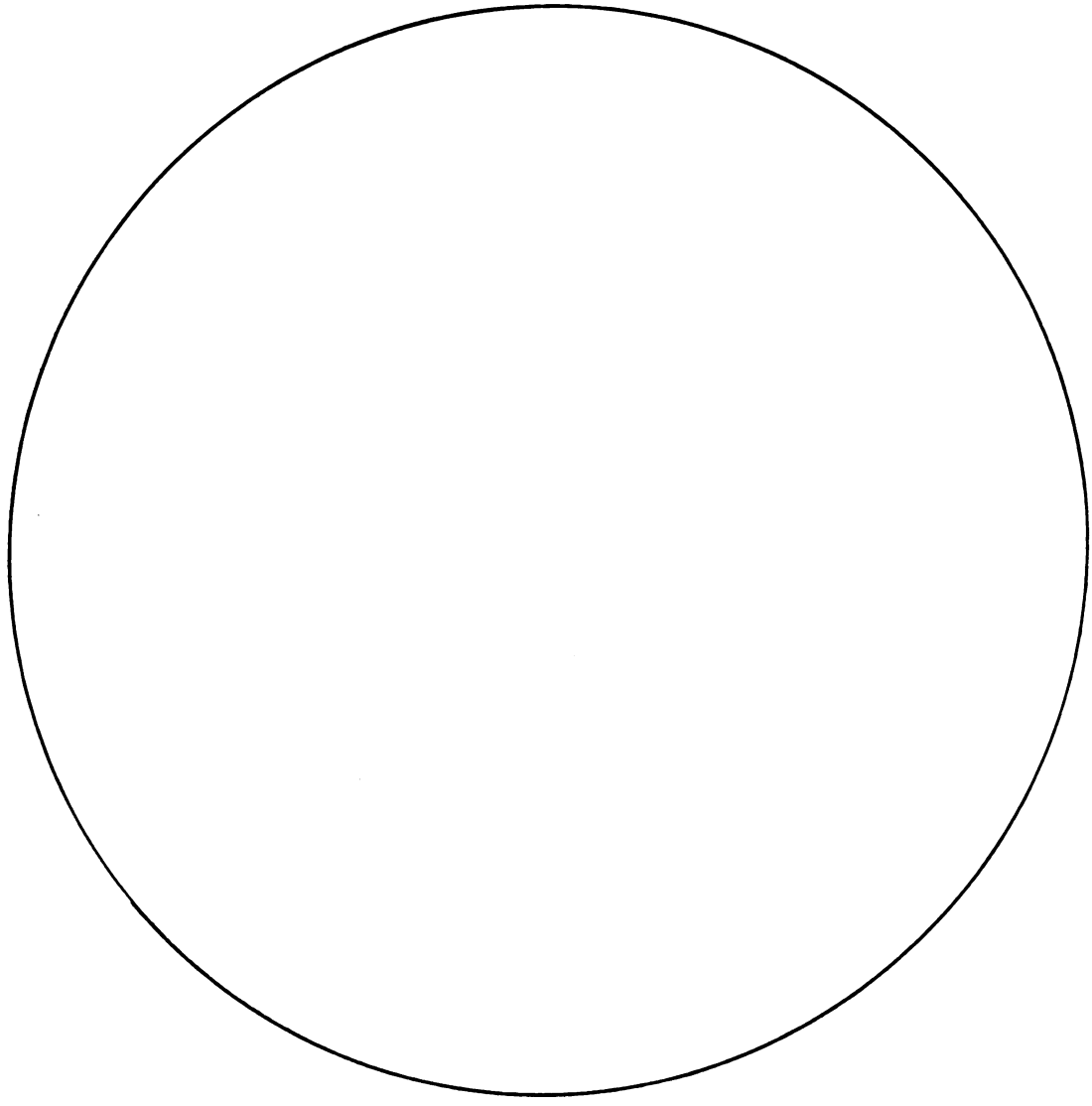

Plate 2 - Square

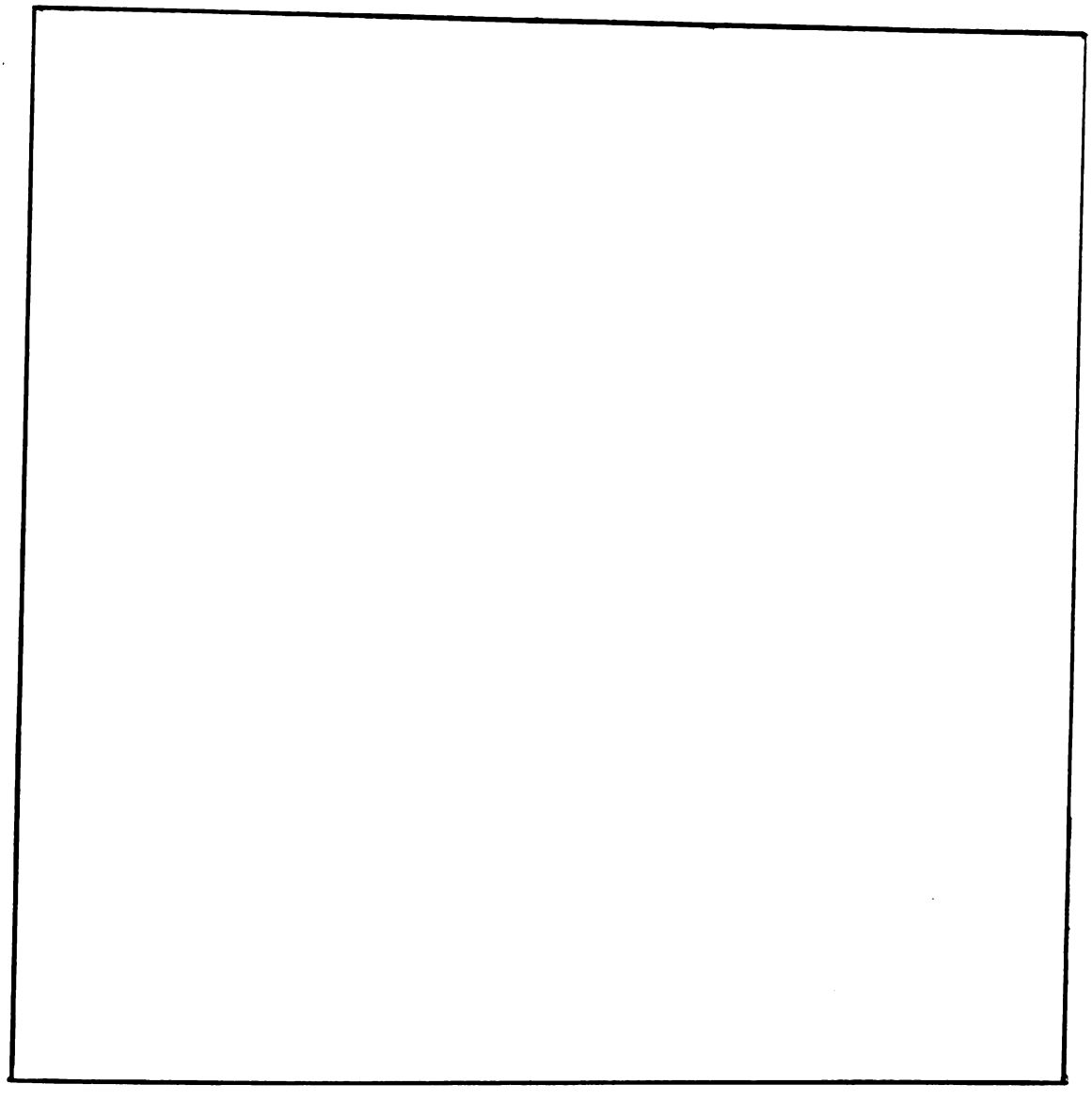

Plate 3 - Rectangle

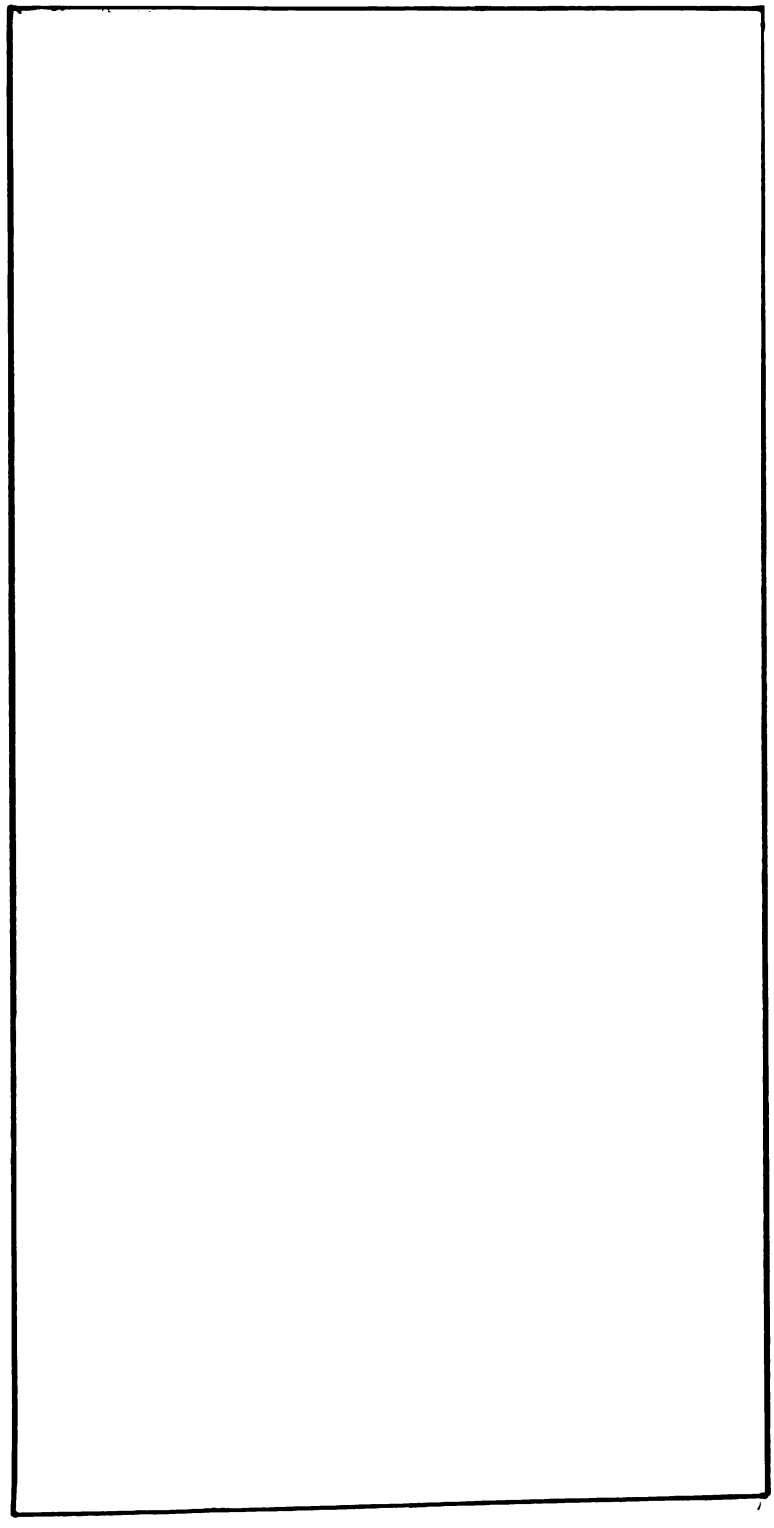

Plate 4 - Triangle

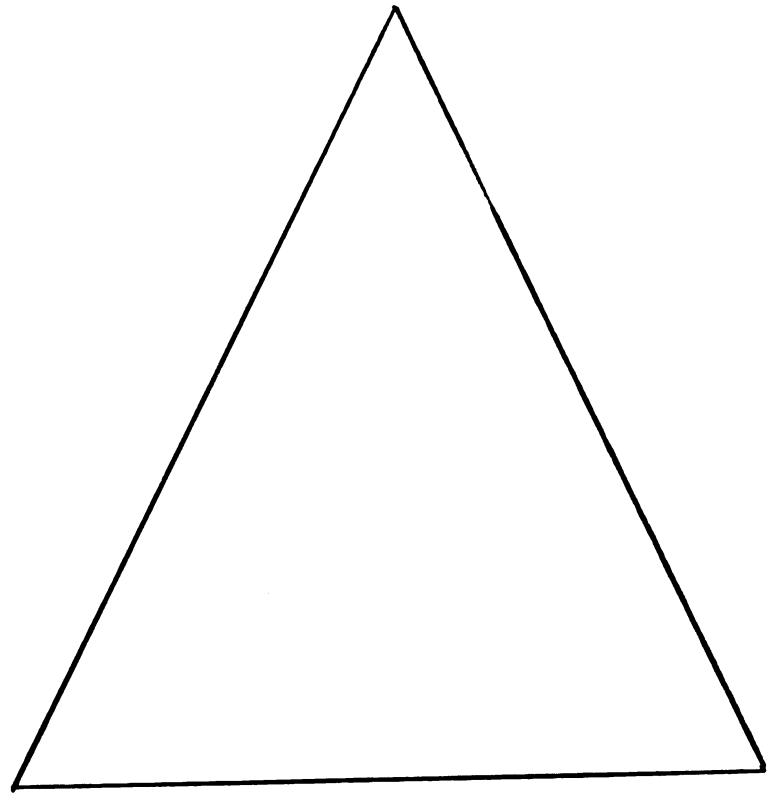

Plate 5 - Horizontal Diamond

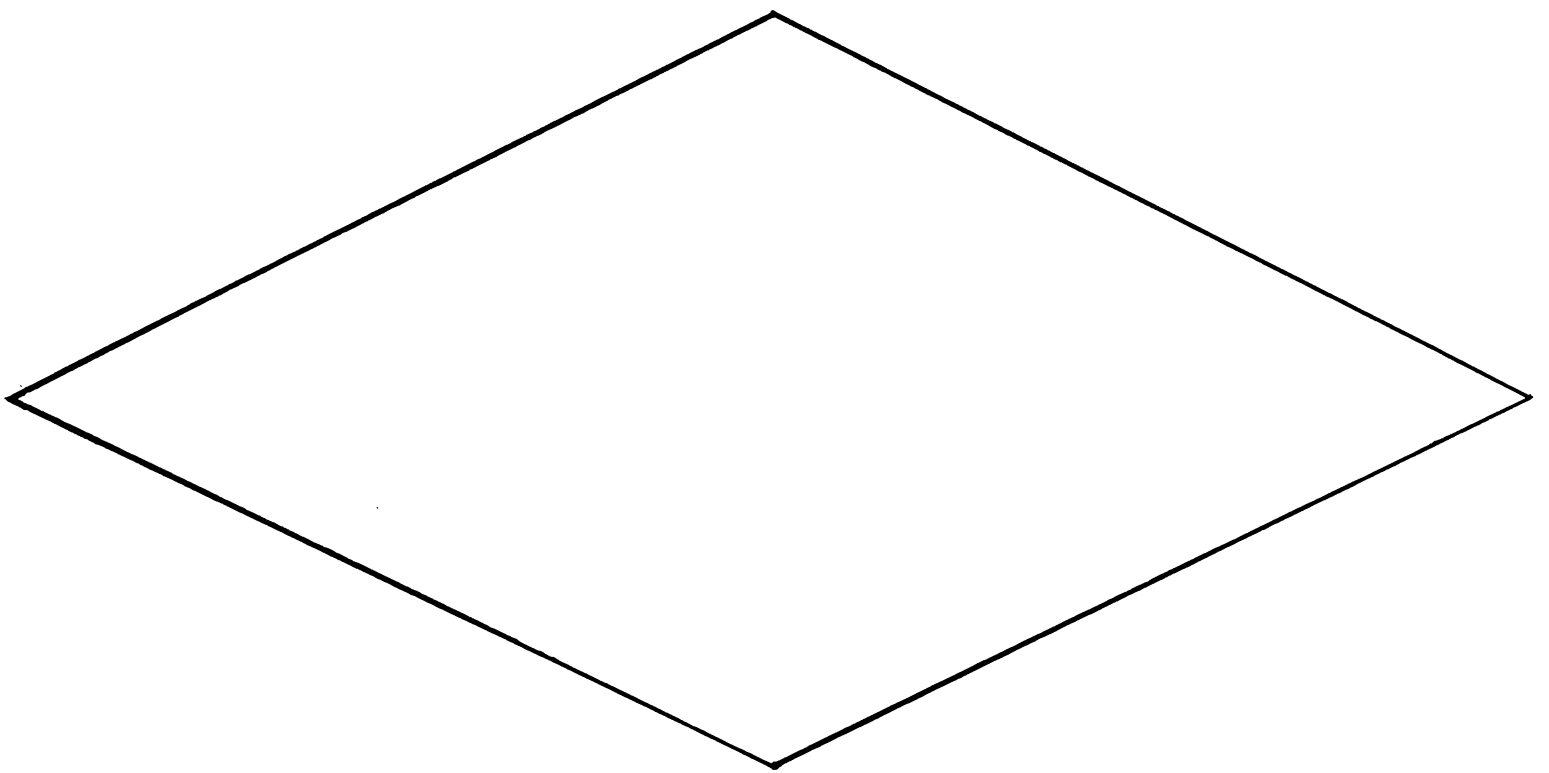

Plate 6 - Vertical Diamond

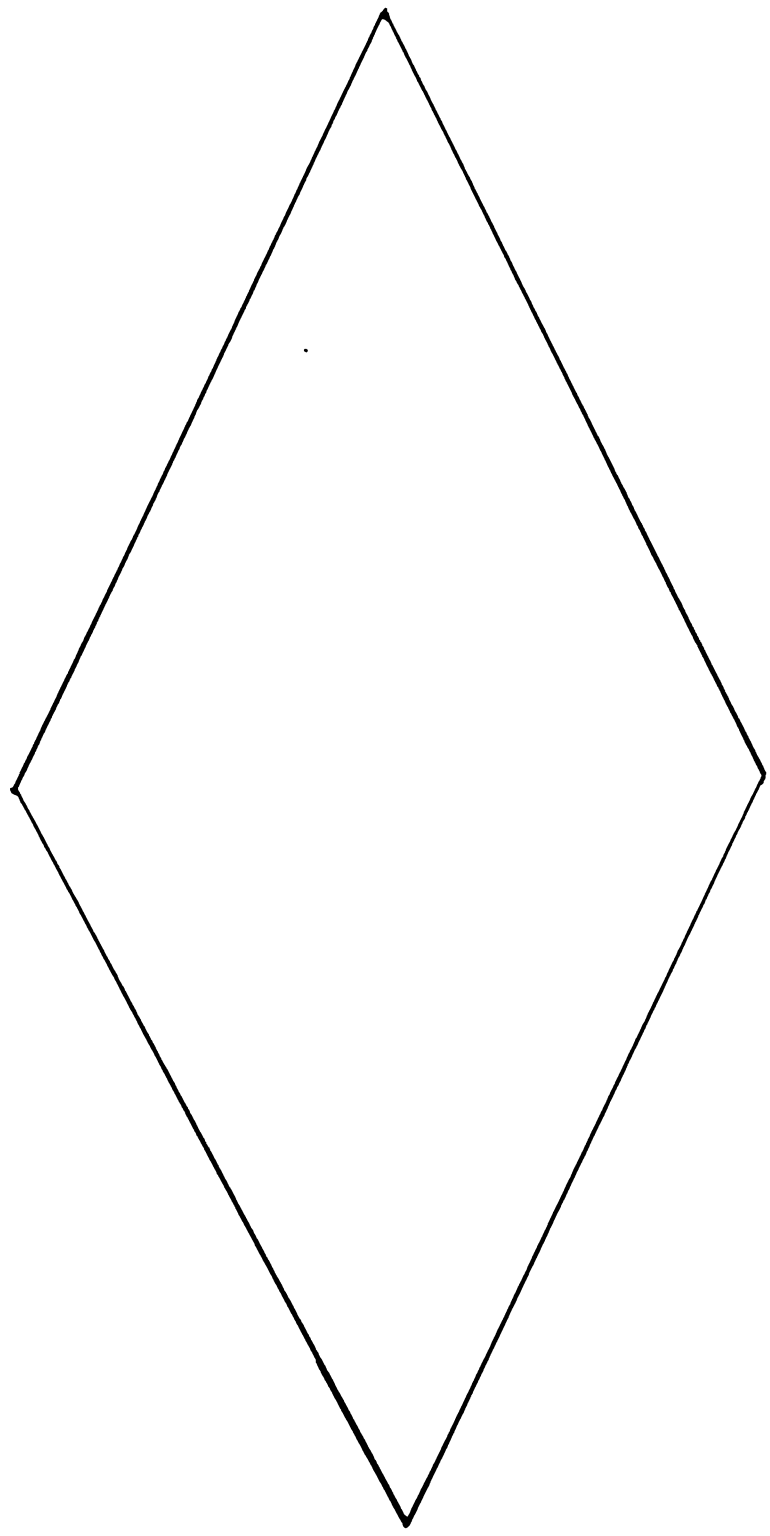

Plate 7 - Composite Template