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A STUDY OF SELECTED PHYSIOLOGICAL AND PSYCHOLOGICAL FACTORS TO DETERMINE THEIR RELATIONSHIP TO THE PERFORMANCE OF THE CRAWL STROKE BY BEGINNING SWIMMERS

Jerry Keith Crites

A dissertation presented to the
Graduate Faculty of Middle Tennessee State University
in partial fulfillment of the requirements
for the degree Doctor of Arts

May, 1975

A STUDY OF SELECTED PHYSIOLOGICAL AND PSYCHOLOGICAL FACTORS TO DETERMINE THEIR RELATIONSHIP TO THE PERFORMANCE OF THE CRAWL STROKE BY BEGINNING SWIMMERS

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ABSTRACT

A STUDY OF SELECTED PHYSIOLOGICAL AND PSYCHOLOGICAL FACTORS TO DETERMINE THEIR RELATIONSHIP TO THE PERFORMANCE OF THE CRAWL STROKE BY BEGINNING SWIMMERS

by Jerry Keith Crites

The purpose of this study was to determine the relationship of selected physiological and psychological factors as they related to the beginning swimmer's ability to perform the crawl stroke and contribute to the teacher's understanding and instructional approach toward a beginning swimmer.

Forty subjects who were members of two beginning swimming classes were used for this study. The beginning swimming classes met for forty minutes twice a week. Prior to any swimming instruction, measurements were collected on shoulder rotation, shoulder extension strength, hip extension strength, body composition, swimming anxiety and swimming ability as measured by the Fox Power Test (revised). After five weeks of crawl stroke instruction, measurements were again collected on swimming anxiety and

swimming ability. The data were then analyzed using the Pearson Product-Moment Correlation to identify significant relationships.

Primary findings of this study were: (1) shoulder rotation, shoulder extension strength, hip extension strength and body composition were not significant factors in the performance of the crawl stroke, and (2) a significant relationship was indicated between swimming anxiety and the ability to perform the crawl stroke.

ACKNOWLEDGEMENTS

The writer gratefully acknowledges the guidance and support of his major professor, Dr. Fran Riel. Further appreciation is expressed for the proofreading and constructive comments of Dr. Wallace Maples and Dr. Robert Aden. Their contribution to the assembly of the following study was very valuable.

The writer sincerely offers special thanks to Dr. Guy Penny for his professional encouragement and invaluable assistance in the development and organization of this study.

Appreciation is also directed to the Chairman of the Health, Physical Education, Recreation and Safety Department, Dr. A. H. Solomon, for permitting the study to be conducted within the instructional program.

Further appreciation is extended to the course instructors, Mrs. Linda Patterson and Mr. Pat Hannon, for supporting this study and allowing part of their instructional time to be used for collecting the research data, and special thanks are extended to their students who consented to participate in this study.

Finally, this study could not have been done without the loving devotion and continual support of the writer's wife, Mary Jane, and son, Justin.

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Chapter 1

INTRODUCTION

One of the outstanding physical educators Dr. Charles Bucher recommends the use of measurement and evaluation techniques to enable a teacher to determine an individual's physical condition, traits or characteristics. In knowing these aspects of an individual, the instructor is assisted in determining where emphasis should be placed in teaching and the teaching procedures that are effective and ineffective.[1]

Good measurement and evaluation techniques may also be used for such purposes as grouping individuals according to similar mental, physical and other traits that will ensure better teaching of skill instruction.[2] Consistent with good measurement and evaluation techniques is a valid theory of instruction that supplies guiding principles to give consistency to practice, to enable the teacher to

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[1]Charles Bucher, Foundations of Physical Education (St. Louis: The C. V. Mosby Co., 1964), p. 432.

[2]Charles Bucher, Administration of Health and Physical Education Programs (St. Louis: The C. V. Mosby Co., 1971), p. 605.

present a structure of knowledge that is appropriate for the child; and to maximize intelligent behavior on the part of the teacher.[3]

The following study is designed to evaluate selected factors that may contribute to the teacher's understanding and intelligent behavior toward a student's failure or success in performing the crawl stroke in a beginning swimming class.

STATEMENT OF THE PROBLEM

This study was designed to analyze: (1) shoulder rotation, (2) shoulder extension strength, (3) hip extension strength, (4) body composition, and (5) anxiety as they relate to the student's ability to perform the crawl stroke as measured by the Fox Power Test (revised).

PURPOSE OF THE STUDY

As previously indicated, the ability to recognize certain factors that contribute to the learning of a basic skill is essential to good teaching; therefore, the primary purpose of this study will be to investigate the relationship of selected physiological and psychological factors as

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[3]William B. Ragan and Celia B. Stendler, Modern Elementary Curriculum (New York: Holt, Rinehart and Winston, 1966), p. 184.

they relate to the beginning swimmer's ability to perform the crawl stroke.

DELIMITATIONS

1. This study was delimited to two beginning swimming classes at Middle Tennessee State University during the fall semester of 1974.

2. This study was further delimited to shoulder rotation, shoulder extension strength, hip extension strength, body composition, anxiety, and the crawl stroke.

DEFINITIONS OF TERMS

Shoulder rotation. A movement where there is a revolving of the arm around its longitudinal axis with no change in position.

Shoulder extension strength. The greatest amount of effort measured in pounds produced by the shoulder extension muscles.

Hip extension strength. The greatest amount of effort measured in pounds produced by the hip extension muscles.

Body composition. The total percentage of body fat as measured by Sloan and Weir nomograms.[4]

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[4]W. A. Sloan and J. B. Weir, "Nomograms for Prediction of Body Density and Total Body Fat from Skinfold Measurements," Journal of Applied Physiology, XXVIII (February, 1970), 221-222.

Anxiety. An abstract construct that labels a negative mental reaction to stimuli as measured by the Swimming Anxiety Scale.[5]

Fox Power Swimming Test (revision). An instrument used to measure a subject's swimming ability.[6]

Crawl stroke. A stroke combining the overarm stroke and the flutter kick.

HYPOTHESIS

There will be no relationship between shoulder rotation, shoulder extension strength, hip extension strength, body composition, anxiety, and the ability to perform the crawl stroke.

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[5]Patricia Jean Daugert, "The Relationships of Anxiety and the Need for Achievement to the Learning of Swimming" (unpublished Doctoral dissertation, University of Michigan, 1966), pp. 1-160.

[6]Joel Rosentswieg, "A Revision of the Power Swimming Test," Research Quarterly, XXXIX (October, 1968), 818-819.

Chapter 2

REVIEW OF LITERATURE

Research in the physiological and psychological aspects of the non-swimmer has been conducted since Fox[1] developed a Swimming Power Test in 1957 and its revision by Rosentswieg in 1968.[2] There has been indicated a need to investigate methods of teaching fearful non-swimmers based on indications of pertinent personality traits, fears and experiences in the water.[3] Whiting and Stembridge concluded that more notice should be taken of the personality of the persistent non-swimmer if better and quicker results are to be achieved.[4]

A survey of related literature reveals physiological and psychological traits as relevant factors in

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[1]Martha Fox, "Swimming Power Test," Research Quarterly, XXVIII (October, 1957), 233-238.

[2]Joel Rosentswieg, "A Revision of the Power Swimming Test," Research Quarterly, XXXIX (October, 1968), 818-819.

[3]R. M. Behrman, "Personality Difference Between Nonswimmers and Swimmers," Research Quarterly, XXXVIII (May, 1967), 163-171.

[4]H. T. Whiting and D. E. Stembridge, "Personality and the Persistent Non-swimmers," Research Quarterly, XXXVI (October, 1965), 348-356.

non-swimmers. This chapter will review separately the related literature of these two areas.

PHYSIOLOGICAL

Reed made an analysis of shoulder joint adduction, oblique adduction and extension of the shoulder joint. He concluded that there were significant differences in strength among the three shoulder joint movements tested and found certain implications related to swimming, especially in relation to the completion of the underwater phase of the arm stroke in the crawl stroke.[5]

The learning rate of fifty-seven Negro and Caucasian college age women was studied in relation to strength, motor ability, buoyancy and body measurements in beginning swimming. The classes were forty-five minutes in duration and were conducted for eight weeks. This study conducted by Burdeshaw found buoyancy and body measurements influenced achievement in swimming more than motor ability or strength. Further analysis by Burdeshaw indicated, although superior in motor ability, the Negro experienced greater difficulty

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[5]Edward W. Reed, Jr., "Analysis of Shoulder Joint Adduction, Oblique Adduction and Extension of the Shoulder Joint" (unpublished Doctoral dissertation, Springfield College, 1967), pp. 1-72.

in learning swimming skills, particularly those skills demanding buoyancy.[6]

General motor ability was also used in a study by Wilson at the intermediate level of swimming for college women. The Scott General Motor Ability Test was administered to seventy college women. After several weeks of instruction, the results of her study showed no relationship existed between general motor ability and achievement in intermediate swimming.[7]

Buoyancy has been another factor of researchers in relation to the ability to perform the crawl stroke. Campbell did a study on buoyancy using thirteen Negro male subjects between the ages of twelve and fifteen who could not swim twenty yards. The criteria used for determining the ability to perform the crawl stroke was speed and distance. The two methods of instruction used were: one group used a floatation device and the other group did not use the device. The study was conducted in nine lessons with the inclusion of testing during that time. Campbell

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[6]Dorothy Burdeshaw, "Learning Rate of College Women in Swimming in Relation to Strength, Motor Ability, Buoyancy, and Body Measurements" (unpublished Doctoral dissertation, University of Texas, 1966), pp. 1-200.

[7]Marcia R. Wilson, "A Relationship Between General Motor Ability and Objectives of Achievement in Swimming at the Intermediate Level for College Women" (unpublished Doctoral dissertation, Women's College, University of North Carolina, 1962), pp. 1-74.

concluded that there exists a positive relationship between buoyancy and the ability to perform the crawl stroke for beginners.[8] However, in the review of literature there was a study that did not support Campbell's findings.

Vanderstok also studied the relationship of buoyancy and the ability to perform the crawl stroke for beginners. Thirty-seven Negro males were instructed according to the American Red Cross Instructor's Manual for a five-week period. Floating ability was tested by the turtle-prone float combination. The statistical analysis by ANOVA and a 12 x 12 $\underline{r}$ matrix indicated no appreciable influence on the subjects' learning rate.[9]

Directly related to buoyancy are floatation devices and conscious relaxation. Bruce did a study on the effects of conscious relaxation and the use of floatation devices on learning beginning swimming. A random sample of freshmen college women were used for subjects. Two scores were used in statistical analysis, namely, a time score and a rating score. The analysis of time scores showed no significant

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[8]Wilburn A. Campbell, Jr., "The Relationship Between Buoyancy of the Negro Male and Learning the Crawl Stroke" (unpublished Doctoral dissertation, Springfield College, 1967), pp. 1-41.

[9]Annie A. Vanderstok, "A Study of the Effect of Selected Biological, Psychological, and Sociological Factors on the Learning Rate of the Negro Male Swimmers" (unpublished Doctoral dissertation, University of North Carolina at Greensboro, 1970), pp. 1-138.

interaction or any significant differences between the use and non-use of conscious relaxation or the use and non-use of a floatation device. A similar analysis was revealed by the rating scores except for a significant difference that was found in the use of a floatation device. The analysis suggested a floatation device should not be used in teaching beginning swimming.[10]

In summary, six physiological factors have been reviewed for this study. On the one hand, Reed reported that shoulder joint adduction, oblique adduction and extension of the shoulder joint had certain implications related to swimming. Burdeshaw reported that Negroes experienced difficulty in beginning swimming skills requiring buoyancy. She further reported that body measurements influenced swimming achievements. Campbell also reported that a positive relationship between buoyancy and the ability to perform the crawl stroke does exist.

On the other hand, Vanderstok concluded that there was no appreciable influence of buoyancy on the ability to perform the crawl stroke. Wilson reported that there was no significant relationship between general motor ability and performing the crawl stroke. Bruce found no significant

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[10]Patricia J. Bruce, "The Effects of Conscious Relaxation and a Floatation Device on Learning Beginning Swimming" (unpublished Doctoral dissertation, Indiana University, 1961), pp. 1-206.

effect of conscious relaxation in performing the crawl stroke. In addition, Bruce's study strongly recommended not using floatation devices for teaching the crawl stroke.

PSYCHOLOGICAL

Researchers have used a number of different instruments to test various psychological factors that could have a significant relationship to the learning of the crawl stroke. Drawing tests, projective tests, scales and test scores have been used for testing psychological relationships with the ability to perform the crawl stroke. Closely related to psychological testing is relevant sociological background information. This information is usually gained from various types of questionnaires. Some instruments have indicated a relationship, while others in different studies have failed to support the same factor as contributing to the success of performing the crawl stroke. The following is evidence of some of these types of tests used in various studies with their findings, implications and conclusions as they relate to the ability to perform the crawl stroke.

The Sheffield Projective Test and a drawing test which closely related to swimming were used by Gnagy. Her

study showed that neither tool proved to be significant as a predictor of fear cases in beginning swimmers.[11]

Daugert did a study using the Mandler-Sarson Test Anxiety Questionnaire and developed a Swimming Anxiety Scale (hereinafter called SAS) and a Fear of Failure in a Sports Activity questionnaire. The subjects were one hundred twenty-seven tenth-grade female students from five different high schools in and adjacent to Detroit, Michigan. Within the limitations of her study she made the following conclusions:

> 1. The Swimming Anxiety Scale was found to be a valid and reliable measure of anxiety or fear toward the activity of swimming.
> 2. Subjects with limited prior swimming experience had higher final Swimming Achievement and lower Swimming Anxiety than did subjects with no prior swimming experience.
> 3. Test Anxiety, Fear of Failure in a Sports Activity, general Need for Achievement scores did not relate to final Swimming Achievement for the beginning or novice swimmers.
> 4. Swimming Anxiety scores significantly related to final Swimming Achievement of both the novice, and to a degree, the beginning group. Subjects with low Swimming Anxiety scores had higher final Swimming Achievement than subjects with high Swimming Anxiety scores.
> 5. Swimming Anxiety significantly decreased for both beginning and novice groups during the course of instruction.
> 6. Specific Need for Achievement scores significantly related to the final Swimming Achievement of both the novice, and to a lesser degree, the

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[11] Susan K. Gnagy, "The Use of Projective Techniques for Identifying Fear in Beginning Swimmers" (unpublished Doctoral dissertation, University of Iowa, 1971), pp. 1-46.

beginning group. Subjects with high achievement scores had higher final Swimming Achievement than did subjects with low Achievement scores.

7. Simultaneous classification of subjects high or low specific Achievement and Swimming Anxiety increased predictive value of the variables.[12]

Sheppard designed a study using the Secord and Jourard Body Cathexis, Bell's Index of Adjustment and Values, and Osgood's Semantic Differential Technique. The purpose of the study was to investigate the effects of learning to swim upon the body concept and self-concept of college students. The subjects were twenty-five male and twenty-five female non-swimmers who participated in swimming classes three times per week for twelve weeks. He reported that learning to swim has no effect upon the college student's body concept, self-acceptance and self-esteem; however, there was a positive effect upon self-description and acquired swimming proficiency.[13]

Gourley also did a study on self-acceptance in relation to the acquisition of swimming skills. She used the American Red Cross beginning swim test to select sixty-eight female non-swimmers in junior high physical education

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[12]Patricia Jean Daugert, "The Relationships of Anxiety and the Need for Achievement to the Learning of Swimming" (unpublished Doctoral dissertation, University of Michigan, 1966), pp. 1-160.

[13]Samona Sheppard, "Changes in Body Concepts and Self-concept Among College Students Who Learn to Swim" (unpublished Doctoral dissertation, New York University, 1971), pp. 1-100.

classes. She used the Berger Self-Acceptance Scale and found a significant increase in self-acceptance after acquiring the swimming skill.[14]

Burdeshaw in a study used Cattell's Sixteen Personality Factor Questionnaire. The purpose of her study was to investigate the personality profiles of ninety-seven university women who were non-swimmers without previous instruction or were persistent non-swimmers with previous swimming instruction. Her conclusions were:

> The nonswimmer without previous instruction and those with previous instruction did not differ significantly on the Sixteen P F Profile, nor on the second order of factors anxiety, introversion-extroversion, tenderminded emotionally alert poise and subduedness-independence. Results did not substantiate a similar personality pattern in university women non-swimmers that has been reported for male non-swimmers.[15]

The Tennessee Self-Concept Scale was used by both Lay and Hurley. Lay used forty-five women and thirty-three men in a basic physical education program of twenty lessons. She found that the scores of the successful group, for both sexes, were significantly higher ($p<.01$) than the scores

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[14]Lenore E. Gourley, "Self-acceptance in Relation to the Acquisition of Swimming Skill" (unpublished Doctoral dissertation, Springfield College, 1969), pp. 1-44.

[15]Dorothy Burdeshaw, "Personality Profiles of Non-swimmers Among University Women," Journal of Sports Medicine and Physical Fitness, XI (July, 1971), 80-86.

of those subjects who were unsuccessful.[16] However, Hurley's study did not support this study.

Hurley administered to twenty-eight non-swimmer female subjects the Tennessee Self-Concept Scale before and after a ten-week program of basic swimming instruction. The study revealed that subjects with a high initial self-concept did not achieve a higher score on the final swimming skills test than did those subjects with a low initial self-concept score. Furthermore, there was no change in the total self-concept that could be attributed to instruction in the basic swimming class.[17]

Vanderstok used the Institute for Personality and Ability Testing (hereinafter called IPAT)--8-Parallel Form Anxiety Battery Forms A, B and D plus observable fear rating on a 1-10 scale for investigating psychological factors on the learning rate of thirty-seven Negro male swimmers. Furthermore, she used a swimming background questionnaire, family background data and an evaluation of subjects for her study. The subjects were involved in a five-week instruction period taught according to the American Red

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[16]Nancy E. Lay, "The Effect of Learning to Swim on the Self-concept of College Men and Women" (unpublished Doctoral dissertation, Florida State University, 1970), pp. 1-75.

[17]Maryl F. Hurley, "The Effects of Basic Swimming Instruction Upon Self-concept" (unpublished Doctoral dissertation, University of Montana, 1971), p. 111.

Cross Instructor's Manual. After relevant statistical analysis, anxiety did not indicate an appreciable influence on the subject's learning rate. However, fear was found to be an important factor, and, as fear diminished, performance improved. Previous experience, preference and practice seemed to be dominant traits in the group of fast learners. Parents' education, family's ability to swim, size of family, and encouragement received did not present a consistent pattern.[18]

A study in the relationship of rhythmic ability and background in dance and music to swimming achievement was conducted by Barnard. She administered the Ashton's Gross Motor Rhythmic Ability Test to sixty-one women and a questionnaire to attain information about the subjects' background in dance and music. She found a substantial relationship between rhythmic ability and rhythmic background and the ability to learn the crawl stroke.[19]

Personality differences between non-swimmers and swimmers were studied by Behrman. His subjects were one hundred two freshmen non-swimmers and one hundred two freshmen swimmers at the City College of New York. The

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[18]Vanderstok, "A Study of the Effect of Selected Biological, Psychological, and Sociological Factors on the Learning Rate of the Negro Male Swimmers," pp. 1-138.

[19]Betty Jean Barnard, "The Relationship of Rhythmic Ability and Background in Dance and Music to Swimming Achievement of College Women" (unpublished Doctoral dissertation, University of Washington, 1964), pp. 1-142.

Guilford-Zimmerman Temperament Survey (hereinafter called GZTS) was administered to the two hundred four subjects; based on the findings of the study, Behrman's recommendations were:

> 1. The methods of teaching excessively fearful non-swimmers should be studied experimentally to find the best possible method for teaching individuals who manifest psychologically unfavorable predispositions to swimming.
> 2. A short questionnaire, in which non-swimmers respond to items pertinent to their fears, their backgrounds of experience in the water, and to a brief test to discover emotional instability, might be effective in the subdivision of non-swimmers for instructional purposes.[20]

Other researchers have given support to these conclusions. Meredith and Harris also used the GZTS instrument in their study of personality traits of college women in beginning swimming. Four hundred forty females enrolled in introductory physical education courses (over a two-year period) at the University of Illinois (Champaign-Urbana campus) were the subjects for their study. They found a general pattern of "introversion" or what the test author called inhibition to social stimuli and the social self-concept.[21]

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[20]Behrman, "Personality Difference Between Nonswimmers and Swimmers," pp. 163-171.

[21]Gerald M. Meredith and Marjorie M. Harris, "Personality Traits of College Women in Beginning Swimming," Perceptual and Motor Skills, XXIX (August, 1969), 216-218.

SUMMARY

In conclusion, there is a general belief that the ability to perform the crawl stroke is influenced by many factors. These factors are in the physiological, sociological and psychological fields of study. In the author's review of literature, there were studies on a non-swimmer's personality traits, social background, anxiety, self-concept and need for achievement. Further review led the author to physiological studies dealing with buoyancy, general motor ability, strength and conscious relaxation of the non-swimmer.

Generally speaking, the literature gives support to various physiological and psychological factors having influence on the ability of a non-swimmer to perform the crawl stroke. There were also studies that reflect certain psychological factors that do not significantly influence the performance of a non-swimmer learning the crawl stroke. The factors of buoyancy, anxiety and strength used in this study have also been supported as influences of performing the crawl stroke.

Chapter 3

METHODS AND PROCEDURES

Forty subjects who were used for this study were members of two beginning swimming classes at Middle Tennessee State University during the fall semester of 1974. Shoulder rotation, shoulder extension strength, hip extension strength, body composition, anxiety, and swimming ability were measured according to preselected tests. The data were analyzed using the Pearson Product-Moment Correlation to determine if a relationship existed between the aforementioned variables and each subject's ability to perform the crawl stroke.

SUBJECTS

Forty students, seventeen males and twenty-three females, were used in this study. There were no restrictions on the students who enrolled in the two beginning swimming classes. During the first class meeting, the students were asked to participate in the research study, and then the general procedures of this study were explained.

TESTING PROCEDURES

The Swimming Anxiety Scale was administered to all subjects before any swimming instruction began and again at the end of the crawl stroke instruction. The revision of the Fox Power Swimming Test was also administered before and after the crawl stroke instruction. The test-retest method and Pearson Product-Moment Correlation was conducted on ten randomly selected subjects to determine the reliability of measurement of the following variables: shoulder rotation (r=.98), shoulder extension strength (r=.98), hip extension strength (r=.61), and body composition (r=.99).

Body Composition

The instrument used to take the skinfold measurements was the Lange Caliper.[1] These skinfold measurements were applied to the Sloan and Weir nomograms to establish total percentage of body fat for each subject.[2] The following skinfold measurements were obtained.

Men. The two sites for skinfold measurements were: (1) from a vertical skinfold in the anterior midline of the

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[1]Lange Calipers: Cambridge Scientific Instruments, Cambridge, Maryland.

[2]A. W. Sloan and J. B. Weir, "Nomograms for Prediction of Body Density and Total Body Fat from Skinfold Measurements," Journal of Applied Physiology, XXVIII (February, 1970), 221-222.

thigh, halfway between the inguinal ligament and the top of the patella, and (2) a subscapular skinfold running downward and laterally in the natural fold of the skin from the inferior angle of the scapula.[3]

Women. The two sites for skinfold measurements were: (1) from a vertical skinfold over the iliac crest in the midaxillary line and (2) from a vertical skinfold on the back of the arm halfway between the acromion and olecranon process with the elbow.[4]

Shoulder Rotation

The Leighton Flexometer Test as prescribed by Mathews was used to measure shoulder rotation.[5] The subject began in a standing position at the projecting corner of the wall, with the arm to be measured extended sideward and bent to right angle at elbow, the shoulder extended just beyond the projecting corner, and the opposite arm simultaneously touching the side of the body and the wall, being sure the

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[3]A. W. Sloan, "Estimation of Body Fat in Young Men," Journal of Applied Physiology, XXIII (1967), 311-315.

[4]A. W. Sloan, "Estimation of Body Fat in Young Women," Journal of Applied Physiology, XVII (1962), 967-970.

[5]Donald K. Mathews, Measurements in Physical Education (Philadelphia: W. B. Saunders, 1973), p. 330.

shoulder blades, buttocks and heels are touching the wall. The instrument was fastened to the side of the forearm.

The movement consisted of two counts. First, the forearm was moved downward and backward in an arc as far as possible, then the dial was locked. Second, the forearm was moved forward, upward and backward in an arc as far as possible, then the pointer was locked. Finally, the subject relaxed and the reading, in degrees, was taken and recorded. The testor was careful to make sure that the upper arm being measured was held directly sideward and parallel with the floor during the entire movement. The heels, buttocks and shoulders touched the wall at all times.

Shoulder Extension Strength

Shoulder extension strength was obtained by a cable-tensionmeter and as prescribed by Clarke.[6] The cable-tensionmeter was secured around upper arm midway between shoulder and elbow joints; the pulling assembly was attached to the wall beyond the subject's head. The subject in supine position held his hips and knees flexed comfortably, free hand resting on chest, upper left arm (test side) close to side, shoulder flexed to 90 degrees, and elbow in 90

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[6]Harrison H. Clarke, Application of Measurement to Health and Physical Education (Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1967), p. 171.

degrees flexion. The testor prevented shoulder elevation by bracing with hands and prevented shoulder adduction by guiding elbow. The cable-tensionmeter reading taken at maximum shoulder extension effort was interpolated into pounds and recorded.

Hip Extension Strength

The procedures developed by Clarke[7] were used to obtain the measurement of hip extension strength. With the subject in a prone position on the table, one end of the cable from the cable-tensionmeter was placed through the table and anchored at its base, then the other end of the cable from the cable-tensionmeter was secured to the thigh three inches above the knee. The subject was then asked to lift the leg from the table. The cable-tensionmeter reading taken at maximum hip extension effort was interpolated into pounds and recorded.

Swimming Anxiety Scale

The Swimming Anxiety Scale was administered according to the test instructions. For each question there was a line or scale on the ends of which were statements of opposing feelings or attitudes. In the middle of the line

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[7]H. Harrison Clarke, Muscular Strength and Endurance in Man (Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1966), p. 28.

was the word "midpoint" which was intended to reflect a feeling or attitude that was in between the statements of opposing feelings described above. The students were required to put a mark (X) on that point on the line which they thought best indicated the strength of their feeling or attitude about the particular question. Each item was marked as they came to it, making sure to mark one, and only one, response to each question. A maximum of 130 points could be obtained.[8]

Test for Swimming Ability

The revision of the Fox Power Swimming Test[9] was utilized as the measure for swimming ability. The test began with the subject being supported level to the surface of the water by an assistant. When the subject was ready, he completed five cycles of the crawl arm stroke. The distance the shoulders traveled to the nearest inch on the best of two trials was then recorded. The revision of the Fox Power Swimming Test was utilized for both the pre- and post-swimming ability tests.

INSTRUCTIONAL PROGRAM

The beginner classes were instructed by qualified instructors, other than the investigator, who had American

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[8]Patricia Jean Daugert, "Swimming Anxiety Scale" included in "The Relationships of Anxiety and the Need for Achievement to the Learning of Swimming" (unpublished Doctoral dissertation, University of Michigan, 1966), pp. 139-142.

[9]Joel Rosentswieg, "A Revision of the Power Swimming Test," Research Quarterly, XXXIX (October, 1968), 818-819.

Red Cross certification. The American Red Cross Beginner Skill Sheet[10] was used as a guide for the instruction in the two beginning classes. Each period consisted of forty minutes, of which ten minutes were devoted to leg movement and ten minutes to the arm movement. The remaining twenty minutes were devoted to combining the arm and leg movements and other beginning skills. The duration of the crawl stroke instruction was five weeks.

STATISTICAL ANALYSIS

The data from this study were analyzed by the Pearson Product-Moment Correlation.[11] Correlations were computed between: shoulder rotation (degrees), shoulder extension strength (pounds), hip extension strength (pounds), body composition (percent), score of swimming anxiety and the crawl stroke (inches) as measured by the Fox Power Test (revised). Means and deviations were computed for the male group, female group and total group, then Pearson Product-Moment was used to compute intercorrelations between the variables: shoulder rotation, shoulder extension strength, hip extension strength, body composition, anxiety, and swimming ability.

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[10]The American National Red Cross, Beginner Swimmer Skill Sheet, Washington, D.C., 1961.

[11]Woodrow W. Wyatt and Charles M. Bridges, Statistics for the Behavioral Sciences (Atlanta: D. C. Heath and Co., 1967), p. 238.

Chapter 4

ANALYSIS OF DATA

Forty students of two Middle Tennessee State University beginning swimming classes were used as subjects in this study to determine if certain physiological and psychological factors are related to performance of the crawl stroke as measured by the Fox Power Test (revised). The factors that were measured before any swimming instruction began were: shoulder rotation, shoulder extension strength, hip extension strength, body composition, swimming anxiety and swimming ability. After five weeks of swimming instruction using the American Red Cross Beginner Swimmer Skill Sheet as a guide, the swimming anxiety and swimming ability tests were administered a second time for comparison purposes. The data for this study were then statistically treated using the Pearson Product-Moment Correlation to compute correlation coefficients between: shoulder rotation, shoulder extension strength, hip extension strength, body composition, pre-anxiety, post-anxiety, pre-swimming ability and post-swimming ability. These correlations were then studied to

identify significant relationships. To more clearly present the results, the relationships were appropriately divided into three major categories: males within the total group, females within the total group, and the total group of subjects.

MEAN SCORES AND STANDARD DEVIATIONS OF THE MALE GROUP

In Table 1, the mean scores and standard deviations for shoulder rotation, shoulder extension strength, hip extension strength, body composition, pre-anxiety, post-anxiety, pre-swimming ability and post-swimming ability are presented for the seventeen (17) male subjects. The mean score for shoulder rotation of the male group was 162.94 degrees and a 10.81 degrees standard deviation. The shoulder extension strength mean score was 55.44 pounds and a standard deviation of 15.09 pounds. The mean score for hip extension strength was 76.89 pounds with a standard deviation of 19.03 pounds. The total percent of body fat, mean score was 10.44 percent with a standard deviation of 6.36 percent. The mean score for pre-anxiety was 59.78 with a standard deviation of 12.68. The post-anxiety, mean score was 53.89 with a standard deviation of 13.89. The difference between the mean scores of pre-anxiety and post-anxiety was -5.89. The mean score for the revised Fox Power

Table 1

Mean Scores and Standard Deviations of the Male Group for the Shoulder Rotation, Shoulder Extension Strength, Hip Extension Strength, Body Composition, Pre-Anxiety, Post-Anxiety, Pre-Swimming and Post-Swimming Variables

Variable	N	M	Standard Deviation
1. Shoulder Rotation (degrees)	17	162.94	10.81
2. Shoulder Extension Strength (pounds)	17	55.44	15.09
3. Hip Extension Strength (pounds)	17	76.89	19.03
4. Body Composition (percent)	17	10.44	6.36
5. Pre-Anxiety (score)	17	59.78	12.68
6. Post-Anxiety (score)	17	53.89	13.89
7. Pre-Swimming (inches)	17	225.17	122.15
8. Post-Swimming (inches)	17	278.28	86.75

Test (pre-swimming ability) was 225.17 inches with a standard deviation of 122.15 inches. The post-Fox Power Test (post-swimming ability) mean score was 278.28 inches with a standard deviation of 86.75 inches. The difference between the mean scores of pre-swimming ability and post-swimming ability was 53.11 inches.

INTERCORRELATIONS FOR THE MALE GROUP

Shoulder Rotation

The correlations for the male group revealed no significant relationships between: shoulder rotation and shoulder extension strength ($r=.10$), shoulder rotation and hip extension strength ($r=.04$), shoulder rotation and body composition ($r=.34$), shoulder rotation and pre-anxiety ($r=.07$), shoulder rotation and post-anxiety ($r=.37$), shoulder rotation and pre-swimming ability ($r=-.03$), and shoulder rotation and post-swimming ability ($r=-.30$). The results, therefore, revealed no significant relationship between shoulder rotation and the results on the Fox Power Test (revised) which was used as an indicator of the ability to perform the crawl stroke (see Table 2).

Shoulder Extension Strength

There was a significant correlation coefficient ($r=.57$, $p<.05$) between shoulder extension strength and hip

extension strength (Table 2). However, there was no significant correlation between: shoulder extension

Table 2

Variables of Significant Relationships Within the Male Group

Variables			
X	Y	r	Level of Significance
Shoulder Extension Strength	Hip Extension Strength	.573	$p < .05$
Pre-Anxiety	Post-Anxiety	.562	$p < .05$
Pre-Swimming	Post-Swimming	.687	$p < .01$

$p < .05$, $r = .4821$
$p < .01$, $r = .6055$

strength and shoulder rotation (r=.10), shoulder extension strength and body composition (r=-.31), shoulder extension strength and pre-anxiety (r=-.41), shoulder extension strength and post-anxiety (r=-.20), shoulder extension strength and pre-swimming ability (r=.35), and shoulder extension strength and post-swimming ability (r=.22). Consequently, shoulder extension strength did not reveal a significant relationship in performing the crawl stroke for the male group.

Hip Extension Strength

Hip extension strength had a significant correlation coefficient (r=.57, p<.05) with shoulder extension strength.

(See Table 2.) The results of the correlations revealed no significant correlations for the male group between: hip extension strength and shoulder rotation (r=.04), hip extension strength and body composition (r=-.43), hip extension strength and pre-anxiety (r=-.32), hip extension strength and post-anxiety (r=-.07), hip extension strength and pre-swimming ability (r=.28), and hip extension strength and post-swimming ability (r=.23). Hence, hip extension strength did not show a significant relationship in performing the crawl stroke.

Body Composition

There were no significant relationships in the male group between: body composition and shoulder rotation (r=.34), body composition and shoulder extension strength (r=-.31), body composition and hip extension strength (r=-.43), body composition and pre-anxiety (r=.24), body composition and post-anxiety (r=.09), body composition and pre-swimming ability (r=-.31), and body composition and post-swimming ability (r=-.48). (See Table 2.) Therefore, body composition did not show a significant relationship with the ability to perform the crawl stroke.

Pre-Anxiety

Pre-anxiety had a significant correlation coefficient (r=.56, $p<.05$) with post-anxiety. However, there was no

significant correlation for the males between: pre-anxiety and shoulder rotation (r=.07), pre-anxiety and shoulder extension strength (r=-.41), pre-anxiety and hip extension strength (r=-.32), pre-anxiety and body composition (r=.24), pre-anxiety and pre-swimming ability (r=-.43), and pre-anxiety and post-swimming ability (r=-.48). Consequently, the variable pre-anxiety did not have a significant relationship in performing the crawl stroke.

Post-Anxiety

A significant correlation (r=.56, $p<.05$) was found between post-anxiety and pre-anxiety as reported earlier. However, there was no significant correlation between: post-anxiety and shoulder rotation (r=.37), post-anxiety and shoulder extension strength (r=-.20), post-anxiety and hip extension strength (r=-.07), post-anxiety and body composition (r=.09), post-anxiety and pre-swimming ability (r=-.44), and post-anxiety and post-swimming ability (r=-.34). Therefore, post-anxiety was not a significant variable in performing the crawl stroke.

Pre-Swimming Ability

A significant correlation (r=.69, $p<.01$) was exhibited between pre-swimming ability and post-swimming ability. However, no significant correlation was found between: pre-swimming ability and shoulder rotation

(r=-.02), pre-swimming ability and shoulder extension strength (r=.35), pre-swimming ability and hip extension strength (r=.28), pre-swimming ability and body composition (r=-.31), pre-swimming ability and pre-anxiety (r=-.43), and pre-swimming ability and post-anxiety (r=-.44). Among the male group, pre-swimming ability was shown to have a significant relationship with the student's final ability to perform the crawl stroke.

Post-Swimming Ability

As mentioned above, the only variable in the male group that had a significant correlation coefficient (r=.69, $p<.01$) with post-swimming ability was pre-swimming ability. The correlations with insignificant coefficients were between: post-swimming ability and shoulder rotation (r=-.30), post-swimming ability and shoulder extension strength (r=.22), post-swimming ability and hip extension strength (r=.23), post-swimming ability and body composition (r=-.48), post-swimming ability and pre-anxiety (r=-.48), and post-swimming ability and post-anxiety (r=-.34).

Table 3

Intercorrelation Matrix of the Male Group for the Shoulder Rotation, Shoulder Extension Strength, Hip Extension Strength, Body Composition, Pre-Anxiety, Post-Anxiety, Pre-Swimming and Post-Swimming Variables

Variable	1	2	3	4	5	6	7	8
1. Shoulder Rotation	1.000							
2. Shoulder Extension Strength	.100	1.000						
3. Hip Extension Strength	.043	.573*	1.000					
4. Body Composition	.339	-.314	-.432	1.000				
5. Pre-Anxiety	.067	-.408	-.316	.240	1.000			
6. Post-Anxiety	.372	-.198	-.071	.090	.562*	1.000		
7. Pre-Swimming	-.025	.350	.284	-.314	-.429	-.442	1.000	
8. Post-Swimming	-.303	.219	.230	-.476	-.480	-.337	.687**	1.000

*p < .05, r = .4821
**p < .01, r = .6055

MEAN SCORES AND STANDARD DEVIATIONS OF THE FEMALE GROUP

Presented in Table 4 are the mean scores and standard deviations for shoulder rotation, shoulder extension strength, hip extension strength, body composition, pre-anxiety, post-anxiety, pre-swimming ability and post-swimming ability for the twenty-three (23) females within the total group. The mean score for shoulder rotation of the female group was 177.91 degrees and 14.48 degrees standard deviation. The shoulder extension strength mean score was 42.64 pounds and a standard deviation of 11.96 pounds. The hip extension strength mean score was 64.09 pounds with a standard deviation of 14.14 pounds. The mean score for body composition was 21.13 percent body fat with a standard deviation of 5.05 percent body fat. The pre-anxiety mean score was 66.14 with a standard deviation of 24.50. The post-anxiety score was 58.77 with a standard deviation of 22.05. The difference between the pre-anxiety mean score and post-anxiety mean score was -7.37. The mean score for pre-swimming ability was 183.91 inches and 119.62 inches standard deviation. The post-swimming ability mean score was 218.77 inches and a standard deviation of 114.18. The difference between the pre-swimming ability mean score and the post-swimming ability mean score was 34.86 inches.

Table 4

Mean Scores and Standard Deviations of the Female Group for the Shoulder Rotation, Shoulder Extension Strength, Hip Extension Strength, Body Composition, Pre-Anxiety, Post-Anxiety, Pre-Swimming and Post-Swimming Variables

Variable	M	M	Standard Deviation
1. Shoulder Rotation (degrees)	23	177.91	14.48
2. Shoulder Extension Strength (pounds)	23	42.64	11.96
3. Hip Extension Strength (pounds)	23	64.09	14.14
4. Body Composition (percent)	23	21.13	5.05
5. Pre-Anxiety (score)	23	66.14	24.50
6. Post-Anxiety (score)	23	58.77	22.05
7. Pre-Swimming (inches)	23	183.91	119.62
8. Post-Swimming (inches)	23	218.77	114.18

INTERCORRELATIONS FOR THE FEMALE GROUP

The data from the females of the total group were analyzed as a separate group to identify possible intercorrelations that might exist among the females. As might be expected, the correlations of the female group revealed some relationships that were not consistent with the intercorrelations of the total group or male group. (See Tables 3, 6, 9.)

Shoulder Rotation

In regard to the female group, computed correlations revealed no significant relationship exists between: shoulder rotation and shoulder extension strength (r=-.23), shoulder rotation and hip extension strength (r=-.21), shoulder rotation and body composition (r=-.37), shoulder rotation and pre-anxiety (r=-.13), shoulder rotation and post-anxiety (r=-.07), shoulder rotation and pre-swimming ability (r=.08), and shoulder rotation and post-swimming ability (r=.23). (See Table 5.) Therefore, shoulder rotation showed no significant relationship for the female group in the performance of the crawl stroke as measured by the Fox Power Test (revised).

Table 5

Variables of Significant Relationships
Within the Female Group

Variables			
X	Y	r	Level of Significance
Shoulder Extension Strength	Hip Extension Strength	.457	$p < .05$
Pre-Anxiety	Post-Anxiety	.887	$p < .01$
Pre-Anxiety	Pre-Swimming	-.769	$p < .01$
Pre-Anxiety	Post-Swimming	-.789	$p < .01$
Post-Anxiety	Pre-Swimming	-.668	$p < .01$
Post-Anxiety	Post-Swimming	-.743	$p < .01$
Pre-Swimming	Post-Swimming	.934	$p < .01$

$p < .05$, $r = .4142$
$p < .01$, $r = .5269$

Shoulder Extension Strength

Shoulder extension strength revealed a significant correlation ($r=.46$, $p<.05$) with hip extension strength. However, there were no significant relationships between: shoulder extension strength and shoulder rotation ($r=-.23$), shoulder extension strength and body composition ($r=-.27$), shoulder extension strength and pre-anxiety ($r=-.10$), shoulder extension strength and post-anxiety ($r=-.07$), shoulder extension strength and pre-swimming ability ($r=-.09$), and shoulder extension strength and post-swimming

ability (r=-.10). Shoulder extension strength, then, did not show significant relationship to the performance of the crawl stroke.

Hip Extension Strength

As mentioned previously, hip extension strength and shoulder extension strength has a significant correlation coefficient (r=.46, p<.05). The correlations were not significant between: hip extension strength and shoulder rotation (r=-.21), hip extension strength and body composition (r=-.14), hip extension strength and pre-anxiety (r=-.23), hip extension strength and post-anxiety (r=-.25), hip extension strength and pre-swimming ability (r=.25) and hip extension strength and post-swimming ability (r=.25). These correlations indicate that hip extension strength does not have a significant relationship with the performance of the crawl stroke for the females.

Body Composition

The results of the intercorrelations demonstrated that no significant correlation coefficient existed between: body composition and shoulder rotation (r=.37), body composition and shoulder extension strength (r=.27), body composition and hip extension strength (r=-.14), body composition and pre-anxiety (r=.14), body composition and post-anxiety (r=.04), body composition and pre-swimming

ability (r=-.18), and body composition and post-swimming ability (r=.002). The data, therefore, indicate that no significant correlation exists between body composition and the ability of the females to perform the crawl stroke.

Pre-Anxiety

There were three significant intercorrelations that were revealed for pre-anxiety. They were pre-anxiety and post-anxiety (r=.89, $p<.01$), pre-anxiety and pre-swimming ability (r=-.77, $p<.01$) and pre-anxiety and post-swimming ability (r=-.79, $p<.01$). However, there were no significant correlation coefficients between: pre-anxiety and shoulder rotation (r=-.13), pre-anxiety and shoulder extension strength (r=-.10), pre-anxiety and hip extension strength (r=-.23), and pre-anxiety and body composition (r=.14). Therefore, pre-anxiety demonstrated a negative relationship with the ability to perform the crawl stroke.

Post-Anxiety

There were also significant correlation coefficients shown between: post-anxiety and pre-anxiety (r=.89, $p<.01$), post-anxiety and pre-swimming ability (r=-.67, $p<.01$), and post-anxiety and post-swimming ability (r=-.74, $p<.01$). There were no significant correlation coefficients between: post-anxiety and shoulder rotation (r=-.07), post-anxiety and shoulder extension strength (r=-.07), post-anxiety and

hip extension strength (r=-.25) and post-anxiety and body composition (r=-.04). Consequently, post-anxiety showed a high negative relationship to the ability to perform the crawl stroke.

Pre-Swimming Ability

There were three significant intercorrelations for pre-swimming ability. They were pre-swimming ability and pre-anxiety (r=-.77, $p<.01$), pre-swimming ability and post-anxiety (r=-.67, $p.<01$), and pre-swimming ability and post-swimming ability (r=.93, $p<.01$). However, no significant correlation coefficients existed between: pre-swimming ability and shoulder rotation (r=.08), pre-swimming ability and shoulder extension strength (r=-.09), pre-swimming ability and hip extension strength (r=.25), and pre-swimming ability and body composition (r=-.18). Therefore, pre-swimming ability indicates a significant relationship with post-swimming ability.

Post-Swimming Ability

As indicated previously, significant correlation coefficients exist between: post-swimming ability and pre-anxiety (r=-.79, $p<.01$), post-swimming ability and post-anxiety (r=-.74, $p<.01$), and post-swimming ability and pre-swimming ability (r=.93, $p<.01$). Also, there were no significant relationships between: post-swimming ability

and shoulder rotation (r=.23), post-swimming ability and shoulder extension strength (r=-.10), post-swimming ability and hip extension strength (r=.25), and post-swimming ability and body composition (r=.002). Therefore, according to the intercorrelations for the female group, the crawl stroke ability of the females negatively correlates with pre-anxiety and post-anxiety; but it positively correlates with pre-swimming ability.

MEAN SCORES AND STANDARD DEVIATIONS OF THE TOTAL GROUP

The mean scores and standard deviations are presented in Table 7 for shoulder rotation, shoulder extension strength, hip extension strength, body composition, pre-anxiety, post-anxiety, pre-swimming ability and post-swimming ability of the forty (40) subjects in the total group. The mean score for shoulder rotation was 172.27 degrees with a standard deviation of 14.80 degrees. Shoulder extension strength had a mean score of 48.05 pounds with a standard deviation of 15.08 pounds. The hip extension strength mean score was 69.45 pounds and a standard deviation of 17.61 pounds. The mean score for the total percent of body fat was 16.77 percent with a 7.62 percent standard deviation. The pre-anxiety mean score was 63.00 with a 20.46 standard deviation. Post-anxiety had a mean score of 56.45 with a 18.90 standard

Table 6

Intercorrelation Matrix of the Female Group for the Shoulder Rotation, Shoulder Extension Strength, Hip Extension Strength, Body Composition, Pre-Anxiety, Post-Anxiety, Pre-Swimming and Post-Swimming Variables

Variable	1	2	3	4	5	6	7	8
1. Shoulder Rotation	1.000							
2. Shoulder Extension Strength	-.226	1.000						
3. Hip Extension Strength	-.208	.457*	1.000					
4. Body Composition	.373	.273	-.140	1.000				
5. Pre-Anxiety	-.128	-.097	-.230	.137	1.000			
6. Post-Anxiety	-.072	-.070	-.247	.043	.887**	1.000		
7. Pre-Swimming	.079	-.088	.246	-.181	-.769**	-.668**	1.000	
8. Post-Swimming	.233	-.096	.249	.002	-.789**	-.743**	.934**	1.000

*p < .05, r = .4144

**p < .05, r = .5269

Table 7

Mean Scores and Standard Deviations of the Total Group for the Shoulder Rotation, Shoulder Extension Strength, Hip Extension Strength, Body Composition, Pre-Anxiety, Post-Anxiety, Pre-Swimming and Post-Swimming Variables

Variable	N	M	Standard Deviation
1. Shoulder Rotation (degrees)	40	172.27	14.80
2. Shoulder Extension Strength (pounds)	40	48.05	15.08
3. Hip Extension Strength (pounds)	40	69.45	17.61
4. Body Composition (percent)	40	16.77	7.62
5. Pre-Anxiety (score)	40	63.00	20.46
6. Post-Anxiety (score)	40	56.45	18.90
7. Pre-Swimming (inches)	40	200.87	119.87
8. Post-Swimming (inches)	40	247.07	107.12

deviation. The difference between pre-anxiety and post-anxiety mean scores was -6.55 inches. The male group had a -5.89 difference (Table 1) and the female group had a -7.37 difference (Table 4). The revised Fox Power Test (pre-swimming ability) mean score was 200.87 inches with a standard deviation of 119.87 inches. The Post-Fox Power Test (post-swimming ability) had a mean score of 247.07 inches with a standard deviation of 107.12 inches which shows a difference of 46.20 inches. The male group increased their mean score by 53.11 inches (Table 1) and the female group increased their mean score by 34.86 inches (Table 4).

INTERCORRELATIONS FOR THE TOTAL GROUP

The intercorrelations of the total group reveal that some of the significant relationships that were indicated in the male and female groups were not revealed in the total group.

Shoulder Rotation

In Table 8, the total group intercorrelations show significant relationships between: shoulder rotation and shoulder extension strength ($r=-.35$, $p<.05$), shoulder rotation and body composition ($r=.55$, $p<.01$). However, no significant relationships existed between: shoulder

Table 8

Variables of Significant Relationships
Within the Total Group

X	Y	r	Level of Significance
Shoulder Rotation	Shoulder Extension Strength	-.346	$p < .05$
Shoulder Rotation	Body Composition	.552	$p < .01$
Shoulder Extension Strength	Hip Extension Strength	.609	$p < .01$
Shoulder Extension Strength	Body Composition	-.385	$p < .05$
Hip Extension Strength	Body Composition	-.473	$p < .01$
Pre-Anxiety	Post-Anxiety	.823	$p < .01$
Pre-Anxiety	Pre-Swimming Ability	-.631	$p < .01$
Pre-Anxiety	Post-Swimming Ability	-.721	$p < .01$
Post-Anxiety	Pre-Swimming Ability	-.575	$p < .01$
Post-Anxiety	Post-Swimming Ability	-.643	$p < .01$
Pre-Swimming Ability	Post-Swimming Ability	.829	$p < .01$

$p < .05$, $r = .3126$

$p < .01$, $r = .4032$

rotation and hip extension strength (r=-.27), shoulder rotation and pre-anxiety (r=-.09), shoulder rotation and post-anxiety (r=.02), shoulder rotation and pre-swimming ability (r=-.001), and shoulder rotation and post-swimming ability (r=-.03). Therefore, shoulder rotation does not demonstrate a significant correlation in the performance of the crawl stroke.

Shoulder Extension Strength

The intercorrelations for shoulder extension strength demonstrated significant relationships between: shoulder extension strength and shoulder rotation (r=-.35, $p<.05$), shoulder extension strength and hip extension strength (r=.61, $p<.01$), and shoulder extension strength and body composition (r=-.39, $p<.05$). There were not, however, significant correlations between: shoulder extension strength and pre-anxiety (r=-.18), shoulder extension strength and post-anxiety (r=-.12), shoulder extension strength and pre-swimming ability (r=.19), and shoulder extension strength and post-swimming ability (r=.12). The correlation coefficients did not reveal a significant relationship to suggest that shoulder extension strength substantially influenced the performance of the crawl stroke.

Hip Extension Strength

The intercorrelations for hip extension strength (Table 8) revealed a significant correlation between: hip extension strength and shoulder extension strength ($r=.61$, $p<.01$) and hip extension strength and body composition ($r=-.47$, $p<.05$). However, no significant correlation coefficients existed between: hip extension strength and shoulder rotation ($r=-.27$), hip extension strength and pre-anxiety ($r=-.24$), hip extension strength and post-anxiety ($r=-.17$), hip extension strength and pre-swimming ability ($r=.29$), and hip extension strength and post-swimming ability ($r=.28$). Consequently, the ability to perform the crawl stroke is not significantly affected by the hip extension strength for the total group.

Body Composition

As previously indicated, significant correlation coefficients were found between: body composition and shoulder rotation ($r=.55$, $p<.01$), body composition and shoulder extension strength ($r=-.39$, $p<.05$), and body composition and hip extension strength ($r=-.47$, $p<.01$). However, no significant relationships were revealed for body composition and pre-anxiety ($r=.15$), body composition and post-anxiety ($r=.07$), body composition and pre-swimming ability ($r=-.26$), and body composition and post-swimming

ability (r=-.29). Therefore, the ability to perform the crawl stroke was not significantly related to body composition.

Pre-Anxiety

The correlation coefficients for pre-anxiety revealed significant relationships between: pre-anxiety and post-anxiety (r=.82, $p<.01$), pre-anxiety and pre-swimming ability (r=-.63, $p<.01$), and pre-anxiety and post-swimming ability (r=-.72, $p<.01$). There were no significant relationships between: pre-anxiety and shoulder rotation (r=-.09), pre-anxiety and shoulder extension strength (r=-.18), pre-anxiety and hip extension strength (r=-.24), and pre-anxiety and body composition (r=.15). Therefore, a significant and negative relationship exists between pre-anxiety and the ability to perform the crawl stroke.

Post-Anxiety

Significant relationships were exhibited for post-anxiety between: post-anxiety and pre-anxiety (r=.82, $p<.01$), post-anxiety and pre-swimming ability (r=-.58, $p<.01$), and post-anxiety and post-swimming ability (r=-.64, $p<.01$). But no significant coefficients existed between post-anxiety and shoulder rotation (r=.02), post-anxiety and shoulder extension strength (r=-.12), post-anxiety and hip extension strength (r=-.17), and post-anxiety and body

composition (r=.07). Consequently, post-anxiety, for the total group, has a significant and negative relationship with the ability to perform the crawl stroke.

Pre-Swimming Ability

Intercorrelations for pre-swimming ability revealed two significant, negative relationships between: pre-swimming ability and pre-anxiety ($r=-.63$, $p<.01$) and pre-swimming ability and post-anxiety ($r=-.58$, $p<.01$). Furthermore, a positive correlation was revealed between pre-swimming ability and post-swimming ability ($r=.83$, $p<.01$). However, no significant relationships existed between: pre-swimming ability and shoulder rotation ($r=-.001$), pre-swimming ability and shoulder extension strength ($r=.19$), pre-swimming ability and hip extension strength ($r=.29$), and pre-swimming ability and body composition ($r=-.26$). Therefore, anxiety interferes with learning the crawl stroke, and the swimming ability at the beginning of instruction relates significantly with the ability to improve swimming ability.

Post-Swimming Ability

Post-swimming ability significantly correlates with pre-anxiety ($r=-.72$, $p<.01$), post-anxiety ($r=-.64$, $p<.01$), and pre-swimming ability ($r=.83$, $p<.01$), but does not significantly relate to shoulder rotation ($r=-.02$), shoulder

extension strength (r=.12), hip extension strength (r=.28), or body composition (r=-.29). Hence, the total group's ability to perform the Fox Power Test, a measure of post-swimming ability, was influenced by anxiety.

Table 9

Intercorrelation Matrix for the Total Group for the Shoulder Rotation, Shoulder Extension Strength, Hip Extension Strength, Body Composition, Pre-Anxiety, Post-Anxiety, Pre-Swimming and Post-Swimming Variables

Variable	1	2	3	4	5	6	7	8
1. Shoulder Rotation	1.000							
2. Shoulder Extension Strength	-.346*	1.000						
3. Hip Extension Strength	-.274	.609**	1.000					
4. Body Composition	.552**	-.385*	-.474**	1.000				
5. Pre-Anxiety	-.086	-.184	-.236	.149	1.000			
6. Post-Anxiety	.024	-.121	-.170	.069	.823**	1.000		
7. Pre-Swimming	-.001	.188	.293	-.257	-.632**	-.575**	1.000	
8. Post-Swimming	-.028	.121	.283	-.293	-.721**	-.643**	.829**	1.000

* $p < .05$, $r = .3126$

** $p < .01$, $r = .4032$

Chapter 5

SUMMARY, FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

SUMMARY

The use of tests and measurements can be a valuable tool to the instructor for classification and evaluation of different skills. The purpose of this study was to contribute to a better understanding and relative significance of selected factors that contribute to the performance of the crawl stroke skill. Therefore, this study was designed to evaluate: (1) shoulder rotation, (2) shoulder extension strength, (3) hip extension strength, (4) body composition, and (5) anxiety as they relate to the ability to perform the crawl stroke.

A review of related literature has revealed numerous studies designed to determine the relationship of physiological, sociological and psychological factors to the ability to perform the crawl stroke. The conclusions of these studies have not all revealed similar findings. This indicates a need for additional studies to further analyze the various factors that influence the performance of the

crawl stroke. Forty male and female students in two beginning swimming classes at Middle Tennessee State University were used in this study. They were instructed in swimming the crawl stroke for five weeks by two different instructors using the American Red Cross Beginner Swimmer Skill Sheet as a guide. The students were tested on all five factors prior to any swimming instruction and retested on anxiety and swimming ability at the end of the five weeks of instruction for comparison purposes.

The data were then evaluated using the Pearson Product-Moment Correlation. Intercorrelations (shoulder rotation, shoulder extension strength, hip extension strength, body composition, swimming anxiety and swimming ability) were conducted on the aforementioned variables for the males, females and total group.

FINDINGS

Within the limitations of this study, the following findings are presented:

1. The pre-swimming test using the Fox Power Test (revised) had the highest significant correlation with the final performance of the crawl stroke.

2. Among the three groups, there was no significant correlation between body composition and final swimming ability.

3. There was no significant correlation between shoulder rotation and final swimming ability in the three groups.

4. There was no significant correlation between shoulder extension strength and final swimming ability in the three groups.

5. There was no significant correlation in the three groups between hip extension strength and final swimming ability.

6. Shoulder extension strength and hip extension strength had a direct relationship in all three groups.

7. Hip extension strength and body composition had a high ($p<.01$) relationship among the males but not a significant relationship among the females.

8. Pre-swimming anxiety and post-swimming anxiety showed a high ($p<.01$) correlation for both the males and females.

9. The significant relationships of the males and females are not evident when statistically treated and analyzed as a combined group.

CONCLUSIONS

Within the limitations of this study, the following conclusions are presented:

1. The best indicator of students' final swimming ability is their initial swimming ability, as measured by the Fox Power Test (revised).

2. Shoulder rotation is not a significant factor in performing the crawl stroke.

3. Shoulder extension strength is not a significant factor in performing the crawl stroke.

4. Hip extension strength is not a significant factor in performing the crawl stroke.

5. Shoulder extension strength and hip extension strength has a positive relationship in all three groups.

6. Body composition is not a significant factor in performing the crawl stroke.

7. Students who express high anxiety at the beginning of the crawl stroke instruction are expected to be the ones who are more anxious about swimming at the conclusion of the crawl stroke instruction.

8. Significant relationships that exist among the males and among the females are not revealed when statistically treated and analyzed as a combined group.

RECOMMENDATIONS

Within the design of this study, the researcher presents the following recommendations: (1) students should

be tested before instruction begins to identify their levels of anxiety toward swimming, (2) pre-swimming ability should be used for classifying students into an appropriate class level as well as ability grouping within classes, and (3) methods of instruction for beginning swimming should be geared so that the anxiety associated with beginning swimmers would be minimized.

In addition, further research should be tended toward: (1) investigating anxiety arousing factors in beginning swimmers where anxiety exists, (2) determining a suitable classification system of students into homogeneous groups based on initial swimming ability and initial swimming anxiety, and (3) developing instructional methods in reducing anxiety in highly emotional beginning swimmers.

APPENDIXES

APPENDIX A

PATRICIA DAUGERT CORRESPONDENCE

S T A T E O F C O N N E C T I C U T

Southern Connecticut State College

501 Crescent Street · New Haven, Connecticut 06515

Tel. 203 397-2101

September 4, 1974

Mr. Jerry Crites
Box 682B
Middle Tennessee State University
Murfreesboro, Tenn. 37130

Dear Mr. Crites,

In regard to our telephone conversation of August 30th, you will find enclosed a copy of the Swimming Anxiety Scale that you requested. Feel free to utilize the scale in any way that it may be helpful in your research.

Good luck and if I can be of further help please feel free to write.

Sincerely,

/s/ Pat Daugert
Patricia J. Daugert
Women's Physical Education Dept.

PJD/amm
encl.

APPENDIX B

RAW SCORES FOR: (1) SHOULDER ROTATION, (2) SHOULDER EXTENSION STRENGTH, (3) HIP EXTENSION STRENGTH, (4) BODY COMPOSITION, (5) PRE-ANXIETY, (6) POST-ANXIETY, (7) PRE-SWIMMING AND (8) POST-SWIMMING

RAW SCORES FOR: (1) SHOULDER ROTATION, (2) SHOULDER EXTENSION STRENGTH, (3) HIP EXTENSION STRENGTH, (4) BODY COMPOSITION, (5) PRE-ANXIETY, (6) POST-ANXIETY, (7) PRE-SWIMMING AND (8) POST-SWIMMING

Subjects	Sex	Variables							
		1	2	3	4	5	6	7	8
S1	F	175	54	72	27	61	44	162	244
S2	F	163	36	51	26	87	69	194	235
S3	M	149	42	74	5	42	38	317	304
S4	F	160	36	59	14	79	84	0	3
S5	F	180	34	70	17	93	92	227	260
S6	F	182	53	72	24	35	41	269	280
S7	F	176	74	93	22	51	57	264	269
S8	F	163	47	62	21	35	33	277	278
S9	M	155	83	96	9	44	36	172	239
S10	M	145	53	72	7	81	48	179	218
S11	M	164	72	90	8	34	37	338	355
S12	M	157	47	55	9	76	54	203	277
S13	M	159	74	95	8	51	31	451	480
S14	F	172	40	56	22	54	46	209	233
S15	M	151	38	80	6	64	55	238	292
S16	M	160	70	94	15	62	68	280	261
S17	F	184	47	32	18	83	76	42	41
S18	M	149	42	68	7	59	76	42	386
S19	M	165	53	74	11	54	44	319	348
S20	M	177	54	96	6	47	51	272	314
S21	F	185	53	70	20	32	30	354	446
S22	M	163	74	86	7	57	56	282	283
S23	F	176	47	72	25	71	62	72	180
S24	M	177	54	86	16	67	69	20	87
S25	F	179	50	86	22	46	45	266	293
S26	M	166	47	76	7	71	57	38	200

Subjects	Sex	Variables 1	2	3	4	5	6	7	8
S27	F	170	50	66	23	120	122	0	0
S28	M	178	70	49	7	61	70	250	263
S29	F	192	38	58	25	63	59	272	304
S30	M	165	27	25	27	62	44	202	216
S31	F	181	19	54	19	73	66	277	243
S32	F	167	47	51	25	63	48	270	281
S33	F	182	38	54	26	71	65	0	144
S34	F	200	44	62	21	45	42	256	301
S35	F	159	54	90	21	100	57	0	56
S36	F	208	36	64	22	42	40	235	303
S37	F	195	47	50	28	100	79	0	109
S38	F	192	19	64	17	80	60	155	186
S39	M	177	51	96	8	73	74	378	306
S40	F	193	28	58	23	31	33	253	365

APPENDIX C

QUESTIONNAIRE ON ATTITUDES ON SWIMMING

QUESTIONNAIRE ON ATTITUDES ON SWIMMING

Name_____ Age_____

School_____ Class Period_____

Date _____ Instructor_____

This questionnaire is designed to give you an opportunity to indicate how and what you feel when engaged in the activity of swimming. One of the reasons for constructing this questionnaire is the fact that very little is known about people's feelings when they are learning to swim. We can assume that people differ in the degree to which they feel at ease and comfortable in the water.

The value of this questionnaire will in large part depend upon how frank you are in stating your feelings and attitudes. Needless to say, your answers to the questions will be kept strictly confidential; they will in no way affect your grade in this class.

We are requesting you to give names only because they may be necessary for research purposes.

For each question there is a line or scale on the ends of which are statements of opposing feelings or attitudes. In the middle of the line you will find the word "Midpoint" which is intended to reflect a feeling or attitude which is in between the statements of opposing feelings described above. You are required to put a mark (X) on that point on the line which you think best indicates the strength of your feeling or attitude about the particular question. The midpoint is only for your guidance. Do not hesitate to put a mark on any point on the line as long as that mark reflects the strength of your feeling or attitude. Mark each item as you come to it; be sure to mark one, and only one, response to each question.

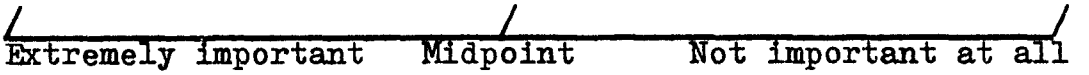
Have you ever had any instruction in swimming?
Yes____ No____

If your answer to the above question is Yes, indicate in the following questions how you do or did react to the situations.

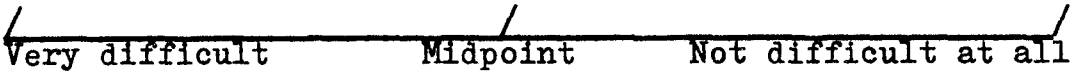
If your answer to the above question is No, indicate to the following questions how you think you would react to or feel about the situations.

THE MIDPOINT IS ONLY FOR YOUR GUIDANCE. DO NOT HESITATE TO PUT A MARK (X) ON ANY POINT ON THE LINE AS LONG AS THAT MARK REFLECTS THE STRENGTH OF YOUR FEELING OR ATTITUDE.

1. Do you feel that it is important for a girl to know how to swim?

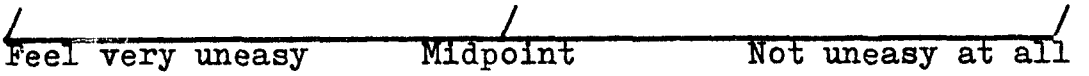


2. Do you feel it is a difficult task to learn to swim?

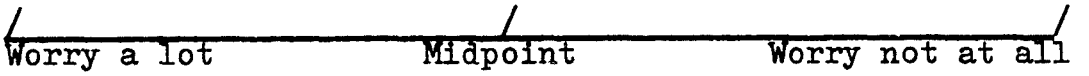


3. Are you afraid you are incapable of learning to swim well?

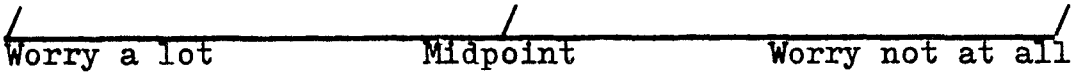
4. Just before your swimming class, to what extent do you feel uneasy about the possible physical danger involved?



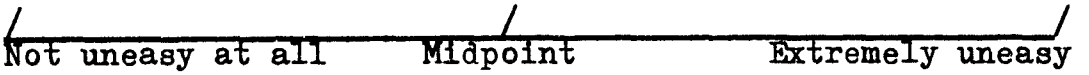
5. While in a swimming pool do you worry about the possibility of drowning?



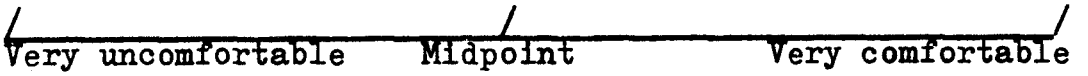
6. While at the beach do you worry about the possibility?



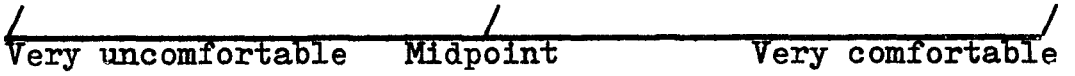
7. Does it make you uneasy to put your head underwater?



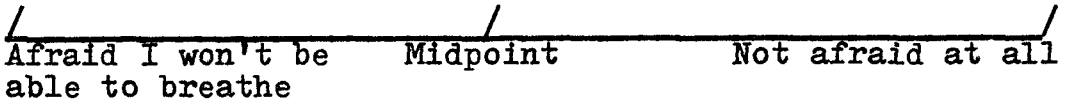
8. Do you feel uncomfortable in water of chest depth?



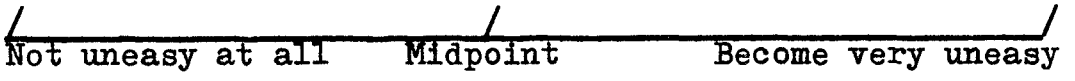
9. Do you feel uncomfortable in water over your head?



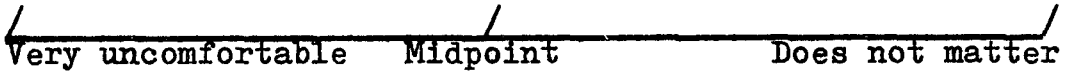
10. Do you become anxious when water gets in your nose and throat?



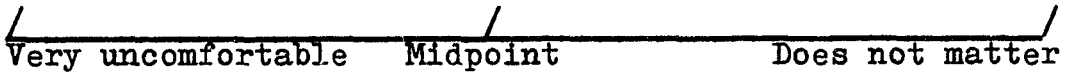
11. Do you become uneasy when water gets in your eyes?



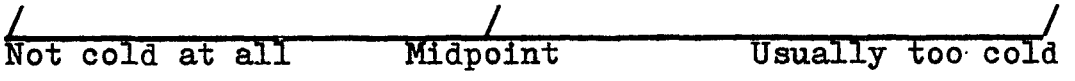
12. Do you feel uncomfortable swimming on your back?



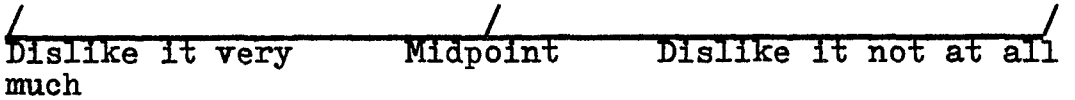
13. Do you feel uncomfortable swimming on your front?



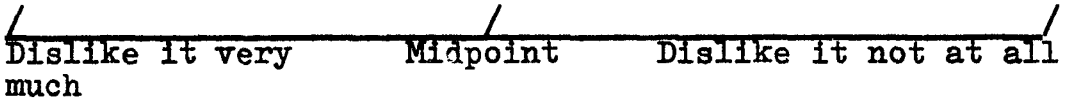
14. Does the water usually seem too cold?



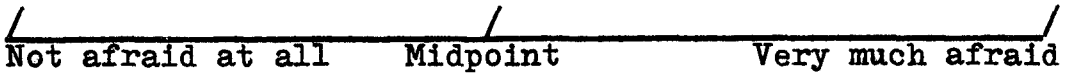
15. Do you dislike jumping into the pool feet first?



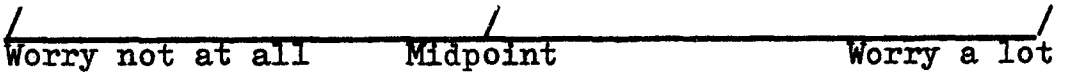
16. Do you dislike going into the swimming pool headfirst?



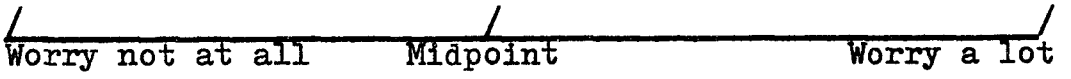
17. Do you think you would be afraid to jump off the diving board?



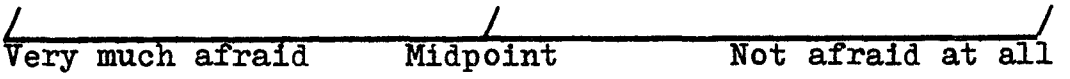
18. Do you worry about stepping off into deep water?



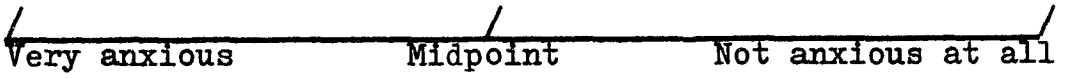
19. Do you worry about losing your balance or footing in the water?



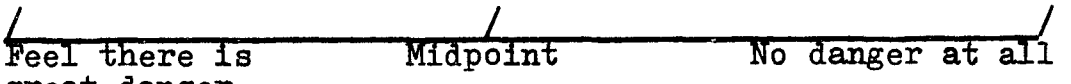
20. Are you afraid you will have an unpleasant experience in the water?



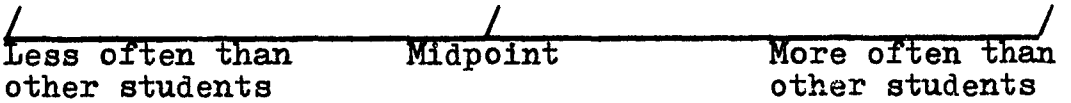
21. Do you think you would feel anxious about being out in a boat alone?



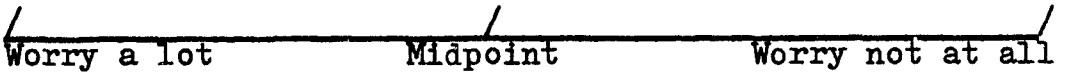
22. Do you feel in danger of injury while swimming?



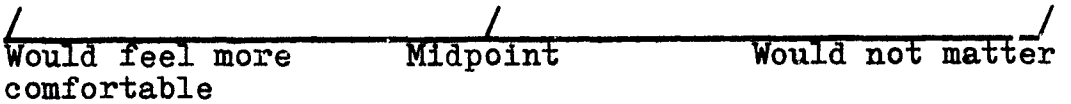
23. In comparison with other students, how often do you think of ways to avoid a swimming class due to your fear of physical danger?



24. While in a swimming class, to what extent do you worry about the dangers involved?



25. Because of the physical danger, would you feel more comfortable learning some sports activity other than swimming?



26. How tired do you feel after a swimming class?

/_____/_____/
Not tired at all Midpoint Extremely tired

27. Are you aware of any unpleasant experiences that have occurred to you or to someone you know that took place at a beach or swimming pool?

Yes____ No____

If your answer is yes, how has this affected your attitude about swimming?

Please explain.

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