1971

Effects of three training techniques on the swimming abilities of trainable and educable mentally retarded children

Richard Abramson
Colby College

THE EFFECTS OF THREE TRAINING TECHNIQUES ON THE SWIMMING ABILITIES OF TRAINABLE AND EDUCABLE MENTALLY RETARDED CHILDREN

by

Richard Alan Abramson

Submitted in partial fulfillment of the
requirements for the Senior Scholars Program

Colby College

1971

APPROVED BY:

Tutor _____

_____

Chairman, Department of

_____

_____

Reader

_____

Reader

_____

Chairman, Committee on Senior Scholars

TABLE OF CONTENTS

ACKNOWLEOGEMENTS

The author wishes to express his thanks to the following people and organizations for their help:

Dr. Dorin Zohner
Dr. Lewis Lester
Dr. Leonard W. Mayo
Dr. John Winkin
Mr. Jack Scholz
Kennebec Valley Council for Retarded Children, Augusta, Maine
Marie Bradford School, Pittsfield, Maine
Hilltop School, Waterville, Maine
Mary Holland Donovan, Skowhegan, Maine
Winslow Public School System, Winslow, Maine
Oakland Public School System, Oakland, Maine
Pittsfield Public School System, Pittsfield, Maine
The American National Red Cross, Washington, D.C.
The President's Committee on Mental Retardation, Washington, D.C.
Mr. Donald Allsion, Director, Maine Association for Retarded Children
Keyes Fibre Company, Waterville, Maine
Mr. Mark Nelson, Bowdoin College Computer Center, Brunswick, Maine
Mr. Joseph Kern, Department of Special Education, Augusta, Maine
The Instructor Aides:
Robin Hamill
Ann LeBlanc
Pam Mause
Wayland Linscott
Claudia Kraehling
Jeff Hancock
Christie Lingham
Jackie Young
Jackie Nienaber
Holly Arimitage
Candy Burnett
Jane Hooper
Pat Flanagan

INTRODUCTION

The acquisition and incorporation of physical skills are a necessary and desirable part of our everyday life. Requisite to our contact with children, students, patients, and adults in the teaching of physical skills is the ability to communicate effectively.

Verbal instruction may often be very effective in teaching physical skills, but there is some significant evidence to indicate that children and slow learners do not always have the necessary verbal skills. Much of human behavior, including concept learning, has often been represented by a single unit S-R theory. For Kendler and Vineberg (1954), this single unit S-R theory is inappropriate with respect to how we as adults learn concepts. Instead, they suggest a "mediational mechanism" which assumes that "the external stimulus evokes an implicit response which produces an implicit cue that is connected to the overt response:"

Figure 1: The Mediational Mechanism, (Kendler and Kendler, 1962)

However, Kendler and Kendler (1962) have pointed out that the utilization of a mediational mechanism is related to the child's chronological age and level of functioning. For example, classified slow learners would utilize the single unit S-R analysis in solving a discrimination problem involving reversal and non-reversal shifts, while the fast learners would utilize

the mediational S-R theory.

In a reversal shift, the subject must learn to switch his responses to do the exact opposite of that which he has done previously. In a non-reversal shift, the subject must learn to choose the dimension which was previously irrelevant, e.g., making his choice on the basis of color rather than size.

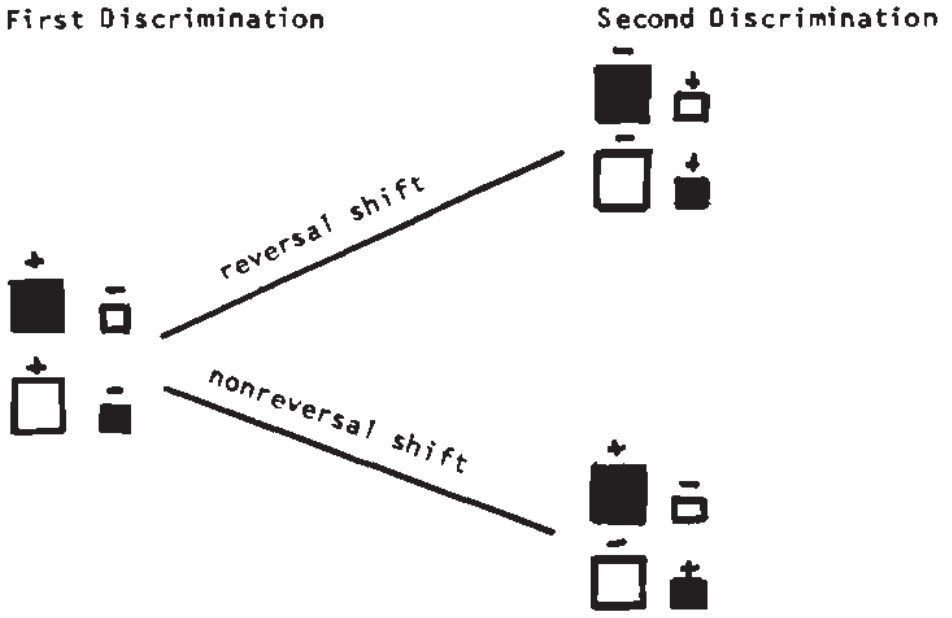

Figure 2: Examples of a reversal and a non-reversal shift, (Kendler and Kendler, 1962, p. 589).

It was noted in the same Kendler and Kendler (1962) that the children would often verbalize the correct solution to the discrimination problem, while making an incorrect response. Flavell, Beach, and Chinsky (1966) pointed out that "a child who 'has' a language, in the sense of having acquired such mastery, may still not know exactly when and where to use what he has, in rather the same way that an individual may 'have' a concept or cognitive rule and yet not think to apply it on every occasion" (p. 296).

Initially, only a limited number of behavioral contexts call forth speech activity, but as the individual's cognitive development proceeds, this number gradually increases.

Kuenne (1946) in an attempt to explain the underlying mechanisms of discrimination learning, specifically as it is relevant to relational versus associationistic concepts in humans, uses Spence's theory on discrimination learning which states:

> Discrimination learning is a cumulative process in which reinforcement strengthens the excitatory tendency or association of the positive stimulus cue to the response of approaching it as compared with the response receives only nonreinforcement, hence developing an opposing inhibitory tendency. (p. 625)

For Spence, when the positive attributes of a cue become sufficiently larger than the negative attributes, learning will occur. Kuenne adapts Spence's theory of the mechanisms which underlie animal behavior, to human Ss by stating that these mechanisms are applicable to a young child, and that "with the development in older children of the capacity to employ verbal responses in such behavior situations, a shift occurs to the verbal type of control" (p. 625).

Consequently, a young child, or a child who has not attained a verbal competence, would learn the discrimination or transposition by means of the positive attributes or reinforcement of that one particular cue, similarly to the way that Spence's animals learned the discrimination.

This does not imply that a young child functions in the same way as a rat, but merely demonstrates the fact that young children, or mentally impaired children, do not possess the ability to control by verbalization, the choice to be made in the discrimination problem. The important variable with regard to this type of learning is the level of excitation of the

positive cue.

Kendler and Kendler's and Kuenne's model are similar in the sense that there are two distinct stages that progress along time. The first stage being similar to Spence's discrimination learning in animals, and the second stage the control of "overt behavior by means of . . . verbal responses or their implicit equivalents . . . " (Kuenne, 1946, p. 625).

Kuenne concludes that children with MA's (mental ages) between 3 and 6 years fall into four groups:

1. Failure to verbalize the size aspect of the problem.
2. Verbal identification of the size difference between the stimuli without explicit association of size with the success or failure of choice behavior.
3. Verbalization of the principle of solution in response to questioning at the conclusion of the experiment.
4. Verbalization of the principle spontaneously during training or transposition trials (p. 637).

Ss in the first two categories had mental ages significantly younger than those in the last two categories.

As further evidence for the lack of requisite verbal competence in children, Luria (1961) points out several important aspects of verbal training. Upon receiving verbal instructions, a child between the age of 18 months and two years readily carries out the required movement, providing that he understands what is meant by the instructions. But, once having started the movement by verbal instructions, he cannot similarly inhibit it with opposing verbal instructions.

> The essence of the instruction is that it demands a synthesis of the two verbal elements: it is this creation of a preliminary system regulating a subsequent course of action that is the principal distinguishing feature of such verbal instructions (p. 603).

But as has already been pointed out, a child at this young age has not developed this regulating mechanism.

Similarly, children between the ages of 2½ years to 3½ years do not possess the capability of utilizing the inhibitory function of speech. In fact, "adult speech which attempts to inhibit nonvolitional motor reactions often operates unspecifically and only intensifies the motor reaction . . . " (p. 604). At the age of 4 (or the first year of pre-school childhood), the capability to perform these more complicated inhibitory reactions becomes manifest, in addition to the increase in more rich, fluent, and mobile speech.

Children between these ages are capable of successfully regulating their motor behavior with the aid of their own speech which is capable of reinforcing the motor action of behavior. This utilization of the child's own speech eventually becomes internalized. "[This] regulatory function is steadily transferred from the impulse side of speech to the analytic system of elective significative connections which are produced by speech" (p. 620).

Thus, in summary of the evidence, children may have a definite limitation with regard to verbal competence, depending on their mental age and level of functioning. There can be no designation of an age when a child will utilize a mediational mechanism to solve a problem; or be able to control his overt behavior via verbal responses; or utilize a regulatory mechanism in initiating motor behavior, but as Reese (1962) points out, "the critical age for the occurrence of mediation [or other cognitive functioning] may be different for the different experimental situations and for different concepts." As the evidence has hopefully

shown, this transition will eventually occur providing the child has not leveled off at too young an age in his intellectual development.

Realizing that children and slow learners do not always have the necessary verbal skills required for the acquisition of physical skills is important. That is, that retarded children, with whom this study is concerned, are usually functioning at a lower physical and performance level than children of normal intelligence. According to Widdop (1968), educable mentally retarded boys and girls function on a lower level than normal boys and girls in regard to mean performance on all physical test items.

In order to be able to understand exactly how a young child or a mentally retarded child functions within the intellectual framework, Jean Piaget's definition of intelligence will hopefully serve to elaborate on the previously cited evidence, as well as to explain how these retarded or young children function within a cognitive sphere.

Intelligence for Piaget (1952),

> . . . consists in an increasingly advanced acquisition of awareness of the organizing activity inherent in life itself, and the primitive stages of psychological development only constitute the most superficial acquisitions of awareness of this work of organization. Intellectual activity, departing from a relation of interdependence between organism and environment, or lack of differentiation between subject and object, progresses simultaneously in the conquest of things and reflection on itself, these two processes of inverse direction being correlative (p. 19).

Piaget speaks of two different kinds of intelligence: sensorimotor and representational intelligence. This representational intelligence grows out of the former, sensorimotor intelligence.

The sensorimotor period, the first of Piaget's "primitive stages of psychological development" constitutes the first two years of the child's life. As the infant progresses through the six substages of the sensorimotor

period, a shift occurs from motor symbols and reflexive actions to conceptual symbols. These six substages of the sensorimotor period are steps in the maturation of the child's intellectual development. At each stage, the experience that the child comes in contact with are necessary to the development within that stage, as it is important for the child when he passes from one stage to the next. In the first stage, the child's contact with these experiences may be less direct, but with each stage, the experiences become more differentiated. "Not only does experience become more active and comprehensive as intelligence matures, but also the 'things' on which it proceeds can never be conceived independently of the subject's activity" (Piaget, 1952, p. 367).

This period has often been characterized as the stage when the child "thinks with his body and peripheral sense organs." For example, Piaget explains how one of his sons, Lucienne,

> . . . having perceived a spool suspended from an elastic band, proceeds to shake his arms and legs, thus equating the movement of the spool to his body movement (observation 107). Being unable to verbalize at this early stage, the child assimilates these facts by means of motor concepts, [similar to Lucienne's bodily movements,] thus indicating that the child understands what he perceives" (Piaget, 1952, p. 188).

Representational intelligence is the ability to form mental images when confronted with verbal symbols or stimuli, or when conceptualizing a sensorimotor skill.

Here is a useful example which will show how we all use sensorimotor and representational intelligence to some degree: Picture the sequence of shifting gears on a standard transmission. Our first reaction in exercizing the sensorimotor act would be to form a mental image via representational intelligence. This mental image would be formed by moving our

eyes or maybe our hand (sensorimotor) in the direction of the standard transmission "H":

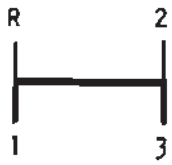

Figure 3: The Standard Transmission "H"

After completing the formation of the mental image, we communicate this image by means of verbal symbols, e.g., "you place the gear shift down in the bottom left corner for first gear, all the way over and up for second, etc. In terms of the processes of symbolic or representational intelligence, we have made the transition from the motoric symbols of actually moving some part of our body to represent shifting, to form a mental or conceptual image of the "H." From this image we are now able to communicate directions for shifting of a standard transmission.

Using Piaget's developmental model as a basis for understanding, we as adults function similarly to the example of the "stick shift." Much learning takes place precisely along this model:

SM (sensorimotor act) → RI (representational intelligence) → VS (verbal symbols)

SM (sensorimotor act) ← RI (representational intelligence) ← VS (verbal symbols)

Figure 4: Adaptation of Piaget's developmental theory, (Zohner, 1971)

The person receiving the information via the verbal symbols of the "teacher" would form a mental image. From this mental image, this person could carry out the sensorimotor act of actually moving the stick shift. Thus, the model proposes that learning and communicating this information exists in a loop. From sensorimotor intelligence, to representational intelligence, to communication by means of verbal symbolism or language, learning takes place. Teaching would utilize the verbal symbols to allow for the formation of a mental image, which would aid in the completion of the sensorimotor act.

For a mentally retarded child, verbal symbols and sometimes mental images are not always available, as he may not have reached this stage of development within the sensorimotor period. Also, as the evidence has shown, this child's available methods of solving problems or controlling his overt behavior may be limited to animalistic functioning, similar to the way in which Spence's animals learned the discrimination problems, or on the other hand, the child may be utilizing a single unit S-R theory, incapable of using verbalizations to guide his behavior. The evidence is overwhelming in regard to the limited means a young child possesses in controlling his behavior. What is more important is the fact that there is a great difference between the capabilities of trainable retarded children and educable retarded children.

It is this author's contention that a trainable mentally retarded child, functioning on a lower level of cognitive processes, might profit more from a non-verbal program of instruction which relies heavily on teaching the skill by means of sensorimotor methods, than by a program relying heavily on verbal symbols or verbal encounter which necessitates the formation of mental imagery.

The effectiveness of this program ultimately relies on the stage of the child's development. If the child is well into the pre-operational period, representational intelligence has appeared, and the child is capable of forming mental images and utilizing verbal symbolism. Such is often the case with the educable mentally retarded child. Consequently, a second hypothesis is justifiable: An educable mentally retarded child might profit more from a verbal or combination verbal-non-verbal program of instruction which relies heavily on teaching the skill by means of verbal symbolism, namely language, than a pure non-verbal or sensorimotor program.

Abramson, Moyer, and Flanagan (1970) studied the two above hypotheses by using educable and trainable mentally retarded children with verbal and non-verbal instruction. They found the following:

1. Educable retarded children--those with the higher I.Q.--learn best with the verbal teaching technique and the trainable children learn best with the non-verbal technique.

2. The non-verbal teaching technique was no more effective than the verbal teaching technique.

3. The educable retarded children did not learn more during the training session than did the trainable retarded children (Abramson, Moyer, and Flanagan, 1970).

The reader must be warned that the Abramson et al study was confounded with respect to experimenter (E), levels of abilities (A), and training techniques (B). Part of the justification of the present study was to extend the training techniques to include a combination verbal-non-verbal method, as well as to replicate the findings of this former study.

As evidence for the support of the two hypotheses of the present study, Piaget and Inhelder (1947) propose that retardation may result from a "partial or total stop in mental functions at a certain normal

development. There may be . . . a similar construction of logical operations which . . . follows a much slower rhythm and remains forever unfinished" (Piaget and Inhelder, 1947, p. 403).

Also, instead of placing emphasis on what a retarded child cannot do, Reiss (1967) emphasizes the fact that "attention should be focused on the level of function and the rate at which the child is developing" (p. 366). Thus, in answer to Reiss' proposition, this present study seeks to ascertain which technique will prove to be most effective in regard to how educable and trainable children learn to swim. Will the non-verbal technique prove to be most effective with the trainables due to the concentration on sensori-motor methods, or will the verbal or verbal-non-verbal technique be most effective with educables, due to the reliance on mental imagery and verbal symbols? The important factor is the difference in the learning that takes place and by which technique this learning becomes crystallized.

METHODS

Subjects: A total of 60 subjects were drawn from private institutions for the trainable mentally retarded and public schools for the educable mentally retarded in Central Maine. All Ss were male, who had no previous swimming skills or limiting disabilities.

Design and Procedure: The experimental design was a mixed factorial design having 2 between and 2 within subject variables. The 60 Ss were divided according to mental ability: educables possessing a M.A. from 6.44 to 11.85 years and the trainables having a M.A. from 2.96 to 5.30 years except for two children: one 19 years of age who had been unable to cope with an educable program in the public school and demonstrated a primitive level of verbal behavior typical of the other children in the trainable group was placed in that group; the other child was 7 years old and in the educable program. He spontaneously labeled skills demonstrated by the E in the pretest before he performed them. A second division was then made by assigning Ss in each ability level at random to three training conditions:

1. Verbal, where the E remains outside the pool with the subject in the water directly in front of him. The skills are explained solely by words and expressions. No demonstrations or gestures can be used to aid the E in his explanation of the skill.

2. Non-verbal, where the E is in the water with the subject demonstrating each skill to be accomplished. The verbal encounter is kept to a bare minimum, e.g., "watch me . . . now you do it." The E may use gestures and demonstrations to explain the skill, but no verbalization may be used in the E's explanation.

3. Combination verbal-non-verbal, where the E is in the water with the subject, demonstrating each skill to be accomplished, but in this technique, the E may verbalize and explain the skill to the subject. Essential-

ly, this technique is the combination of the verbal technique and the non-verbal technique.

The Ss received 15 minutes of private instruction per session for 7 consecutive sessions spread out over 7 weeks. All instruction for all subjects was given by the same E and conducted at the Colby College Pool. Twenty skills were selected from the American National Red Cross Instructor's Manual: Swimming for the Handicapped (1960), and an unpublished study by Abramson, Moyer, and Flanagan (1970). These are listed and described in Appendix #1. The skills are progressive, starting with simple tasks and going on to more difficult ones as the performance of the Ss improved. On the Ss first training period, the E and aides administered a pretest to determine which skills should be taught.

Each S was assigned three skills for completion during his training period. If the performance criterion was attained or surpassed, the next incomplete skill was assigned. However, if the S failed to reach the assignment level on three successive trials, the skill was terminated, and the next skill was assigned. Results were recorded by tape measure or stop watch by aides assigned at random to the various ability and treatment conditions.

The performance on each skill for each subject for each day was converted to a percentage by finding the maximum score attained by any subject and considering it to be the new performance criterion from which the percentage of success could be calculated.

RESULTS AND DISCUSSION

The results of this study, as indicated by the between subject Anova summarized in Table 1, failed to confirm the two major hypotheses stated in the INTRODUCTION.

sv	df	SS	MS	F
A (level of ability)	1	32.92	32.92	1.84
B (training technique)	2	7.11	3.55	.58
AB	2	12.14	6.07	.33
N/AB	54	967.99	18.26	-----

Table 1: Analysis of Variance on the percentage of success for each skill, subject, and day.

The results did not substantiate those obtained by Abramson, Moyer, and Flanagan (1970), where the ability level by training techniques ($F=14.83$, $df=1/10$, $p < .01$) indicated that the training technique and ability level were both important in determining how well the subject performed.

In that study, it was found that mean performance level for the educable mentally retarded group receiving verbal instruction, was significantly higher than the mean performance level for the same group receiving non-verbal instruction (9.01 versus 5.76). Similarly, the trainable group's mean performance level was significantly higher with the non-verbal instruction than for the verbal instruction (9.13 versus 4.18).

There were two major differences between the data collected in the two studies. First, the instructors were confounded with training techniques and ability levels in the first study but not

in the second; and second, the response measure in the present study represents a refinement beyond that used earlier. Whereby the first study reported data in the "Daily Percentage of Success on Specific Skills," which was simply the percentage of skills completed as compared to the skill assigned for that day, the present study refined the data collection by changing the arbitrary maximums on skills to an empirical measure calculated by observing the S's highest performance and comparing it to the S's skill on a given day. Since both of the above represent methodological refinements, one should strongly consider the possibility that the significant training technique by ability level interaction of Abramson, et al. reflects the difference between the effectiveness of the instructors involved.

The Abramson, Moyer, and Flanagan study (1970) also found an interaction between training techniques and days ($F=3.27$, $df=12/118$, $p < .005$). Both techniques started at roughly the same point with the non-verbal technique increasing more rapidly until day 13 where the mean for the non-verbal technique was 15.86 and the mean for the verbal technique was 14.86. One possible implication of these results might be that the new situation with a strange E teaching swimming in a novel manner without the use of words and solely by demonstrations may have inhibited both the educable and trainable children. After several training sessions, the unfamiliarity may have worn off allowing the children to adapt more readily to this method of instruction.

The studies of Kendler and Kendler, Flavell, Beach, and Chinsky, Reese, and Luria utilize the subject's chronological age rather than mental age in determining the age when specific verbal mecha-

nisms appear; the exception being Kuenne's study which does draw upon the subject's M.A.. Although Kuenne used M.A. as a criterion with respect to her subjects, these subjects had normal I.Q.. The subjects used in the studies of Kendler and Kendler, Luria, Flavell et al., and Reese also utilized subjects within the normal range of I.Q.. The present study drew upon subjects with M.A.'s much lower than their respective chronological ages. Should the mediational aspects of learning be more closely related to chronological age than M.A., no significant differences in the present study would be expected.

There exists the possibility that the differences in M.A.'s between the educable group and trainable group were not large enough. The mean M.A. for the educable group was 9.0 years whereby the mean M.A. for the trainable group was 4.74 years.

One must also consider the possibility that the training techniques in the present study simply failed to adequately utilize the verbal and non-verbal learning skills possessed by the Ss.

Data were collected for the analysis of the two within subject variables (specific skill, and sessions) but the analysis has not been completed due to problems in the computer program. Analysis is expected in the near future and the outcome of the technique by sessions, and ability level by technique by sessions interactions will be looked at with considerable interest.

The present data do suggest the need to extend the work to assure that the difference between the mental age of the high and low ability groups is great enough to guarantee mediation in the older group but not in the younger. The specific proposal here

would be to use a group of normal Ss, a group of children with low mental age and high chronological age (retarded children), and a group with low chronological age and high mental age (gifted children). Some work should also be done to determine the most effective procedures in both sensori-motor and verbally mediated techniques in the teaching of swimming before they are utilized in the above design.

APPENDICES

APPENDIX #1

SKILL PROGRESSIONS AND PERFORMANCE CRITERION

SKILL #	SKILL NAME	PROGRESSIONS	PERFORMANCE CRITERION
Skill #1	Approach water	none	none
Skill #2	Enter water	none	none
Skill #3	Hold breath	3,6,10 seconds	10 seconds
Skill #4	Face in water	3,6,10 seconds	10 seconds
Skill #5	Blow bubbles	none	none
Skill #6	Bobbing	5,10,15,20 times	20 times
Skill #7	Prone float	3,6,10 seconds	10 seconds
Skill #8	Prone glide	3,6,10 feet	10 feet
Skill #9	Prone kick glide	5,10,15,20 feet	20 feet
Skill #10	Kick holding on to stationary object	5,10,15,20 seconds	20 seconds
Skill #11	Front tow with kick	5,10,15,20 feet	20 feet
Skill #12	Kick holding on to flutter board	5,10,15,20 feet	20 feet
Skill #13	Back float	3,6,10 seconds	10 seconds
Skill #14	Back glide	3,6,10 feet	10 feet
Skill #15	Back kick glide	5,10,15,20 feet	20 feet
Skill #16	Human stroke	5,10,15,20 feet	20 feet
Skill #17	Front arm pull	5,10,15,20 times	20 times
Skill #18	Rhythmic breathing (land)	5,10,15,20 times	20 times
Skill #19	Rhythmic breathing (water)	5,10,15,20 times	20 times
Skill #20	Combined stroke (arms and legs)	5,10,15,20 feet	20 feet

PRE-TEST TOTAL _____

NAME _____ CLASSIFICATION _____ V, NV, VNV _____

IQ: STANFORD-BINET _____ WISC V- P- F- AGE & DOB _____

Appendix #2

DATE:																			
SKILLS:	Pre-test	A - C	A - C	A - C	A - C	A - C	A - C	A - C	A - C	A - C	A - C	A - C	A - C	A - C	A - C	A - C	A - C	A - C	A - C
1. Approach water																			
2. Enter water																			
3. Hold breath																			
4. Face in water																			
5. Blow bubbles																			
6. Bobbing																			
7. Prone float																			
8. Prone glide																			
9. Prone kick glide																			
10. Kick holding on to stationary object																			
11. Front tow with kick																			
12. Kick holding flutter board																			
13. Back float																			

NAME _____ V, NV, VNV _____

Appendix #2 (con't.)

DATE:																
SKILLS:	Pre-test	A - C	A - C	A - C	A - C	A - C	A - C	A - C	A - C	A - C	A - C	A - C	A - C	A - C	A - C	A - C
16. Human stroke																
17. Front arm pull																
18. Rhythmic breathing (land)																
19. Rhythmic breathing (water)																
20. Combined stroke (arms and legs)																
RESULTS:																
BEHAVIOR:																
Enjoyed class																
Was sociable																
Cooperative																
Uncooperative																

APPENDIX #3

sv	df	SS	MS	F
A (ability level)	1	10.73	10.73	.47
B (training technique)	1	14.53	14.53	.04
AB	1	335.79	335.79	14.83**
N/AB	10	226.37	22.64	-----

** $p < .01$

Table 2: Results of Abramson, Moyer, and Flanagan study (1970) of Daily Percentage of Success on Specific Skills.

REFERENCES

ABRAMSON, R.A., MOYER, D.C., & FLANAGAN, P., "The effects of a verbal teaching technique on the swimming abilities of educable and trainable mentally retarded," unpublished study, Colby College, 1970

FLAVELL, J.H., BEACH, D.R., & CHINSKY, J.M., "Spontaneous verbal rehearsal in a memory task as a function of age," Child Development, 1966, 37, pp. 283-300

HARPER, R.J.C., ANDERSON, C.C., CHRISTENSEN, C.M., & HUNKA, S.M., The Cognitive Processes: Readings, Englewood Cliffs: Prentice-Hall, Inc., 1964

KENDLER, H.H., & KENDLER, T.S., "Vertical and horizontal processes in problem-solving," Psychological Review, 1962, 69, pp. 1-16

KUENNE, M.R., "Experimental investigation of the relation of language to transposition behavior in young children," Journal of Experimental Psychology, 1946, 36, pp. 471-490

LURIA, A.R., "The development of the regulatory role of speech," HARPER ET AL., The Cognitive Processes: Readings, Englewood Cliffs: Prentice-Hall, Inc., 1964, (secondary source)

PIAGET, J., The Origins of Intelligence in Children, New York: W.W. Norton and Company, Inc., 1952

PIAGET, J., & INHELDER, B., "Diagnosis of mental operations and theories of intelligence," American Journal of Mental Deficiency, 1947, 51, pp. 401-406

REESE, H.W., "Verbal mediation as a function of age level," Psychological Bulletin, 1962, 59, pp. 502-509

REISS, P., "Implication of Piaget*s developmental psychology for mental retardation," American Journal of Mental Deficiency, 1967, 72(3), pp. 361-369

THE AMERICAN NATIONAL RED CROSS, Swimming for the Handicapped: Instructor's Manual, Washington: The American National Red Cross, 1960

WIDDOP, J.H., "The motor performance of educable mentally retarded children with particular reference to the identification of factors associated with individual differences in performance," Dissertation Abstracts, 1968, 28, (8-A), p. 3010

ZOHNER, G.D., personal communication, Colby College, 1971

were divided into three swimming training techniques: verbal, non-verbal, and combination verbal-non-verbal; within each ability level: educable and trainable mentally retarded. Ss received 7 training sessions over a period of 7 weeks. No effects were found for ability level, training techniques or the interaction between them. Moreover, the findings suggest that the research in the area of verbal and non-verbal mechanisms of learning should be reexamined and a new experimental design should include normal, retarded and gifted children.