A STUDY OF THE EFFECTS OF A SWIMMING PROGRAM UPON PERCEPTUAL-MOTOR ABILITY AND READING ABILITY OF SLOW READERS

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CHAPTER I

INTRODUCTION

Psychologists and experts in the field of reading have long believed that reading difficulties may be associated with specific physical abnormalities. There is evidence to indicate that visual perception may be related to reading achievement, and there is limited research on the relationship between perceptual-motor ability and reading ability. This study was conceived because of the possible relationship between reading ability and perceptual-motor ability. A search of the literature in the field of perception, reading and swimming revealed no studies designed to determine the effects of a swimming program on the reading ability and perceptual-motor ability of children.

While it is true that perception is related to reading ability, it may also be true that perceptual-motor ability is related to reading ability. Swimming skill may be a predictor of perceptual-motor ability; therefore, it may be directly related to reading ability. If it can be determined that swimming, reading ability, and perceptual-motor ability are inter-related, then the value of a swimming program in the elementary curriculum could be established. This could be a break-through in the development of reading skills in elementary school children and would provide further substantiating evidence of the value of physical education in the general education curriculum.

Swimming would appear to have the potential for making some unique contributions to the perceptual skills of a child. It is the writer's opinion that the resistance afforded by the water on the swimmer's body increases the sensory input and may enable the student to better perceive his actions and positions. Another contribution is suggested by Barabara Godfrey who feels that the swimming pool serves a special function in motor pattern development far beyond that which any other medium can achieve [1] The pool presents an unstable, but supportive and sometimes resistive medium to the child. It is one in which movement reactions and capabilities are quite different from those on land or in air.

In order to understand the development of perception through swimming, it is important to understand perception in terms of other activities. Gestaltist theorists claim that perception is not composed of many small sensory elements but of fields of sensation which enable the individual to perceive objects and events in the environment as bounded "wholes."[2]

Doman and Delacato contend that the sensory input provided by creeping and crawling movements improves not only mobility but also speech and vision.[3] They feel that their treatment is related to reading and through their developmental process reading ability can be improved.

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[1] Barbara B. Godfrey, "Motor Therapy and School Achievement," Journal of Health Physical Education and Recreation, May, 1964, p. 65.

[2] Hope M. Smith, "Motor Activity and Perceptual Development," Journal of Health Physical Education and Recreation, February, 1968, pp. 28-33.

[3] Carl H. Delacato, Neurological Organization and Reading (Springfield, Illinois, 1966).

Critics maintain that the improvements reported in the youngsters treated by this method, result less from the Doman- Delacato program than from the intensive love and attention concentrated on them. There is also a lack of experimental data to verify the Doman- Delacato theory.

Doman and Delacato base their ideas on Hebb's theory regarding cell assembly.[4] These assemblies, repeatedly active at the same time, tend to become associated so that activity in one facilitates activity in another. This is an explanation of the developmental theory of learning on which this paper is based. If it can be shown that swimming is an activity facilitating perceptual-motor development and if perceptual-motor ability is associated with reading development, then swimming should be a step in the development of reading ability.

Statement of The Problem

The purpose of this study was to determine the effects of a swimming program on the reading ability and perceptual-motor ability of elementary school children who were classified as "slow-readers." A sub-problem was to determine the effects of a special physical education program on reading ability and perceptual-motor ability as compared to a swimming program.

Scope of Study

Twenty-four elementary school children were placed in three groups of eight each and paired on I.Q. scores. Two groups of subjects were

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[4] A. Jean Ayres, "Occupational Therapy for Motor Disorders Resulting from Impairment of the Central Nervous System," Rehabilitation Literature, XXI (October, 1960), p. 308.

experimental groups with one receiving training in a special swimming program and the other receiving training in a special physical education program. The third group was controlled and did not receive any extra training. The subjects were given a pre-test and post test in reading ability and perceptual-motor ability. All subjects participated in a daily regular physical education program. Each subject received special remedial reading instruction daily. The experiment was conducted for five weeks.

Kephart's Perceptual-motor Test was used to determine the perceptual-motor ability, and the Bond-Balow-Woit Reading Test was used to determine reading ability. The scores from these tests were compared on pre-test and post test scores and this comparison was correlated to determire the relationship between reading ability, perceptual-motor ability, swimming, and a special physical education program.

Delimitations and Limitations

As in any experimental research there are certain limiting factors is this study which must be noted. The length of the special swimming program was limited to five weeks. Had the program been conducted over a longer time period, the results may have been different. The real results from this program may not be fully understood until the end of the summer since many of the swimming subjects will have participated in a swimming program for an additional three months and this extended training could bring more change than was possible in the five weeks of the experiment.

There were only eight subjects in each group. With this small number of subjects, the results may be different from those obtained on

a larger group. The larger the population tested, the more representive of the total population are the results; therefore, the greater the reliability of the study.

The subjects had different physical education instructors, this could have resulted in different motivational stimuli being presented to the children. Each instructor presented the material in his own way and this could have affected the learning situation. One instructor seemed to have a more personal relationship with the students than did another of the instructors.

The subjects in the physical education program had an eight to one relationship with the instructor. The swimming program's instruction was based on a two to one or one to one (student to instructor) ratio. This difference in individual attention could have affected the results.

Some of the swimming students had the same instructor daily while others did not. The results might have been different had all students received instruction from only one instructor.

The varsity swimming team shared the pool with the experimental group four days a week, and this could have affected the learning situation by distracting the subjects' attention. At the beginning of the program, the subjects did seem to be distracted by the swim team but after a week in the pool, the children were able to concentrate on swimming.

DEFINITIONS OF TERMS USED

Reading Ability - accurate recognition and understanding of words and the letters from which they are formed. Reading ability is measured by achievement in vocabulary and word recognition, comprehension, evaluation and interpretation.

Perception - the ability to recognize basic forms and discriminate between these forms. It is a response to a situation which is determined by past experiences and by the present stimuli.

Perceptual-motor - the ability to integrate tasks which involve the combining of sensory information and cues gained from complex voluntary movements.

Slow reader - a child who has at least "average" intelligence but has failed to grow in reading ability.

CHAPTER II

REVIEW OF LITERATURE

A review of the literature is presented relating to perceptual-motor ability, reading ability, and swimming. Since this experiment is directly concerned with these three areas and their relationship to each other, a comprehensive review of the literature available is included.

Perceptual-motor and Reading Ability

Poetker, McCormick, Schnobrich, and Footlik conducted an experiment to determine if slow learners or underachievers improve their reading achievement following perceptual-motor training.[1] It was hypothesized that as the result of a special program of exercise, significant gains in reading achievement would occur in children with average I.Q. who exhibit below average reading ability.

Fourteen sets of three children were matched in age and sex. The children in each set were then randomly distributed into three groups. One group received perceptual-motor training twice a week for forty-five minutes each session. Group two received standard physical education training twice a week for forty-five minutes. The third group received

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[1] Clarence C. McCormick and others, "Improvement in Reading Achievement through Perceptual-motor Training," Research Quarterly, AAHPER 39: 627-633, (October, 1968).

no extra training, activity, or attention. The program was conducted for seven weeks. The Lee-Clark Reading Test was administered before and after the program.

None of the groups showed statistically significant gains, but the experimental perceptual-motor group showed significant gains over the other groups. It was concluded that perceptual-motor training could be used in conjunction with the regular physical education program, contributing by increasing the child's capacity for academic achievement.

In another study, Jeralyn Plack conducted an experiment to determine what relationships exist between specific motor skills and achievement in reading of children in grades one, three, and five.[2] The Johnson motor achievement battery was used to measure motor skill achievement.

One hundred and seventy-two subjects were tested and graded in reading ability. When the subjects were grouped into high, middle, and low reading achievement, there were significant differences in motor skill between the high and middle reading achievement levels. The gains were not significant in the low achievement group.

Newell Kephart in a discussion on perceptual-motor ability argues that every child undergoes an extensive process of sensory-motor development which provides the matrix of readiness skills for more complex learning.[3] He believes that the body develops in definite stages and if

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[2]Jeralyn Plack, "Relationship Between Achievement in Reading and Achievement in Selected Motor Skills in Elementary School Children," Research Quarterly, AAHPER 39:1063-1068 (October, 1968).

[3]Newell C. Kephart, The Slow Learners in the Classroom (Columbus, Ohio, 1960), pp. 23-50.

one stage is omitted, then there is little value in trying to go to the next stage. The missing step has to be filled in before progress can be made because development is a hiearchy and each skill is built upon the preceding one. Children must learn to change their posture in space readily, and balance and posture must be flexible to permit movement and to enable the child to be aware of all positions of body parts in space. Kephart's perceptual-motor approach attempts to orient the child to his environment in order for him to make perceptual-motor matches that will facilitate learning. He considers perceptual-motor orientation as the foundation for symbolic and conceptual activities.

Swanson's study concluded that perceptual-motor performance and reading and number readiness in kindergarten may be used as a predictor of achievement in the first grade.[4] He found significant positive correlation for both measures. The Metropolitan Readiness Test was slightly higher than the Perceptual-Motor Survey. The investigator was led to believe that the Perceptual-Motor Survey was a predictor of academic success in the first grade, but as Kephart had stated, it was probably best used as an additional determiner of prediction in conjunction with other such applicable measures.

Doman and Delacato stress certain exercises for improving movement skills.[5] They, along with Kephart and others, believe that there is no simple distinction between perceptual skill and movement skill. It follows that training in movement should improve related perceptual

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[4]Elizabeth Maier Swanson, "Perceptual-Motor Performance and Reading and Number Readiness in Kindergarten as Predictions of Achievement in First Grade (unpub. Masters Thesis, Purdue University, 1963).

[5]Delacato, p. 19.

skills, but little scientific evidence is available that supports the assumption that perceptual-motor training increases ability to perform related perceptual-motor skills. This is one of the areas of critical evaluation of the Doman-Delacato theory.

Bowers developed a program for neurological organization that has been distributed for general use.[6] His rationale rests on the assumption that children omitting any one of four recognized levels of development in which there is progressive movement will perform poorly at the next level. These four levels are: 1) moving arms and legs without forward movement; 2) crawling; 3) creeping; 4) walking.

Influenced by Delacat 's approach, Bowers believes it necessary to provide the opportunity for children to experience the neuromotor activities common to the level of development that may have been interrupted or omitted. He believes that neurological organization is essential to visual perception, spatial perception, and reading and writing skills. Therefore, improvement in neuromotor areas should also contribute to increased performance in academic areas.

Bryant Cratty states that there is no direct evidence that indicates that perceptual-motor activities improve intellectual ability (there is no general agreement on what intellectual ability is); however, there are certain components of the overall educational program in which motor activities contribute positively.[7] He concluded that participation in various perceptual-motor activities plays a definite role in the

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[6]Louis Bowers, A Program for Neurological Organization (University of Southwestern Louisiana, Layfayette, Louisiana, n. d.).

[7]Bryant J. Cratty, Developmental Sequence of Perceptual-Motor Tasks (New York, 1967), p. 3.

total educational program of retarded and neurologically handicapped children, including the programs of "normal" children. According to Cratty unless the principles for transferance of learning are applied, it is unlikely that such training will result in marked changes in the academic success of educationally handicapped children. It must be noted that most children with perceptual-motor problems usually have learning difficulties. Many intellectually gifted children exhibit motor difficulties, discounting the theory that all learning difficulties are solely related to motor ability. Still, learning difficulties of some children are attributable to perceptual-motor difficulties. Cratty's studies have indicated positive relationships between movement and intelligence, but the findings are not significant.

It is generally believed that vision is directly related to reading. Cratty states that reading disability is attributed to many different problems, including poor vision, mixed eye dominance, perceptual handicaps including gross motor and fine motor problems.[8] Generally no one particular cause embodies the total problem, each is related to another; thus the child is multi-handicapped. Perceptual-motor may be one source of improving reading which leads to improvement in other areas. It is said that balance is the basis of all visual perceptions because gravity is the only constant in the universe.[9] This statement applies uniquely to this study in that balance is one of the major considerations in the

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[8]Bryant J. Cratty, (Professor at University of California, Los Angeles, California), "Movement Panaceas, Principles of Learning and the Scientific Method of Problem Solving," speech, (Texas Womens University, Denton, Texas, November, 1968).

[9]Cratty, "Movement and the Intellect," speech, (San Diego, California, June, 1967).

perceptual-motor test. In relation to Cratty's statement about gravity, it would be interesting to note if balance improves through swimming, since swimming places the student in a completely different situation in relationship to gravity due to a buoyance factor. The key to helping a child with learning problems lies in attempting to understand the child. Improvement in behavior of people cannot be gained by simply inserting them into a formula.[10]

Julian Stein stated in a discussion on perceptual-motor functions that some youngsters with reading problems improve with perceptual-motor training.[11] This is because the training is helping their particular need but we cannot generalize and say that this program is going to work with every child who has, apparently, the same problem.

Dr. Charles Drake at the same symposium stated that reading consisted of a number of sequential acts and the first of these is some scanning mechanism which allows the child to concentrate on a series of graphic symbols.[12] The average child who has trouble comprehending only, has normal and often high perceptual-motor skills. It is the individual who is having the decoding problem who normally has perceptual-motor disability. There is no evidence to say that motor training will help all slow readers.

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[10]Cratty, speech, (Texas Womens University, Denton, Texas, November, 1968).

[11]Eric Denhoff, Perceptual-Motor Foundation: A Multidisciplinary Concerned (Washington, D. C., 1969).

[12]Ibid.

Academic Achievement

Barbara Godfrey conducted an experiment to determine the relationship of gross motor activities as a therapy to facilitate academic school achievement.[13] Problem solving activities were used to elicit movement patterns and to induce experimentation on the part of the child.

Four subjects were given problem solving activities including activities involving the trampoline, mats, apparatus, rhythm instruments, and swimming. The activities were carried out in a two hour session each week and continued throughout the week on their own. The program varied in length from one to five semesters. The results showed increased scholastic achievement and school grades improved by one letter grade; however, there was little increase in I.Q. The matched control group did not show the same improvement. Of this control group, three out of four went down in achievement scores and all four went down on I.Q. scores.

Ismail, Kephart, and Cowell conducted several extensive studies and derived a number of motor aptitude tests, including Kephart's physical education material and found that I.Q. and academic success could be predicted from these motor tests.[14] The prediction could be made better for lower achievers than for high or average achievers. They found that balance and coordination were the most important motor factors in predicting academic achievement and I.Q.

In Pritchard's study, he investigated the progress of children in

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[13] Godfrey, p. 65.

[14] A.H. Ismail, N.C. Kephart, and C.C. Cowell, Utilization of Motor Aptitude Tests in Predicting Academic Achievement (August, 1963).

school during a single school year in the Purdue Motor Therapy Laboratory.[15] He found that there was improvement in academic accomplishment for most, but that there was no statistically significant improvement in academic achievement for the subjects in the motor therapy program. The experimenter concluded that nine months was too short a time period to give anything other than a possible indication of positive contribution of motor therapy to academic achievement. If Pritchard's conclusion is correct, it suggests that the five week experimental period used in this study did not allow time for significant results.

James Oliver found that he could significantly improve the I.Q. of educable retardates by subjecting them to an extra three hours a day of physical activity in which they learned recreational skills and participated in fitness activities.[16] He speculated that the improvement elicited stemmed from a heightened motivational state and an improved self-concept.

Soloman and Prangle found that improvement in a population of retarded children subjected to a special physical education program resulted only in motor ability. I.Q. and other measures of school achievement remained unaffected.[17]

Elenor Methany states that human mentality is a process which

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[15]Donna Moor Pritchard, "The Role of Motor Therapy in the Achievement of Children" (unpub. Masters Thesis, Purdue University, 1965).

[16]J.N. Oliver, "The Effects of Physical Conditioning Exercises and Activities on the Mental Characteristics of Educationally Sub-Normal Boys," British Journal of Educational Psychology, XXVIII (June, 1958), pp. 155-165.

[17]A. Soloman and R. Prangle, "Demonstrations of Physical Fitness Improvement in the Educationally Mentally Retarded," Exceptional Children, XXXIII (November, 1967), pp. 177-181.

transforms sensory experience into abstractions or concepts which symbolize the meaning of sensory perception to a person.[18] Evidence from clinical experiences and the data from a few controlled experiments suggest that the individual's personality and behavior function better when the body experiences physical competence. This suggests that physical movement and ability in such movements may possibly relate to the child's competence to analyze abstract information.

Donna Obricht started a motor facilitation program in Illinois, the purpose of which was to help each child develop perceptual-motor abilities through participation in a series of motor activities and the use of Frostig's materials.[19] The six hundred and thirty-five subjects participated for one year. The lessons were planned in developmental sequence and the children were not allowed to proceed with the next step without performing the preceding one. This is in keeping with Kephart's developmental theory. The results of her program have not been published at this date, but the teachers involved in the program have been pleased with the program.

Swimming

Walking, swimming, skating and other motor skills which are of a continuous nature are more resistant to forgetting than are skills made of separate movements, according to Gagne and Fleishman.[20] If this is

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[18] Ruth Hook Wheeler and Agnes M. Hooley, Physical Education for the Handicapped (Philadelphia, 1969), p. 93.

[19] Donna Obricht, Motor Facilitation Project (Wheeling, Illinois, 1967).

[20] R.M. Gagne and E.A. Fleishman, Psychology and Human Performance, (New York, 1959), p. 493.

true, then it is interesting to consider the relationship between swimming as an unforgettable motor skill and reading as an unforgettable academic skill.

Fait believes that swimming is the most successful therapeutical physical education activity for handicapped persons because the buoyancy of the water provides support for the body. Sustained by the water, a crippled body can perform otherwise impossible movements.[21] Even those students who are incapable of walking, severe cerebral palsy victims, for example, are frequently able to swim. Mentally retarded students find the buoyancy of the water comforting. If this success can be accomplished with the handicapped children, similar results may be evident in slow readers in the relaxing environment of the water which may induce a better learning situation.

Weakened muscles are aided through buoyancy. Daniels and Davis advocate swimming as a value in assisting muscular control and coordination plus range of motion from very limited to full movement and progressive development of strength and endurance.[22] They feel that a swimming program results in not only the learning of the skills but also contributes to psychological adjustment and social outcomes. Many physically or mentally handicapped children are plagued with a lack of self-confidence. Through the development of self-confidence, improved body perception may also develop. Swimming is one of the best activities for persons with disabilities of any type. Wheeler and Hooley feel that

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[21]Hollis F. Fait, Special Physical Education: Adapted, Corrective, Development (Philadelphia, 1966), p. 262.

[22]Arthur S. Daniels and Evelyn A. Davis, Adapted Physical Education (New York, 1965), pp. 439-479.

body image or body perception plays a vital role in human movement, whether dealing with the handicapped or non-handicapped person.[23]

Swimming compares with other endurance activities by increasing heart rate, oxygen uptake, and pulmonary ventilation. These are influenced by body position and water immersion which may also influence body perception. Although swimming is a fitness activity, it may also be used to improve perception through body position and water immersion, each in its own relationship.

From the review of literature, it is apparent that there is some basis for concluding that programs designed to improve perceptual-motor ability may result in an improvement in learning. Much of the data is empirical in nature with only a few studies using experimental designs. This is an area in need of more research. Considerably more experimental evidence must be gathered before definite conclusions can be drawn regarding the nature of this relationship. Many administrators feel that ideas must be thoroughly proven before they can be employed in the curriculum. This is a justifiable philosophy but many potentially usable ideas lack such evidence and are denied the opportunity for inclusion. There is no experimental data stating that swimming or physical education can be harmful to slow readers, therefore, another philosophy can be considered, a liberal one. This philosophy may see the program justified in the respect that if it does not hurt them, then why not try it? If swimming were incorporated into elementary school programs, the present programs might be jeopardized. It would cause an added expense to the school systems, one that most schools would not want to have.

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[23]Wheeler and Hooley, p. 92.

Logic tells us that perception is directly related to past and present experiences; therefore, the more the child can experience, the better he can perceive. Since the swimming pool offers such a different environment, it seems that this experience would help the child in his associations with other academic subjects. The swimming pool could be used in conjunction with the present physical education program to give the child the experiences he needs to develop his abstract thinking.

CHAPTER III

PROCEDURE

The subjects were selected from the elementary schools in Stillwater, Oklahoma, where all were enrolled in special reading classes. At the beginning of the 1968 academic year, the subjects were given a battery of reading tests which classified them as slow readers. The students were also considered for the remedial class on the basis of referrals from the classroom teachers. They were retested on reading at the beginning of this study to determine the level at which each student was functioning.

For the purpose of this study, the subjects were divided into three groups, 1) swimming 2) special physical education 3) control. The physical education group had already been chosen and the students had been participating in a special physical education program for a period of three months before the present study. Since this group was already established, the other two groups were paired with this group by the I.Q. scores recorded on the Wechsler Intelligence Scale for Children. There were eight subjects enrolled in the special physical education group; therefore, eight subjects were included in each of the other two groups. The swimming group consisted of seven boys and one girl. The physical education group consisted of six boys and two girls, and the control group included five boys and three girls. All subjects participated in a regular physical education program provided at their schools. The

swimming program was conducted five days a week for thirty minutes each.

All subjects were tested on reading ability and perceptual-motor ability before and after the experimental period. Each group was given the Bond-Balow-Woit Test which measures word recognition, comprehension of significant ideas, and comprehension of specific instructions. The advanced test included items in basic vocabulary, reading to retain information, reading to organize, reading to evaluate and interpret, and reading to appreciate. The subjects were also given parts of The Purdue Perceptual-Motor Survey.[1] They were tested on the walking board, jumping, identification of body parts, imitation of arm movements, angels-in-the-snow, and an obstacle course which consisted of stepping over a bar at knee level, under a bar at shoulder level, and walking between two surfaces just wide enough to pass through sidewards. These portions were chosen because they dealt specifically with perceptual-motor skills. Kephart's test is divided into five major divisions, balance and posture, body image and differentiation, perceptual-motor match, ocular control and form perception. The perceptual-motor match was not used because it dealt mainly with drawing or writing skills which the author did not deem pertinent to this study. The ocular control and form perception were visual skills that were probably adequately accounted for in the reading tests. The researcher added a balance test designed to measure the subject's ability to maintain his balance. Since balance seems to be an important perceptual-motor ability it was included as a separate item. The subjects were asked to stand on their right foot, with their

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[1]Newell C. Kephart and Eugene G. Roach, The Purdue Perceptual-Motor Survey (Columbus, Ohio, 1966).

eyes closed, and hold their balance as long as possible, up to ten seconds. The students repeated the activity on the left foot, and the length of time that the subjects held their balance was recorded. This test was not standardized but it was one of the author's design.

Swimming Program

Group I, designated as the swimming group, was given a five week swimming program in addition to their regular physical education activity. The program was given daily (Monday through Friday) for thirty minutes. The subjects were given individual instruction with no more than two subjects per instructor. The instructors followed the American Red Cross Beginning Swimming Instructors Manual which includes the activities in Table I below.

TABLE I

SWIMMING PROGRAM

American Crawl	Human Stroke and Flutter Kick
Back Crawl	Jump into Deep Water
Back Float	Leveling Off
Back Kick and Glide	Prone Float and Glide
Breath Holding	Rhythmic Breathing
Change of Direction	Running and Jumping into Deep Water
Changing Position	Treading Water
Diving	Turning Over
Elementary Back Stroke	Underwater Swimming

Each subject's swimming ability was subjectively evaluated by the researcher and an assistant at the beginning of the program and again at the conclusion of the program. The subjects were rated as "beginner-beginner" (ones never having been in the water and very afraid of it) "beginners" (those who had overcome the fear but were not knowledgeable in any skills) and "advanced-beginners." The instruction was given by junior and senior physical education majors and graduate students at Oklahoma State University. Some instructors worked with the same child daily while other children did not have the same instructor each time. Each instructor had a Life Saving or Water Safety Instructors Certificate.

Special Physical Education

Group II was given a special physical education program in addition to their daily regular physical education class. (Refer to Table II on page 23 for the activities included in this program.) The special program was thirty minutes per day (Monday-Wednesday-Friday). The students had been receiving the training for a period of three months prior to the beginning of this study. The program was taught by the regular physical education instructor and the student teacher in the elementary school.

Control Group

Group III was the control group and received no special physical activity other than the regular physical education program. The regular physical education program was conducted for thirty minutes a day (Monday through Friday). The activities in the program are included in Table III on page 23.

TABLE II

ACTIVITIES IN SPECIAL PHYSICAL EDUCATION PROGRAM

Angels-in-the-Snow	Jumping Up and Down
Bicycle Riding	Rhythm Sticks
Crab Crawl- forward and backward	Rhythms to Music
Fitness Test	Running Backward
Identification of Body Parts	Throwing and Catching
Jumping Jacks	Weaving Skills

Identification of Circles, Squares, etc.

Obstacle Course- weaving, rolling ball, dribble

Rolling Ball Down Straight Line (feet and hands)

Rub Stomach and Pat Head

Running the Grapevine (front wards, backwards)

Walking Board- forward, backward, sideward

TABLE III

ELEMENTARY PHYSICAL EDUCATION ACTIVITIES

Agility Skills- body movements, ball handling, etc.

Bowling	Rhythms
Circuit Training	Soccer Skills
Fitness Test	Softball Skills
Games	Tumbling
Relays	Volleyball

The daily physical education program in which each group participated was taught by two different instructors in the elementary schools. For two weeks, the first and second grade children participated in more

structured activities than recess, including rhythms and games. The other three weeks were spent in "recess activities" that consisted of the children doing whatever they wanted to do—— primarily kickball.

The remedial reading program was continued throughout the five week experimental period. I.Q. scores were obtained through the assistance of a reading specialist before the program started in order to aid in matching the groups. These I.Q. scores were recorded from the Wechsler Intelligence Scale for Children. The reading specialist used the Linguistic approach in the remedial reading class. This approach is based on the theory that reading must first begin with a knowledge of the language, therefore, the students learn words and sounds first.

The statistical design for this experiment was divided into three parts. The Kruskal-Wallis one-way analysis of variance was used to show the significant difference between reading ability and perceptual-motor ability on the pre-test and post test of each.[2] The Wilcoxon matched-pairs signed-ranks test was then used to test the null hypothesis that there was no significant difference from zero in the swimming, special physical education or control groups.[3] Finally, the Spearman rank correlation coefficient was used to compare the post tests of each group.[4] The (.05) level of confidence was accepted as indicating that a difference was significant.

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[2]Sidney Siegel, Nonparametric Statistics (New York, 1956), pp. 184-193.

[3]Ibid, pp. 75-83.

[4]Ibid, pp. 202-213.

CHAPTER IV

RESULTS

The groups were paired on I.Q. scores obtained from the Wechsler Intelligence Scale for Children. The Kruskal-Wallis one-way analysis of variance was used to show the significant difference between the pre-test and post test scores on the Bond-Balow-Woit Reading Test and Kephart's Perceptual-Motor Test plus the balance test. The Kruskal-Wallis technique tested the null hypothesis that the subjects in the sample came from the same population with respect to averages. The scores were ranked in a single series, and the sum of the ranks was calculated to determine whether or not the sums were from the same population. If the observed value of H is equal to or larger than the value of chi square for the set level of significance, H_0 may be rejected at that level of confidence. H must equal 14.07 in order to reject the null hypothesis. The groups did not reach this level; therefore, the null hypothesis cannot be rejected at the .05 level of significance. (Refer to Table IV on page 26)

The Kruskal-Wallis tests for significantly large differences. Because of the short time period between the pre-tests and post tests in this study, large changes could not be expected to occur; therefore, the analysis of variance may have been an inappropriate statistical technique to apply on this experiment. Under these circumstances, it is not surprising that the differences were found to be non-significant. The

more appropriate question to ask of the data is: can it be inferred that the gains made by each of the groups are "real"; that is, do the gains differ significantly from zero (no gains)? Do the data imply that the same gains will be noted if the experiment is repeated? The perceptual-motor ability scores showed significance between the groups at the 3% to 5% level of confidence on the pre-test and between the 1% and 2% levels on the post test. Because of this difference in percentages on level of confidence, there could be an indication that perceptual-motor ability would improve more readily than reading ability. It could also indicate that the activities presented were more applicable to perceptual-motor ability than to reading ability. The results suggest that perceptual-motor ability could be improved with these activities but further experimentation must be conducted before any conclusions can be drawn.

TABLE IV

H VALUES IN THE KRUSKAL-WALLIS ONE-WAY ANALYSIS OF VARIANCE

Test	H	P
Reading Pre-test	.455	N.S.
Reading Post test	.841	N.S.
Perceptual-Motor Pre-test	7.626	.3-.5
Perceptual-Motor Post test	10.126	.1-.2

In order to determine how "real" the findings are, three tests of significance rather than one were used, thus decreasing the possibility of obtaining significant results by chance. The principle involved was

formulated for cases where large numbers of hypotheses were being tested. In the study, the hypothesis being tested was that poor readers in a swimming program or a special physical education program would show no statistically different gains in perceptual-motor ability or reading ability than the poor readers who had no special program. It would appear that using three tests to examine the null hypothesis exaggerates the odds against rejecting it for one particular combination of the three factors. However, there appeared to be no one overall test of significance appropriate for this hypothesis.

The value of T was calculated from the Wilcoxon matched-pairs signed-ranks test. The T was obtained from the sums of the ranks of those differences with a like sign (plus or minus). If the null hypothesis were acceptable, this would indicate there were approximately an even number of differences with both positive and negative signs. Table V shows the T's obtained from each of the groups.

TABLE V

T VALUES IN THE WILCOXON MATCHED-PAIRS SIGNED-RANKS TEST FOR THREE EXPERIMENTAL GROUPS ON TWO VARIABLES

Groups	N	Reading		Perceptual-Motor	
		T	p	T	p
Swimming	8	12	NS	4.5	NS
Special Physical Education	8	5.5	NS	0	.01
Control	8	13.5	NS	4	.05

The special physical education group and the control group exhibited statistically significant differences ($p < .05$). The swimming group did

not show similar gains. The special physical education group showed significant gains at the .01 level of confidence; therefore, the null hypothesis of no difference between the pre and post tests was rejected on perceptual-motor ability for the special physical education group and the control group. The null hypothesis was not rejected for the swimming group on perceptual-motor or for all three groups on reading ability. This could be interpreted to mean that under the conditions of this experiment, there was no change in perceptual-motor ability or reading ability in the swimming group, thus the null hypothesis cannot be rejected. There were no significant changes in reading ability in the special physical education program or control group; therefore, the null hypothesis cannot be rejected. The changes in perceptual-motor ability by the special physical education group and the control group were statistically significant, thus the null hypothesis may be rejected.

In order to measure the relationship between the two variables of reading ability and perceptual-motor ability, each group was tested on the Spearman rank correlation coefficient. Rho was determined from the differences in the ranks of each subject on the two variables. Rho must be .643 to be significant at the .05 level of confidence. None of the groups reached this significance; therefore, the indication would be that there is not a relationship between reading ability and perceptual-motor ability and that the scores on one cannot be predicted by the scores on the other.

It would be interesting to learn if these same results would occur where the experimental period was extended for several months. Further study would be necessary before the significance of these findings is realized.

CHAPTER V

SUMMARY AND CONCLUSIONS

The experiment resulted in statistically significant gains for the special physical education group and the control group on perceptual-motor ability. The swimming group did not show significant gains in perceptual-motor ability and none of the groups showed significant improvement in reading ability. It would be rash to make any extensive generalizations on the basis of the performance of such a small group in one short experiment. Although the special physical education group showed significant gains in perceptual-motor ability at the .01 level of significance, it cannot be discounted that the control group made similar gains at the .05 level of significance. Since the control group did improve significantly, one might reach the conclusion that the gains by these two groups was a chance factor. This could indicate that the non-significant results exhibited by the swimming group could also occur by chance. The gains could be contributed to many different factors. The control group could have participated in other gross motor activities other than through the school. The subjects could have received individual instruction in these activities thus initiating greater improvements.

However, these results do supply some confidence in the notion that further investigation of these training methods would be justified to determine their value in helping educators to overcome some of the

problems of slow readers. It would be interesting to retest these students after three months of summer swimming and again calculate the results. It is somewhat mysterious that the swimming group did not show greater indications of improvement. It would seem that any gross motor skill would lend itself to improvement in perceptual-motor ability as opposed to no activity, but this remains to be determined by further research. It is even possible that future studies will show swimming to be detrimental to slow readers in improving their perceptual-motor ability and reading skills.

In summary, it is concluded that in this experiment the swimming program did not improve the reading ability or perceptual-motor ability of the subjects. The special physical education group and the control group did improve significantly in perceptual-motor ability but the reasons for these gains remain obscure.

There are many possibilities for research in this field. Other activities such as gymnastics could be used in conjunction with perceptual-motor ability and reading ability. There could have been different results had younger children been used. Reading readiness may be affected more than reading ability through the use of such a program. Different results may occur in perceptual-motor ability in the younger children. The younger child may be more susceptible to perceptual-motor learning at this early age.

In future studies, more subjects should be used in order to better relate to the population. The length of the program should be at least one year to insure evaluation of all changes The length of all programs should be the same, and it would be helpful if the instructors were the same in all programs. The student to teacher relationship

should be the same in all programs. This would alleviate the possibility of individual attention being the contributing factor in the results.

There should also be more research done to determine the relationship between reading ability and perceptual-motor ability. There are very few studies relating these two variables. This study was based on the assumption that perceptual-motor ability and reading ability are related but this is based on the results of only a few studies; therefore, more research is needed in this field.

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APPENDIX

TABLE VI

I.Q. SCORES OF PAIRED SUBJECTS

Subject	Swimming	Physical Education	Control
A	100	101	109
B	120	122	124
C	115	111	114
D	100	98	99
E	80	88	91
F	90	93	95
G	96	101	103
H	119	126	122

TABLE VII

RAW COMPOSITE SCORES ON READING TEST

Subjects in Swimming Group	Pre-Test	Post Test
A	2.9	3.0
B	3.2	2.5
C	2.8	2.5
D	3.5	2.9
E	4.5	5.5
F	2.1	2.2
G	4.3	4.0
H	4.3	4.0

TABLE VIII

RAW COMPOSITE SCORES ON READING TEST

Subjects in Physical Education Group	Pre-Test	Post Test
A	2.9	2.6
B	3.0	2.5
C	2.6	2.1
D	4.1	4.1
E	3.0	2.7
F	3.1	3.3
G	3.8	3.9
H	5.3	5.1

TABLE IX

RAW COMPOSITE SCORES ON READING TEST

Subjects in Control Group	Pre-Test	Post Test
A	4.4	4.4
B	5.5	5.2
C	2.4	2.3
D	2.2	2.1
E	2.7	3.0
F	3.8	3.3
G	4.5	4.4
H	6.4	7.7

TABLE X

RAW SCORES ON PERCEPTUAL-MOTOR TEST

Subjects in Swimming Group	1	2			3	4	5	6	7		Total
A Pre-Test	4	4	4	2	3	3	4	2	4	3	30
Post Test	4	4	3	3	3	3	4	2	2	3	29
B	4	4	4	2	4	4	2	2	4	10	32
	4	4	3	3	4	3	4	3	2	9	33
C	4	4	4	2	3	3	4	3	3	4	34
	4	4	4	2	3	3	4	3	4	1	32
D	4	3	3	2	2	2	4	2	2	2	26
	4	3	4	3	3	3	4	3	2	2	31
E	2	2	2	2	2	3	4	3	2	2	24
	4	4	4	2	2	3	3	3	1	2	28
F	4	4	4	2	2	3	4	1	2	2	28
	4	4	4	2	3	3	4	2	2	4	32
G	4	2	2	3	3	2	3	2	2	2	25
	4	2	4	2	3	3	3	3	2	2	28
H	3	2	4	3	3	2	3	2	2	2	26
	4	4	3	3	4	3	4	4	4	4	37

1) Walking Board
2) Jumping and Hopping
3) Identification of Body Parts
4) Identification of Movements
5) Obstacle
6) Angels-in-the-Snow
7) Balance

Balance Key

0-2 1 point
3-5 2 points
6-8 3 points
9-10 4 points

TABLE XI

RAW SCORES ON PERCEPTUAL-MOTOR TEST

Subjects in Physical Education Group	1	2		3	4	5	6	7		Total
A Pre-Test	3	2	3	3	3	3	4	2	3 2	28
Post Test	4	4	4	3	4	3	4	3	2 3	34
B	3	3	3	2	4	3	3	3	2 2	28
	4	4	4	3	4	3	4	4	2 2	34
C	4	2	3	3	3	3	4	3	3 3	31
	4	4	4	3	4	3	4	3	1 2	32
D	4	2	4	2	4	3	4	3	2 3	31
	4	2	4	2	4	3	4	3	3 4	33
E	4	2	3	2	3	3	4	2	2 1	26
	4	4	4	2	4	3	4	3	2 1	31
F	4	2	2	2	3	3	4	3	2 2	27
	4	4	4	2	3	3	4	4	4 1	33
G	4	3	3	3	4	3	4	2	3 2	31
	4	3	4	3	4	3	4	3	4 2	34
H	4	4	4	2	4	3	4	3	2 3	33
	4	4	4	3	4	3	4	4	2 2	34

1) Walking Board
2) Jumping and Hopping
3) Identification of Body Parts
4) Identification of Movements
5) Obstacle
6) Angels-in-the-Snow
7) Balance

Balance Key

0-2 1 point
3-5 2 points
6-8 3 points
9-10 4 points

TABLE XII

RAW SCORES ON PERCEPTUAL-MOTOR TEST

Subjects in Control Group	1	2	3	4	5	6	7	Total
A Pre-Test	4 4	3 3	4	3	4	2	4 4	35
Post Test	4 4	3 3	4	3	3	3	4 4	35
B	4 3	3 2	3	3	3	3	3 2	29
	3 3	4 3	4	3	4	3	4 3	34
C	4 3	4 3	4	3	4	2	4 2	33
	4 3	4 3	4	3	4	3	3 3	34
D	4 4	4 2	4	2	4	2	4 4	34
	3 4	3 4	3	3	4	3	2 4	33
E	4 3	3 2	2	3	4	2	4 4	31
	4 4	4 3	3	3	4	3	4 4	36
F	4 4	4 3	3	3	4	3	4 4	36
	4 4	4 3	4	3	4	3	4 4	37
G	4 3	3 3	3	2	4	3	2 4	31
	4 3	4 4	4	3	3	3	3 4	35
H	4 3	3 3	4	3	3	3	4 3	33
	4 4	4 3	4	4	4	3	4 3	37

1) Walking Board
2) Jumping and Hopping
3) Identification of Body Parts
4) Identification of Movements
5) Obstacle
6) Angels-in-the-Snow
7) Balance

Balance Key
0-2 1 point
3-5 2 points
6-8 3 points
9-10 4 points

TABLE XIII

KRUSKAL-WALLIS ONE-WAY
ANALYSIS OF VARIANCE

$$H = \frac{12}{N\,(N\ 1)} \sum_{j\,=\,1}^{k} \frac{R_j^{\,2}}{N_j} - 3\,(N\ 1) \Big/ 1 - \frac{T}{N^3 - N}$$

k = number of samples

N_j = number of cases in jth sample

R_j = sum of ranks in jth sample

$\sum_{j\,=\,1}^{k}$ directs one to sum over the k samples

$T = t^3 - t$ (when t is the number of tied observations in a tied group of scores)

$\sum$ T directs one to sum over all groups of ties

TABLE XIV

WILCOXON MATCHED-PAIRS SIGNED-RANKS TEST
FOR SWIMMING GROUP ON READING ABILITY

Subjects	Pre-Test	Post Test	d	Rank of d	Rank With Less Frequent Sign
A	4.3	4.0	.3	5	
B	4.3	4.0	.3	5	
C	2.1	2.2	-.1	-2	2
D	3.5	2.9	.6	7	
E	3.2	3.1	.1	2	
F	2.9	3.0	-.1	-2	2
G	2.8	2.5	-.3	5	
H	4.5	5.5	-1.0	-8	8
					T = 12

TABLE XV

WILCOXON MATCHED-PAIRS SIGNED-RANKS TEST
FOR PHYSICAL EDUCATION GROUP
ON READING ABILITY

Subjects	Pre-Test	Post Test	d	Rank of d	Rank With Less Frequent Sign
A	5.3	5.1	.2	3.5	
B	4.1	4.1	0	1.0	
C	2.9	2.6	.3	5.5	
D	3.1	3.3	-.2	-3.5	3.5
E	2.6	2.1	.5	7.5	
F	3.0	2.7	.3	5.5	
G	3.0	2.5	.5	7.5	
H	3.8	3.9	-.1	-2.0	2.0
					T = 5.5

TABLE XVI

WILCOXON MATCHED-PAIRS SIGNED-RANKS TEST
FOR CONTROL GROUP ON READING ABILITY

Subjects	Pre-Test	Post Test	d	Rank of d	Rank With Less Frequent Sign
A	2.2	2.1	.1	3.0	
B	5.5	5.2	.3	5.5	
C	3.8	3.3	.5	7.0	
D	2.7	3.0	-.3	-5.5	5.5
E	2.4	2.3	.1	3.0	
F	6.4	7.7	-1.3	-8.0	8.0
G	4.5	4.4	.1	3.0	
H	4.4	4.4	0	1.0	
					T = 13.5

TABLE XVII

WILCOXON MATCHED-PAIRS SIGNED-RANKS TEST
FOR SWIMMING GROUP ON
PERCEPTUAL-MOTOR ABILITY

Subjects	Pre-Test	Post Test	d	Rank of d	Rank With Less Frequent Sign
A	30	29	1	1.5	1.5
B	32	33	-1	-1.5	
C	34	32	2	3.0	3.0
D	26	31	-5	-7.0	
E	24	28	-4	-5.5	
F	28	32	-4	-5.5	
G	25	28	-3	-4.0	
H	26	37	-9	-8.0	
					T = 4.5

TABLE XVIII

WILCOXON MATCHED-PAIRS SIGNED-RANKS TEST
FOR PHYSICAL EDUCATION GROUP
ON PERCEPTUAL-MOTOR ABILITY

Subjects	Pre-Test	Post Test	d	Rank of d	Rank With Less Frequent Sign
A	28	34	-6.0	-7.0	
B	28	34	-6.0	-7.0	
C	31	32	-1.0	-1.5	
D	31	33	-2.0	-3.0	
E	26	31	-5.0	-5.0	
F	27	33	-6.0	-7.0	
G	31	34	-3.0	-4.0	
H	33	34	-1.0	-1.5	
					T = 0

TABLE XIX

WILCOXON MATCHED-PAIRS SIGNED-RANKS TEST
FOR CONTROL GROUP ON
PERCEPTUAL-MOTOR ABILITY

Subjects	Pre-Test	Post Test	d	Rank of d	Rank With Less Frequent Sign
A	35	35	0	1.0	1
B	29	34	-5	7.5	
C	33	34	-1	-3.0	
D	34	33	1	3.0	3
E	31	36	-5	-7.5	
F	36	37	-1	-3.0	
G	31	35	-4	-5.5	
H	33	37	-4	-5.5	
					T = 4

TABLE XX

SPEARMAN RANK CORRELATION COEFFICIENT

$$r_s = \left| \frac{-\,6 \sum_{i=1}^{N} d_i^2}{N^3 - N} \right.$$

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