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AN EVALUATION OF SWIMMING ABILITIES OF THE FRESHMAN MEN
OF UTAH STATE AGRICULTURAL COLLEGE

by

Rollo J. Morris

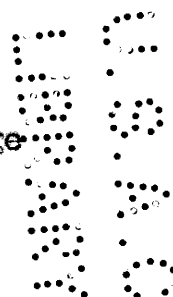
A thesis submitted in partial fulfillment
of the requirements for the degree of
Master of Science

in

Physical Education

Utah State Agricultural College

1949



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INTRODUCTION

Statement of problem. The purpose of this study is to attempt to determine and evaluate the swimming abilities of the male freshman students of the Utah State Agricultural College. A method of classification will be used to determine and evaluate the swimming abilities of these students.

Hypothesis. It is assumed that a check list can be used to determine swimming abilities.

The method of determining the swimming abilities will be of value as a quick way of classifying entering students. The classifications will be valuable as bases for swimming instruction.

Historical background of swimming. Before undertaking this study, it is necessary to present a background and justification for it. The following pages of the introduction serve this purpose.

Swimming is the propulsion of living creatures through water by natural means. Man is a living creature, but it is known that he does not swim instinctively. Consequently, if man is to swim he must first learn the skills of the activity. Probably the first swimming stroke used by man was the dog paddle. This stroke is natural for quadrupeds, and it is possible that the method was perceived and imitated by early man.

From this time of very early man down to the early civilization of the Egyptians, there is a gap in the history of swimming due to the lack of pictured or written evidence.

However, the Egyptians did leave evidence of their interest and participation in swimming. Some descriptions and drawings of 4000 years ago tell and show vivid accounts of swimming activities. Egyptian soldiers are pictured in drawings which show the importance of swimming as a military maneuver. Although some of the participants pictured in the drawings are using inflated skins to supplement buoyancy, there is also pictured the definite use of an overarm stroke with limited leg action. This evidence might suggest a step in the evolutionary process of swimming from the beginning dog paddle to the overhand crawl stroke.

In referring to the written accounts of Egyptian swimming, McVicar (8,p.56) says:

There it is recorded that swimming instructors were known upon the banks of the Nile, for a nobleman of the middle kingdom (2160-1780 B.C) left testimony to the fact that his children and the children of the king took their swimming lessons together.

The Greeks have also contributed to the history of swimming. Early Greek literature and paintings reveal that swimming baths were built in Greek cities as early as 1700-1400 B.C. The Greeks were very proficient at swimming due partly to their geographic location and partly to the importance of swimming as a part of their physical education process.

McVicar (8,p.57) quoting Herodotus, a historian of a later period than that mentioned above, states:

Herodotus distinctly implies that all Hellenes knew how to swim. "The Hellenic loss at Salamis," he says, "was small. For as they knew how to swim (as opposed to the barbarians who did not), when their ships were destroyed they swam over

to the island." He takes it as a matter of course that every sailor could swim. The whole crew of a captured trireme, during the Peloponnesian War, as often as not jumped overboard and escaped by swimming using an over-arm stroke.

About one hundred years later, further reference was made to the importance of swimming. At this time, the Romans were powerful as militarists, and they recognized swimming as a valuable means of conditioning and training for their young soldiers. Writings about the Roman life give accounts of the swimming prowess of Caesar and Cassius. It has been further told that while in battle Caesar swam from one boat to another holding aloft his books.

It is interesting to note that, in connection with swimming, the Romans highly favored the baths. These baths were not the limited structures as we know them today but were spacious, richly constructed buildings of beautiful architecture. They were large enough to permit swimming in a limited fashion. The baths were originally built for the lower classes, but later they were much favored by the higher orders and as time passed they became the favorite meeting places of all the populace for bathing and social gatherings.

The popularity of the baths continued down through the centuries and was adopted in other countries including England.

Swimming was next traced to England where the activity was becoming a contest of endurance.

McVicar (8, p.61) writes:

It is recorded that about 1830, a Dr. Beddho

or Bedale swam from Liverpool to Runcorne, full 20 miles, defeating Mr. Mathew Vipond by half a mile. He was, incidentally, assisted by a four-hour current. Nevertheless, it was a remarkable feat at this time.

Another endurance feat which attracted world-wide attention was the swimming of the English Channel. The first person to succeed in swimming the channel was Captain Mathew Webb, an Englishman, who was later drowned attempting to swim the Niagara rapids.

The attention created by Webb's Channel swim in 1875 was the cause of many later attempts by people of various other countries including the United States. In 1926 Gertrude Ederle of the United States became the first woman to succeed in the crossing. Miss Ederle swam the channel in fourteen hours and thirty-one minutes.

In addition to the brief history of swimming in its relation to the people of different countries, it is also necessary to trace the evolution of the different swimming strokes as they have influenced the swimming of those people.

The first mention of any stroke was in relation to ancient man and his method of imitating the dog paddle technique of the quadrupeds. Dog paddling consists of extension and forceful recovery of the arms under water while the legs are moved up and down as they follow the body which is in a prone position with the head up. Beginning dog paddling may have had variations from this, but the method was primarily the same. It seems evident that dog paddling is a predecessor to the front crawl stroke. However, authorities differ as

to whether the change from dog paddle to crawl was direct or whether some other stroke intervened.

Definite strokes as standards for swimming eventually became recognized, and the breast stroke was probably the first to come into use. Since its innovation, the breast stroke has been tremendously popular. In fact until 1800 it was considered the fastest of the methods of swimming.

It was at this time that the side stroke came into vogue and was recognized (then) as a speedier method than the breast stroke. McVicar (8,p.63), in quoting Kenworthy, says:

Until within the last few years it was generally supposed that Breast or Belly swimming was the swiftest process, but this opinion has proved fallacious. The side stroke is now universally acknowledged as the superior method and young swimmers would do well to practice it accordingly.

Later a variation of the side stroke, the English overarm, appeared. This stroke was nothing more than the ordinary side stroke with the upper arm being recovered above water, extended ahead of the swimmer, and pulled vigorously toward the feet in a sweeping motion which gave greater power.

Further variation of the side stroke brought about the use of the efficient trudgeon crawl, a fast stroke which was also adaptable to distance swimming. The trudgeon, so named for John Trudgeon who introduced it, combined overarm use of both arms with a powerful thrust kick of a scissor type with an alternating flutter kick.

It is natural that, in the interest of speed, the scissor kick would eventually drop out of the trudgeon in favor of the speedy flutter kick. Thus the crawl evolved as the

fastest stroke of humans.

The crawl stroke is thought to have been first used, as a separate stroke, in the South Sea Islands from where it was introduced into Australia about 1900 then to England and America. When the advocates of the new crawl stroke became proficient at it, they were able to eclipse all existing speed records.

This introduction of speed swimming brought about by the crawl stroke resulted in a newly aroused spirit of competition in swimming. The significance of this competitive spirit was revealed in the Olympic Games of 1906 when for the first time swimming was included on the agenda of sports. Since that time, swimming has risen to second place in importance in Olympic sports.

The popularity of swimming has not been confined only to international sports but has spread as a suitable activity for all. Evidence of this popularity is shown in the great investment of swimming facilities in the western hemisphere.

Much of this investment has been shown in the United States where an especially rapid growth of swimming pools has been noted during the last thirty years. Luehring (7,p.33) states that there were approximately 8,000 swimming pools in the United States in 1939 with about half of them indoor and half outdoor. Eighty percent of these have been built since 1920 and over half since 1925.

Luehring (7,p.34) also presents the following statistics

reported by the Office of Education, Department of the Interior to the White House Conference on Child Health and Protection. The data concerns the extent to which swimming pools are provided in city schools throughout the country.

Table 1. Percentage of Schools with Pools

City Population	High Schools	Jr. High Schools	Elementary Schools
100,000 or over	25.6%	20.0%	1.2%
30,000 to 100,000	23.9%	7.7%	1.0%
10,000 to 30,000	14.8%	5.6%	0.0%
5,000 to 10,000	0.0%	0.0%	0.0%

This table shows the importance of swimming as a part of the physical education program in the high school. However, it also shows the lack of importance of swimming in elementary and junior high schools, the very places where the basic swimming skills should be provided.

Luehring (7,pp.60-61), quoting from the Report of the Committee on Curriculum Research, says:

Elementary forms of aquatic control such as breathing, balance, buoyancy, and early achievements in knowledge, skills, and attitudes in swimming and diving should be acquired in the elementary and secondary school period. Research by leaders in physical education indicates that the optimum time for learning swimming and diving seems to be during the junior high school years, grades 7 to 9, and the next best time during the elementary school period, grades 4 to 6.

In further stressing the importance of swimming in high school and college as well as the lower grades, Luehring (7,pp.48-67) lists the criteria for determining the standards suitable for the swimming pool in educational institutions:

Daily Availability: The swimming pool for educational institutions should be available daily when the institution is in session.

The wide interest in swimming activities, their extensive carry-over values for later life needs, and the time needed to teach and acquire desirable attainments in aquatic physical education all indicate that the program in swimming activities should have regularity and continuity and extend throughout the school year.

Educational Needs: Swimming is a feature of physical education. Recently a regulation has been put into effect in Boston requiring that all high school girls as well as boys learn to swim.

Benjamin Franklin, founder of the University of Pennsylvania, himself a skillful swimmer and an early American teacher of and writer on swimming, included this activity in his proposals for the education of the youth of the commonwealth.

The Report of the Committee on Curriculum Research of the Society of Directors of Physical Education in Colleges contends that for men and boys, swimming and diving surpassed all other leading physical education activities in combined all-around desirable outcomes in terms of physical, social, and psychological values.

In the Report of the Sub-Committee on Girls' Athletics in Secondary Schools of the White House Conference on Child Health and Protection, Miss Coops indicates that experts rated swimming as the most valuable of six individual and dual sports selected for the high school girls.

Swimming pools today are considered a necessary part of the equipment of any department of physical education. The majority of colleges and universities have some facility for swimming and in these institutions the practice of having a swimming requirement for graduation is common.

Values of swimming. Swimming is an activity which invites participation because it offers exercise. All of the muscles are used in swimming and water activity, and used in such a way that there is no injury due to strain. The supporting action of water enables the body to relax, consequently resulting in an easy flow of muscle movement which in turn is influential in attaining ideal muscle tone and development.

Such accomplishments are contributory to good health, confidence, and good posture.

Moreover, swimming is an excellent form of entertainment in which to be indulged for the sheer joy of unrestrained movement. Swimming games and races add much to the popularity of the sport. Another important and more serious contribution of swimming is that of water safety. He who has learned to swim to any degree of proficiency has also learned confidence and has lost that almost inherent fear of water peculiar to humans. He who has learned to swim has also acquired a talent which at some time may mean the saving of a life, even his own.

The swimming program must justify itself to the general physical education situation by contributing to the objectives of physical education just as physical education objectives contribute to the objectives of education.

Williams (17, pp. xiii-xv) lists four good physical education objectives. Can swimming as an activity be justified in the light of these objectives?

1. Development of the Organic Systems of the Individual Through Physical Activities.

As has already been mentioned, swimming is an exercise, and as such, takes its place along with the various other activities which are contributing to this first objective of physical education. As has been further mentioned, swimming is a strainless muscle stretcher and developer. Muscles constitute an organic system.

The muscles, in cooperation with the nervous system,

make possible the remarkable processes of reciprocal innervation. The natural physiological action of reciprocal innervation is exemplified in the harmonious movement of swimming.

The excellent muscle tone attributed to swimming activities gives firmness to the skeletal muscles, and they maintain a steady pull on their attachments. This firmness is important in the maintenance of posture and in a certain pressure on the abdomen.

Muscle tone is due to stimuli from the central nervous system, and the normality of blood pressure is dependent upon the tone of the muscular walls of the arteries. Also, good digestion needs the support of well toned muscles of the stomach and intestines. Walker (15,p.73) states:

Certainly everyone should swim. Apart from its utility as a safeguard to life, it is the experience of one of the large swimming schools in London that carefully regulated swimming develops muscle, and relieves to a great extent, backache or pain in the lumbar muscles.

2. Development of the Neuromuscular System in General, and Particularly in Relation to Control over Fundamental Skills.

There are various types of skills, some of which will be dealt with here. The first skills which might be considered are those which lead to leisure time activities. It is known that among students, the things well learned and well performed are the things which they regard with favor and which they later will perform most often. Such is true of swimming. The sight of crowded beaches, school pools, club pools, and municipal pools is proof that swimming is

an enjoyable sport to both old and young.

Another group of skills are those entailing safety. Here again, swimming draws a first in the form of the many purposeful campaigns of water safety pertaining to life saving, swimming as a means of self-preservation, and safe bathing procedures. The American Red Cross organization, the Boy Scouts organization, and numerous private resorts and clubs sponsor safety campaigns each year in order to educate the public in safety measures.

There are other skills which are more artistic in nature and may be abstractly concerned with mental development. These aesthetic skills or appreciations are developed by the satisfactory accomplishment of swimming as an art.

3. Development of Certain Attitudes Toward Physical Activity, and Particularly Toward Play.

Modern life is a rush and a strain--even to youngsters, and it is a duty of our physical education program to provide refreshment which is so welcome during the school day. The job is not one of "teaching to play", but of letting wholesome play develop by initiative. Swimming and water games are beneficial tools of physical education in this respect. Such games as "water tag", "water polo", and "keep away" are invitations to participation because of their care-free, unrestrained characteristics. Children and older youngsters are certainly fulfilling this objective of physical education by the joyous attitudes they have toward water games.

4. Development of Standards of Conduct.

Just as in other sports and games of the physical

education program, the team spirit, the sportsmanship, the code of fair play, and the respect for competitors, is also evident in swimming activities. Good conduct may be found in the simple low organized games of "water tag", or it may be found in the highly organized team competition of the Olympic Games.

Abiding by the rules is just as important and evident in swimming as in basketball or boxing. The influence of the swimming teacher is just as powerful in building good character as is the influence of the civics teacher.

The importance of swimming to the physical education program may be increased by an orderly logical teaching procedure. One fundamental technique, which is a part of logical procedure, is the homogenous grouping of swimmers for instruction. This classification according to ability makes possible uniform instruction without the confusion caused in a varied ability class. Moreover, the instructor of a homogenous class can definitely note progress in individuals and in the class as a whole, because he is dealing with only one set of standards. This progress among classified pupils can be accurately measured from the original classification to the attained classification at the end of the teaching phase.

As an intramural sport, swimming is of special value, because the participants need not be concerned with bruised and exhausted conditions following the contest. Swimming is a recreative sport and is preferred by intramural players

who are interested in fun rather than tedious training schedules. Mitchell (9,p.114) says:

Unless other agencies are handling the situation, the intramural department can satisfy a popular desire by furnishing instruction in swimming and life-saving at scheduled times. This may be very informal or may be done in classes with graded instruction permitting students to join any group according to their proficiency.

During the last forty to fifty years, interscholastic and intercollegiate swimming have been developed extensively. The popularity of swimming as an athletic sport in colleges is emphasized by the National Collegiate Athletic Association. The educational body has the purpose of formulating standard rules to govern intercollegiate competition, and the first rules for swimming meets were made in 1913. The addition and development of swimming in relation to interscholastic and intercollegiate athletics has given color and diversity to a program usually composed of seasonal or core athletics. It is true that other sports have also been added and variety derived from them, but the unusual qualities of a swimming meet or a water game have broadened the outlook of modern athletics.

During World War II the importance of the swimming ability of the service man was brought forcibly to the attention of the military leaders. The geographic location of the numerous fighting fronts, the necessity of beach landings, and the necessity of flying planes over vast stretches of ocean emphasized the need for training the fighting men in water as well as on land. Knowing how to swim often meant the

difference between death and survival.

Hewitt (6,p.354) states:

It has been estimated that about 16 percent of the men enrolled in the pre-flight flying schools of the nation cannot swim a stroke. The American Red Cross reports that only 10 percent of the men in the Army are expert swimmers and that about 90 percent of the men are still in the novice class. These statistics are not too surprising if we realize that swimming is taught in relatively few of our schools. Many of the institutions that are fortunate enough to possess a natatorium have not seen fit to make swimming compulsory.

The Army and Navy were in agreement that every service man should know certain fundamental skills. He should be able to swim quickly away from a sinking ship to avoid being drawn down with it. He should be able to swim under water to avoid burning oil or gasoline. He should be able to swim or stay afloat for several hours, and in order to do this last fundamental, he must know the three essential wartime strokes, elementary back stroke, side stroke, and the breast stroke.

Consequently, during the War many of the colleges and training camps in the United States were concentrating to prepare service men to adequately take care of themselves in water. At the University of California, achievement scale scores were worked out for the following events: twenty yard and twenty-five yard underwater swim, fifteen minute swim for endurance, and the glide and relaxation-ability test for the elementary back stroke, breast stroke, and side stroke. These skills represented the fundamentals necessary to protect the service man in emergencies while on or in the water.

REVIEW OF LITERATURE

Use of check lists. Due to the large number of students involved in this study, it was necessary to survey their abilities by the use of a check list. Consequently, it is advisable to review the literature to see the potentialities of a check list (or questionnaire) of this type.

Despite the faults found in the use of a questionnaire, a study of this type demands the use of a questionnaire. The fact that the questionnaire is used in various kinds of research surveys and is sanctioned by leaders in research, justifies its use in this study.

Good (5,p.325) says:

The questionnaire is an important instrument in normative-survey research, being used to gather information from widely scattered sources. It is probably outranked in frequency of use only by the survey test. In fact, out of 581 printed studies representing research of all kinds, Koos found that in practically one-fourth of them the questionnaire was used.

In addition Whitney (16,p.136) states:

But T. L. Kelley of Harvard University calls attention to the fact that an act of human judgement is involved in getting any information about any phenomenon in any realm of thought, even in the so-called sciences, and that the only instrument available for predicting future is the questionnaire.

The method of classifying students, as to levels of swimming ability, by the use of questionnaire has not been widely used. Yates, (18,p.459) says:

For seven years we have been classifying the students entering Barnard College in swimming through a self-evaluating questionnaire. The correlation between the judgement of 109 students of their swimming ability, shown by their answers

to the questionnaire, and their actual swimming ability, shown by a test in the water following the answering of the questionnaire, was 89 percent. All questionnaire items are objective. Some questions check others. Familiarity with the questions and with the standards of the swimming classes makes it possible to classify a student, barring contradictions, in 30 seconds.

This self-evaluating questionnaire is a quick and reliable means of classifying the students for swimming classes and of obtaining an overall picture of the swimming ability of the students, whether they take swimming or not.

Cureton (1, pp. 148-150) describes a questionnaire used by Cranston, which was given to 125 freshmen at Springfield College. From it, information was gotten concerning which swimming strokes were learned first, which stroke became the most natural to use, which were the weakest swimming skills, and what influences aroused the desire to learn to swim.

Cureton (2, pp. 164-174) also used a check list as part of his questionnaire in determining the adequacy of beginner tests. His questionnaire and check list was sent to 200 swimming instructors, and on the basis of their answers, he was able to form conclusions as to the adequacy of the tests.

Sechler (12, pp. 1-39) used a questionnaire to find the swimming abilities of 1800 boys and girls of the secondary schools of the District of Columbia. From the results he was able to form conclusions and make recommendations concerning the introduction of swimming into those schools.

Use of pool tests. Before the check list used in this study was applied as a test in the pool, there arose the necessity of validating it in the light of similar tests which had been used in the past. Since the items used in this check list

were taken from Red Cross tests, the problem became one of reviewing past usage of the Red Cross tests.

Red Cross swimming methods, which include the tests, have been in use since 1914. Cureton (1,p.116) describes a typical instance in the progressive efforts of the Red Cross to improve their standards.

In 1929 a national questionnaire was sent to 1100 camps in 38 different states, which resulted in the collection of some valuable material. The Red Cross is providing national leadership in aquatic education through its institutes located each year in strategic parts of the country for training leaders. Some 400,000 active life savers are serving as voluntary teachers in the United States.

The information found in the Red Cross book, Swimming and Diving, is a further contribution to an adequate and complete swimming system to fit the needs of the American people.

Enlows (3,p.viii) in speaking of the author of Swimming and Diving says:

Years were given by him to study and research in the field of swimming and diving before the work was begun. Careful compilation of notes and studied evaluation of material preceeded its actual writing. While it was being written, opinions of eminent swimming authorities were sought regarding the authenticity or the merit of the statements made therein.

Many helpful and valuable suggestions were made by sympathetic and understanding colleagues, instructors and coaches.

The Boy Scouts of America, an organization which sponsors an intensive and extensive swimming program for American boys, use the swimming methods of the Red Cross for instruction and testing.

Cureton (2,p.5) conducted a survey which revealed the

adequacy of the Standard Beginner's Test as used by the Red Cross. In questioning 35 selected Y.M.C.A. swimming instructors and physical directors, he found that 83.6% of them favored the Red Cross Standard Beginner's Test. In reviewing the results of the survey, Cureton says that the Standard Beginner's Test is very acceptable in relative difficulty and validity.

In a summarized list of research objectives of his study, Cureton (2,p.6) includes:

3. To derive standards for these most important items, including names, descriptions and quantitative characteristics, in the form of relative validity and difficulty ratings.
4. To formulate a comprehensive testing battery for measuring beginning swimming ability and to determine the statistical characteristics of the instrument and the test scores resulting from its application, together with normative standards for various groups.
7. To determine the contribution of the classified groups of items to the established criteria of beginning swimming ability and to compute the relative weighting coefficients for an optimum combination of the scores on the groups to permit a most meaningful total score.
8. To prepare rating lists of the relative validity and difficulty characteristics as a basis for selecting test items to meet various needs.
10. To apply the derived results to the formulation of three batteries of progressive tests to be recommended for meeting the need of short, middle-length, and full courses of instruction.

The navy training program sponsored an extensive swimming campaign for its recruits during World War II. The testing procedure of this campaign included identical skills to those used in Red Cross procedures. In describing the governing principles of the navy tests, the officers of the

Aviation Training Division (14,p.208) say:

There are a few essential principles which apply to the construction and use of tests. The tests must, of course, measure adequately what they are designed to measure. They must be brief and still serve their purpose. They must be easily administered and scored. They must require limited explanation. They must be sufficiently comprehensive to include the major points of emphasis. The tests should be arranged in a logical progression, both with respect to the individual parts of a single test and with respect to tests of successive classification.

Sheffield (13,pp.24-26) lists the skills of preliminary and elementary swimming tests which are also very similar to those used by the Red Cross.

METHOD OF PROCEDURE

The Red Cross standardized tests which form a basis for this study are contained in the American National Red Cross Instructor's Manual of Swimming and Diving Courses. These various items are also related to time and distance according to the pupils' abilities.

There are four Red Cross swimming tests. They are Beginner, Intermediate, Swimmer, and Advanced Swimmer.

The check list (see app.) and swimming test used in this study are identical, therefore, they will be referred to synonymously as the check list.

The check list is original, although the items in it were adapted from the four Red Cross tests. While constructing the check list, the thought was kept in mind that it should present a valid measure of the contents of the Beginner, Intermediate, Swimmer, and Advanced Swimmer courses. It was also made up with the idea of representing a connecting link

between the objectives (see introd.) and the activity of swimming.

Being constructed of the various items of the four Red Cross swimming tests and courses, the check list is valid in the respect that it represents the course material.

Ross (11,p.85) says that a valid test consists largely of a representative sampling of the materials of the course.

Furthermore, when the check list is used to measure swimming abilities, all of the various levels from Beginner to Advanced Swimmer are represented.

Definition of terms. For the purpose of informing readers of the meanings of the various items of the check list, it is necessary to define the items. The definitions listed below are standard for swimming terminology.

Prone float-

The body is face down in the water with arms and legs fully extended. This is the basic position for swimming on the belly.

Plain front dive-

A head foremost clean entry into the water from the deck (about two feet elevation) with full coordination, body straight, and arms and legs fully extended and together.

Turning over from prone float to back float-

Rolling the body over from a prone float to a floating position on the back.

Frog kick-

The body is prone. At the count of one, the heels are

drawn toward the buttocks as the knees swing out. At the count of two, the legs are extended so that they are wide apart. At the count of three, they are forcibly squeezed together.

Overhand arm stroke-

Arms alternate in motion with the body in a prone position. The arm is extended ahead of the body over the water, enters the water, pulls forcibly with cupped palm back to about the hip, where the elbow naturally bends and leaves the water as the arm is ready to be again extended.

Sidestroke of arms-

The body is on the side with the arms alternating in pull. In recovery the bottom arm is extended full length. The top arm is flexed along the side of the chest.

Flutter kick-

The legs are fully extended but not stiffened as they thrash in an up and down motion.

Scissors kick-

Both legs are drawn up toward the body, which is on the side, the top leg extends in an anterior direction at an angle from the hip and the bottom leg extends posteriorally at the same angle. Then they are forcibly kicked together to a fully extended trailing position.

Breast stroke of arms-

The body is in prone position. The arms extend full length ahead of the body in the glide. Each arm is then pulled in a sweeping half-circle to the level of the shoulder

at which point the hands recover simultaneously to the sternum. In the last phase of the stroke they are extended to the full length position again.

Sculling on back, hands only-

Arms are at the sides. With a slight flexion of the elbows, adduction of the forearms, and extension of the wrist the arms are in a position for the stroke which is a short forceful push toward the feet. Each arm alternates. Hands are slightly cupped on each force stroke.

Sculling on back, legs only-

Legs are fully extended with loose knees. They alternately thrash up and down in a flutter.

Frog kick on back-

This kick is the same as the prone frog kick.

Underwater swim-

Subject is completely submerged and progresses underwater by any stroke.

Back crawl-

Legs thrash in a flutter while arms are used in a windmill fashion from the shoulder. Recovery is out of the water.

Dog paddle-

Body is prone. The legs employ a flutter while arms are alternately extended partially ahead of body then pulled toward the feet and underneath the body. The arms are recovered underwater.

Breast stroke-

Frog kick and breast stroke of the arms are combined

in the prone position. Leg force is alternated with arm pull.

Side stroke-

Scissors kick and side stroke of the arms are combined with the body on its side. In the glide the arms are extended; the bottom one, ahead; the top one, along the side. The legs are also extended. In the force stroke the top arm is pulled toward the feet simultaneously with the force kick of the legs.

Crawl stroke-

The body is prone. The legs are thrashed in a flutter while the arms are moved in the overhand arm stroke. Breathing is usually done by turning the head to the side while the arm on that side is finishing the force stroke.

Submerge-

This term merely means staying under the water.

Back float-

The body is on the back. Usually the arms are spread and the legs extended, but variations may be used including a vertical position.

Tread water-

The body is vertical with the head out of water. Any stroke may be used to retain this position as long as there is no progression as in actual swimming.

There are various terms used in relation to the check list. They are defined as follows:

Validity-

This term refers to the check list and items as to whether or not they are measuring swimming abilities.

Reliability-

This term refers to the check list as to whether or not it is accurate in its measurement.

Correlation-

This term refers to various associations among results brought out by the check lists.

Abilities-

This term refers to the skills and techniques of the subjects as related to swimming.

Check list construction. While constructing the check list, it was deemed necessary to set up an introduction to it for the purpose of approaching the pupils, gathering additional information about them, and adding interest to the study. The first step in construction of this introduction was to consider the significant items which were to go into it. These items were considered in the light of what further knowledge was needed for the study.

It was thought necessary to know the following information regarding the freshman student:

1. Name and location of his high school.
2. Whether or not that school had a pool.
3. Whether or not the freshman can swim.
4. Whether or not he has had swimming instruction.
5. Where he learned most of his swimming.

6. What Boy Scout merit badge he has, if any.
7. What Red Cross swimming rating he has, if any.
8. Whether or not he has had life saving instruction.
9. What Red Cross life saving rating he has, if any.
10. Whether or not he has ever nearly drowned.
11. Whether or not he is afraid of water.
12. His ability in the various skills from Beginner to Advanced Swimmer.

These items were then incorporated into the tentative check lists and distributed among the members of the physical education graduates for criticism.

After these first check lists were returned, it was found that all the graduates had criticisms regarding the items. A study of the criticisms revealed that, although all of the items were considered necessary, some should be more clearly worded and nearly all should require less writing on the part of the one answering. In other words, in phrasing a question requiring a "yes" or "no" answer, the "yes" and "no" should be written out with a space following each. The student answering could then merely check his answer.

The check list was then revised to accommodate these criticisms and issued to the writer's graduate committee for further criticism. Each member of the committee had criticisms regarding the clarity of the various items. Only one member regarded any of the items as superfluous or ambiguous. On the basis of these criticisms, the following items

were omitted.

1. Whether or not he can swim.
2. Whether or not he has had swimming.
3. Whether or not he has had any life saving instruction.
4. Whether or not he has ever nearly drowned.
5. Whether or not he is afraid of water.

Also on the basis of these criticisms, it was decided to list the various Boy Scout and Red Cross ratings so that the students could indicate by a check mark the highest rating attained.

After further consideration, it was decided to omit the question concerning the Boy Scout ratings, because it did not contribute to the purpose of the study.

After the necessary revisions had been made, the check list was issued to some of the members of the Utah State Agricultural College swimming team for the purpose of getting opinions of the validity of the items.

The members of the swimming team answered the check lists issued to them and then performed the various skills in the pool to see how their written answers compared with their performances. This was done also for the purpose of giving the swimmers a first hand acquaintance with the check list items.

After the swimming team members had answered the check lists and performed the skills of the check lists in the pool, they wrote their opinions as to whether the check list was a

true measure of swimming ability. Those opinions are expressed as follows:

Paul F. Kretschmer (freestyle):

If a person can perform all the skills that are listed on the check list and perform them in a good smooth fashion, the results should give a good measure of his swimming ability.

Fred Kayolski (freestyle):

The check list is all right as a measure of swimming ability, but it should not be conducted as a test in one session.

Elwood M. Cottle (backstroke):

The check list should be a good measure of swimming ability.

Art R. Keely (freestyle):

A good swimmer might easily overrate or under-rate himself. The ordinary swimmer who has done considerable swimming but has not been fully instructed might modestly rate himself. The swimmer who knows how to swim but has not done much will overrate himself. Distances as stated on paper seem much shorter than under actual conditions.

Ira Hill, team captain (freestyle, distance):

The check list is a valid measure of a swimmer's ability if given, with the exception of the underwater swim and the thirty-minute swim, in a two-hour period. A test of this sort given in a longer period would not be a true measure of a swimmer's ability as a large amount of an individual's skill lies in his ability to relax while swimming. During the thirty-minute swim, the person tested should be required to cover a certain distance to determine the degree of confidence in the water.

The check list was next issued to members of the Physical Education Department staff who are directly connected with swimming instruction. These people are qualified instructors and have had many years of experience in swimming

instruction and coaching.

In addition these instructors were given the opportunity to observe the writer as he conducted a pool test, using the check list items on a group of freshman boys.

Miss Dutton, one of the instructors, used the check list in her intermediate girls' swimming class. There were twenty girls in the class and each answered the check list. Then Miss Dutton checked their answers against pool performance. The correlation between the girls' scores, on the check lists and in the pool, was $.70 \pm .23$.

The opinions of these instructors concerning the validity of the check list are as follows:

Miss Elizabeth Dutton, Women's Physical Education Department Head:

The check list is a valid measure of swimming ability which covers all skills. The items, however, should run from simple to most difficult and should include such skills as swimming with one arm and both legs or two arms and one leg.

Professor Kenneth Vanderhoff, Swimming Coach:

The check list is well rounded enough to present a true picture of an individual's ability in swimming. It is broad enough to cover most of the basic skills, and it is simplified well enough for the layman to understand and use for testing.

Vaughn Gordon, Swimming Instructor:

This check list would measure the swimming ability of a person up to and including the Swimmer classification. It should, however, include more elementary and advanced skills.

These opinions are not offered as conclusive evidence of the validity of the check list but merely as aids for revision.

The check list was next issued to a group of freshman

men for criticism. Doing this was considered a necessity, because the freshmen were the actual subjects of the survey and any misunderstandings of the check list by them should be solved before the final issuance. Only one of the freshmen of the group interviewed had any misunderstanding of the check list. His complaint was that of not knowing the meaning of some of the various skill items. Further investigation revealed that he was a very poor swimmer. The rest of the group expressed themselves as having no difficulty in understanding the terminology of the check list, therefore, it was decided not to change the wording of the items but to leave them in their present terminology as Red Cross skills.

The survey. After this final check, the check list was ready for final issuance to the freshman men as a whole. This procedure was carried out by issuing the check lists to the freshmen in the Military Science Department in which most of the able-bodied freshmen are enrolled.

The total number of freshmen surveyed was 381. While this total is only about one-half the total number of freshmen enrolled at the Utah State Agricultural College, it is a cross-sectional group. The average swimming abilities of this group will closely approximate the average abilities of all of the freshman men. Piper (10,p.264) says:

If one takes a haphazard lot of samples from any group, he finds that the average of these samples closely approximates the average of the whole.

Grading the check lists. Before analyzing the data from the returned check lists, it was necessary to set up a method of

grading the check lists and applying them to a rating scale. This was done by assigning arbitrary values to the various items of the check list listed in questions six to eight inclusive. The rating scale was devised by fitting the Red Cross achievement skills, from the four Red Cross tests, to the skills listed in the check list. Thus the Red Cross achievement skills assumed values in five classifications which are listed below.

Table 2. Swimming classifications and their values

<u>Class</u>	<u>Scores</u>
Below Beginner	0 - 16
Beginner	17 - 54
Intermediate	55 - 83
Swimmer	84 - 96
Advanced Swimmer	97 and over

The Below Beginner classification is not a true Red Cross classification but it is felt that the freshmen who do not score at least seventeen points on the check list should be classified also.

Correlations. After the returned check lists were graded it was decided to check the scores of some of the individuals by applying the check list as a pool test. It was also decided to select a group, the classifications of which corresponded with those of the larger group, for the testing.

When the check list was used as a test in the pool, it was found that more than two hours were needed to test one individual and that two sessions in the pool were necessary for each individual. Twenty-one freshmen were tested in this manner. They were recruited from two fraternities, one dormitory,

and various living quarters in the town. No more than four were taken into the pool at one time, and these alternated in doing the various skills so that individual attention was given to each freshman. During these tests, careful attention was given to any reasons why the freshmen misunderstood or had questions concerning the items of the test. It was found that those freshmen who had had Red Cross swimming instruction had no difficulty in understanding the various items. Some of the others required explanations before they could do the skills.

The procedure of correlating the results of the check lists with the results of the pool tests is as follows:

Table 3. Computation of the coefficient of correlation.

Check list scores	Pool scores	Ranks		Differences	D ²
		X	Y		
100	95	1	5	4	16
82	89	2	10	8	64
81	97	3	3	0	0
80	87	4	11	7	49
79	94	5.5	6	.5	.25
79	96	5.5	4	-1.5	2.25
78	90	7	9	2	4
76	93	8	7	-1	1
75	73	9.5	15	5.5	30.25
75	100	9.5	2	-7.5	56.25
72	92	11	8	-3	9
65	68	12	17.5	5.5	30.25
62	65	13	19	6	36
61	68	14	17.5	3.5	12.25
51	76	15	14	-1	1
45	62	16	20	4	16
42	102	17	1	-16	256
40	38	18.5	21	2.5	6.25
40	79	18.5	13	-5.5	30.25
30	69	20	16	4	16
28	82	21	12	-9	81
					<u>717</u>

$$\rho = 1 - \frac{6\sum D^2}{N(N^2-1)} = 1 - \frac{4320}{9240} = 1 - .466 = .534 \approx .02$$

Thus the correlation between the check list scores and the pool scores was computed as $.53 \pm .02$ by the rho method. By using the product-moment method, a correlation coefficient of $.55 \pm .02$ was found. This positive coefficient indicates that there is a direct relationship between the two sets of scores; that is, there is a tendency for the high values in one column to be associated with the high values in the other column. However, by inspecting the two columns of scores it is readily seen that there is a wide variation in some cases.

As the check lists were being used for the purpose of classification, it is necessary to examine them for the discriminating value of the items. Ross (11,p.86) in discussing the discriminating factor says:

It is worthy to note that in one study the simple device of comparing the best third and poorest third of the class on each item, and considering those items most valid which showed the highest percentage of successful responses in the highest third as compared with the lowest third, was slightly more effective than the more elaborate methods. Whether one compares the best third with the poorest third, the best fourth with the poorest fourth, or similar proportions of the distribution, seems a matter of small consequence, and the technique is the same.

This procedure was followed in analyzing the discriminating value of the items of the check list used in this study.

Although the check list was not of pass or fail construction, the scores made on each item by the highest thirty-eight freshmen were compared with the scores made on each item by the lowest thirty-eight freshmen. The following table shows the discriminating value of each item of the check list.

Table 4. The high group average score made on each item as compared with the low group average score made on each item.

<u>Items</u>	<u>High Group</u>	<u>Low Group</u>
1	2.92	.079
2	3.11	.289
3	3.39	.026
4	4.50	.000
5	4.58	.000
6	4.45	.000
7	4.63	.079
8	4.63	.000
9	4.55	.026
10	4.55	.000
11	4.39	.000
12	4.29	.000
13	3.34	.026
14	4.58	.000
15	4.71	.156
16	4.71	.052
17	4.97	.026
18	4.89	.000
19	2.55	.395
20	4.42	.000
21	4.71	.079
22	5.89	.052

Thus the discriminating power of the items is high. The only item which tended to bring the two groups nearer together is number nineteen. This item is the one concerning the length of time one can stay submerged and it is natural that most of the freshmen would vary less on this item.

In order to measure the consistency of the check list, the half test method was used. The correlation between the scores for the odd numbered items and the scores for the even numbered items was computed as $.95 \pm .01$. This high coefficient indicates the slight differences between the half scores. By the use of the Spearman-Brown Prediction Formula, the coefficient of correlation for the whole check list was computed as $.99 \pm .00$. This coefficient indicates a reliable

check list.

A further measure of consistency was made by issuing the check list again to twenty-eight of the freshmen and comparing the answers with the answers of the previous issuance. The correlation between the two sets of answers was $.93 \pm .02$. This coefficient substantiates the high reliability found by the half test method.

ANALYSIS OF DATA

In order to explain the results of the survey it is necessary to make a breakdown of the check list and analyze the answers to each item.

The number of high schools from which the freshmen were graduated was 142. There were representatives from twenty-three states and four foreign countries. This information indicates that the group surveyed was representative.

The results of the first question of the check list are tabulated as follows:

Table 5. The number of freshmen and high schools of the representative states

State	Number of Freshmen	Number of High Schools
Utah	219	53
Idaho	94	36
Others	68	53

It is readily seen that Utah and Idaho, naturally, have the strongest representation.

It was found that most of the freshmen had attended their respective high schools for three years or more. Only thirty had attended the high school from which they graduated for

a two-year period and only ten had attended their particular high school for one year. A breakdown into percentages reveals that: 2.6% attended their high schools for a one-year period, 7.9% attended their high schools for a two-year period, 44.4% attended their high schools for a three-year period, and 45.1% attended their high schools for four years.

The significance of the length of time the freshmen attended their respective high schools, is revealed if any determination is to be made of the influence of the high school upon the learning of swimming.

Of the 381 freshmen who were surveyed, 301 or 79% of them were graduated from high schools having no pools. The remaining eighty freshmen who graduated from schools having pools, revealed that only in forty-nine cases did most of the learning of swimming take place in a high school pool. Only one high school pool was indicated as having contributed most of the learning of swimming to the pupils of that particular high school.

Many other places had more influence upon the learning of swimming than did the high school pool, however, it must be realized that many of the students learned to swim before arriving in the high schools. The various places where swimming was learned are listed in table six. Some freshmen did not answer to this particular item and some answers were confusing, consequently, the full total is not represented. However, the number of pupils who answered was large enough to reveal a definite indication of where most of the swimming

was learned.

Table 6. Places at which most learning of swimming was acquired

<u>Place of learning</u>	<u>Number of pupils</u>
Old swimming hole	154
High School pool	49
Boy Scout locale	29
Red Cross locale	29
Hotsprings locale	18
Y.M.C.A. or club pool	13
Town pool	13
A college pool	7
Ocean	5
Army camp	1

It is interesting to note that the natural swimming hole is a more important factor in contributing to swimming learning than any other place including the high school pool.

The freshmen were asked to indicate the highest Red Cross rating they had attained. All of them would not have attained a rating, consequently the answers were limited. This question was more or less a check on the ability scores. The ratings indicated are listed as follows:

Table 7. Number of freshmen having Red Cross ratings

<u>Beginner</u>	<u>Intermediate</u>	<u>Swimmer</u>	<u>Advanced Swimmer</u>
32	40	46	30

By segregating the above numbers according to states it was found that the distribution was fairly even.

Table 8. Percentages, by states of pupils having Red Cross swimming ratings

<u>Idaho</u>	<u>Utah</u>	<u>Others</u>
31.3%	24.9%	22.7%

After the check lists were graded and fitted to the rating scale (see method of procedure, table 2) it was found

that the freshmen had rated themselves as follows:

Table 9. Number of pupils in the various Red Cross classifications as rated by their grades on the check lists. Also expressed as percentages of the total group.

Below Beginner	69	or	18.1%
Beginner	113	or	29.7%
Intermediate	145	or	38.1%
Swimmer	39	or	10.2%
Advanced Swimmer	15	or	3.9%

Figure one shows a graphic illustration of the above percentages.

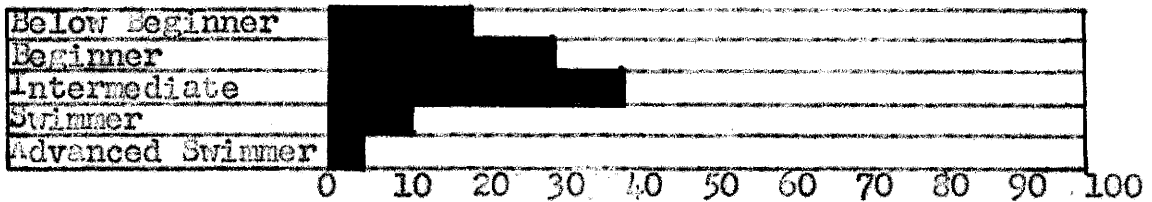


Figure 1. Classifications of the swimming abilities of the freshman men expressed in percent of the whole group

Thus 47.8% of the freshmen rated themselves lower than Intermediate.

In order to appreciate more fully the significance of the above statement it is necessary to understand the composition of the Intermediate classification.

The Intermediate course of instruction provides, mainly, the learning of the various basic swimming strokes. Emphasis is put upon coordinating leg movement with arm movements. These strokes are not undertaken with the idea of perfecting them, but for the purpose of introducing the student to different ways of swimming. The Intermediate course also contains the teaching of greater skill in back floating, treading water, underwater swimming, and plain front diving.

The various skills of the Intermediate test are listed below.

Table 10. The swimming skill items of the Intermediate Swimming classification

Flutter kick	20 yards
Scissors kick	20 yards
Frog kick	20 yards
Sidestroke of arms	10 yards
Breast stroke of arms	10 yards
Overhand stroke	10 yards
Elementary back stroke	50 yards
Side, breast, or overhand	100 yards
Back float	1 minute
Sculling (hands only)	10 yards
Treading water	30 seconds
Underwater swim	5 yards
Front dive	good form
Any or all strokes	5 minutes

As has been stated, 47.8% of the freshmen surveyed rated themselves lower than the Intermediate classification which includes the above listed skills. This does not mean that 47.8% of the freshmen cannot do any of the above skills, but it does mean that the indicated number of freshmen could not score at least fifty-five points on the check list or complete all of the above skills.

SUMMARY

This study has shown the classification of large numbers by use of a check list is advantageous in regard to time and ease of administration. The check list used is a valid instrument in itself, but its great weakness lies in depending upon the judgement of the students answering.

Further weaknesses of the check list method are revealed because the following factors are difficult or impossible to control.

1. Disturbing environmental conditions during the testing.
2. Complexes of students who may overrate or underrate according to self opinion.
3. Antagonism of students.
4. Preferential impulses (answering as subject would prefer it to be rather than what it is).
5. Faulty judgement as to time and distance as mentally visualized.
6. Indifference of students.
7. Unfamiliarity with standard terminology of check list items.
8. Time lapse since student last swam.

A better way to determine swimming ability is to use a pool test of the same items as the check list. However, this method is time consuming and for that reason was not used in this study. The results of this method are valid and reliable with a minimum of judgement used by the examiner. Nearly all values are derived from time and distance measurements, and can thus be scored objectively.

A disadvantage of the pool test method lies in the fact that personal traits of the student may enter into his performance. For instance, a lazy student may do only what he considers necessary to make a fair showing on the test. This difficulty may be overcome to some extent by proper introduction to the test before it is conducted. A proper introduction to the test would not only make clear the meaning of the items, but would bring about a better response from the pupils. An explanation of the purpose of the study and the importance of an honest response to the questions would result in finer rapport between the examiner and the subjects. The introductory explanation technique should also be a necessary feature of the check list administration.

The correlation of $.53 \pm .02$ shown between the check list results and the pool test results is not a definite indication of reliability between the two unless one considers the relationship in the light of the disadvantages of the check list method.

It is the assumption of the writer that a person scoring very low on the check list because of poor swimming ability and lack of understanding of the terminology of the items, will also score very low on the pool test. Following this line of reasoning, support is given to the fact that the check list does segregate poor and non-swimmers from the rest of the group.

The results of the check lists show that a representative group of freshmen was surveyed, with most of the students coming from the Utah-Idaho area surrounding Utah State Agricultural College. Most of these students learned most of their swimming in "the old swimming hole", and no correlation was shown, in most cases, between swimming ability and whether or not the high school of graduation had a swimming pool.

Of the students surveyed, 48.7% indicated that they could not successfully complete all of the skills listed in the Red Cross Intermediate classification.

RECOMMENDATIONS

1. If a check list is used for classification of students as to swimming ability, the check list should be made up of four separate compact tests including compiled skills for Beginner, Intermediate, Swimmer, and Advanced

Swimmer classifications as used by the Red Cross. These tests should include endurance swimming and swimming strokes for distance to represent the levels of the various classifications.

2. The check list should be administered with adequate time and instruction of terminology to insure the maximum correctness of answers.
3. The students should be informed as to the importance and purpose of the survey.

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APPENDIX

