Chapter I

INTRODUCTION

Our knowledge of the process of man's evolution tells us quite clearly that life was first sustained in water and that it took millions of years before it was established on land. Millions more passed before man came into being. As a land animal man learned to walk upright, taking the weight of his body on his feet, and he discovered that the water, where he could no longer walk upright and employ his muscles as on land, was a source of danger.¹

Man learned to swim long before it was possible for him to leave us any written record of his aquatic accomplishments.² Most animals swim by instinct, even those who do not really like water, and can swim at their


first attempt by performing their accustomed movements of running.  


Man, on the other hand, has to be taught this art and he finds the process of learning to swim somewhat artificial inspite of the fact that water is the first natural element for man. Before birth the child is totally immersed in a membrane of fluid, 'the waters', and later he is exposed to the air once he is born.  

5 That is why, babies are said to have a natural swimming reflex and for some babies it is easier to learn to swim than to walk.  

6, 7 The babies seem to be naturally confident splashing about the water, a confidence which they can loose as they get older.

One of the most interesting reflexes seen in infants is a swimming movement when they are held in or over water. These swimming movements have been filmed
by McGraw\textsuperscript{8} in infants 11 days old. If infants are placed in water, the head must be supported because they are unable to maintain the head above the water level. These movements are more rhythmic than the land crawling movements and usually disappear by about the fifth month of age. The same reflexive swimming movements have also been noted by several experimenters in a number of mammalian species.

It would appear from the study of primitive people that man made the beginning by crawling on his hands and knees in the shallow water on beaches. He entered this new environment primarily in pursuit of food, and secondly for the pleasant sensation that bathing gave him and then developed the first real urge to swim.\textsuperscript{9}

From these beginnings swimming has now become progressively developing sport ever since the front crawl stroke had its beginning in 1873, when an Englishman,


\textsuperscript{9}Sarsfield, \textit{Swimming for Everyone}.  

John Trudgen, won a race in London by bringing both arms alternately over the water. His leg kick was completely different from the modern front crawl, as he used an ordinary breast-stroke action. Later by the 1890s, the breast-stroke leg action had changed to the scissor-like movement of the side stroke.\textsuperscript{10}

The next improvement in the stroke came in 1898, when Arthur Cavill, one of six Australian brothers who were all good competitive swimmers, surprised a London audience by beating a well-known champion using a double over-arm technique, but with both legs tide because the then popular scissor movement of the legs was actually holding swimmers back. Later his brother Dick Cavill added a vertical kicking action of the legs, and by 1902 a technique was born which must have looked very like the modern front crawl. Thereafter, the front crawl went through several stages, each with its own particular variation. The early Australian crawl, with two-beat leg kick, gave way to the American crawl, with its six-

beat leg kick. This was the stroke with which Johnny Weismuller, the most famous screen Tarzan, dominated world swimming in the 1920s.\textsuperscript{11,12}

Thereafter, various methods and techniques have evolved for teaching nonswimmers. World over mass instruction is the normal procedure. The Crawl Stroke is usually taught first since it is the most commonly used of the four competitive strokes and considered to be the basic stroke. The body position, leg kick, arm stroke, and breathing are taught separately. Later these are combined to produce the whole stroke.\textsuperscript{13}

There is a trend of starting swimming at a younger age. It is necessary for the child to be familiar with the water at an early age in order that he be a good senior swimmer. Forsyth\textsuperscript{14} conducted a survey and found

\textsuperscript{11}Ibid.

\textsuperscript{12}Encyclopaedia Americana, 1969 ed., s.v."Swimming:"


\textsuperscript{14}Glenn Forsyth, "Burnout: Psychological or Physiological?" Swimming Technique 11 (April 1974):2.
that the swimmers who started early in competitive swimming were the most prevalent. The average age of the first competition of beginning swimmer was 9.5 years.

The beginning swimmer is totally involved in any learning experience, and his final level of skill attainment may be very well related to such personal factors as body build; height and weight; strength; endurance; flexibility; balance and coordination; reaction, movement and reflex times; kinesthesia; perception; intelligence; aspirations and motivation; anxiety, stress, and tension; availability of time and facilities; and quality of teaching.15,16

It has become necessary for physical education teachers and sports coaches to have an understanding of the nature of the learner and to test and measure the individual differences in the rate of learning gross bodily motor skills. The teaching and learning can not be sound if the children do not possess the pre-requisites for learning and performing a particular skill. Such


children who lack in basic knowledge and general motor ability are likely to be handicapped in learning motor skills. Brace\textsuperscript{17} pointed out that such tests could be used to classify students into groups on the basis of their ability to learn motor skills and that the ability to learn might be increased by improving the traits or factors involved in learning.

The study of conditions and factors which influence human learning has long been of interest to psychologists and educators. They have always been concerned and still continue to explore the mechanics and manner by which human beings learn and how learning can be accomplished more efficiently. Early researches in this area were primarily designed to study the nature of learning verbal materials. Interest has now also spread into the area of motor learning involving fine and/or gross movements. The earlier theories of learning formulated and modified by the psychologists can offer much to the physical educator also since physical education, like all the disciplines

in the educational sphere, is concerned with the most
effective teaching methods. The theories provide guide-
lines within which one may work and suggest a frame of
reference. It would be very convenient for the physical
educator to have a list of learning principles to follow.
He could use these as handy guidelines to be a more
effective and successful teacher.\textsuperscript{18}

"Swimming, which was considered to be only a
survival activity, has now developed into one of the
most popular competitive sports at the international and
Olympic levels. This is perhaps one of a few sports
where performance levels are progressively increasing and
records broken at short intervals. Presently swimming
occupies the most important place in the field of games
and sports because of its better values.\textsuperscript{19}

"The role of science in swimming has grown over
years as more and more swimmers search for a competitive

\textsuperscript{18}Singer, \textit{Motor Learning and Human Performance},
pp.267-339.

\textsuperscript{19}William H. Freeman, \textit{Physical Education and Sports in Changing Society} 2nd ed. (Delhi: Surjeet Publications,
edge based on something more than long tradition or guesswork. Talent, it seems, has sprung up on every team, so much so as to put the burden of winning on the wisdom of the swimming teacher's and coach's workout. No wonder then they may look to science to understand how and why certain things work and to sort out from their teaching and training regimens which methods are effective and which are not.²⁰

²⁰There is a great concern of sport scientists, coaches and teachers of physical education to identify those characteristics of sportsmen that show potential for developing high level of skills in specific sport, so that such potential sportsmen might be identified as early in their lives as possible, so that they might be nurtured scientifically to unfold their talents.²¹


Now-a-days, especially in Eastern Europe, teams of sport scientists, working with the top class coaches in the sport concerned, single out the basic physical characteristics (body size, weight, proportions and constitution) and psychological qualities which, for the sport concerned, might be the performance limiting factors. It is necessary then to find individuals with these attributes and characteristics, using a series of scientifically prepared objective, reliable and valid tests at the grass-root level. 22 "The secrete of sensational results achieved by the East German women swimmers is that the swimmers are so strong because of the system of scientific selection which uses cardio-vascular and anthropometric tests, carried out periodically from a very early age." 23

There seems to be a general agreement that anthropometric endowments are the best criteria of predicting success in sport. 24 However, psychological and physiological factors are also recognised as potential factors that are essential to exploit the anthropometric advantages


a would be top class sportsman might possess. Hence, it may be reasonably assumed that certain psychological factors like intelligence, aspiration level and concentration and certain physiological factors like aerobic capacity, vital capacity, body density, power, strength and flexibility might be largely contributing to quicker learning of swimming techniques provided the athlete also possesses optimum leverage of limbs and body proportions in executing strokes keeping oneself balanced in the aquatic media. Thus, it seemed to be worthwhile investigating the contribution of selected anthropometric, behavioural and physiological factors to success in learning the basic front crawl stroke swimming.

**Statement of the Problem**

The present study was undertaken with the purpose of investigating certain anthropometric, behavioural and physiological factors as predictors of success in learning front crawl stroke swimming.

**Delimitations**

1. The study was delimited to the male students in the age group of 12.6 to 14 years studying in various schools of Greater Gwalior.
2. For the purpose of this study, the following absolute anthropometric variables were selected:

a) Weight
b) Height
c) Foot length
d) Foreleg length
e) Thigh length
f) Leg length
g) Trunk length
h) Forearm length
i) Upperarm length
j) Arm length
k) Head circumference
l) Shoulder width
m) Upperarm girth
n) Thigh girth
o) Calf girth

3. For the purpose of this study, the following relative anthropometric variables were selected:

a) \( L_{e} \) length/Trunk length
b) \( F_{e} \) leg length/Thigh length
c) \( F_{w,a} \) arm length/Upperarm length
4. For the purpose of this study the following
   behavioural factors were selected:
   
a) Aspiration level
   b) Intelligence
   c) Concentration

5. For the purpose of this study the following
   physiological variables were selected:
   
a) Percentage of body fat
   b) Body density
   c) Vital capacity
   d) Aerobic capacity
   e) Power
   f) Arm and shoulder strength
   g) Abdomen strength
   h) Leg strength
   i) Average ankle flexibility
   j) Trunk-hip flexibility
   k) Shoulder flexibility.

Limitations

1. The experimental period available was 10 weeks
   only, which was considered adequate for learning basic
front crawl stroke.

2. Non-availability of some of sophisticated instruments was also considered a limitation for the purpose of this study.

3. Certain factors like life style, daily routine of activities and the dietary habits of the subjects which might have effected the results of the study could not be controlled. However, the subjects were requested not to participate in any other physical activity during the course of the study. Moreover, it was assumed that the random selection of the subjects has assured the nullifying effect of other factors.

4. No special motivational techniques and floatable teaching aids were used to influence their learning. Although, the subjects were encouraged to do their best, however, the difference that might have in the amount of learning due to lack of the same was recognised as another limitation of the study.

**Hypotheses**

On the basis of the knowledge reflected by the available literature, research findings and the scholar's understanding of the problem it was hypothesised that:
1. There will be significant relationship between Anthropometric Variables recorded before commencing instructions in swimming and learning scores in front crawl stroke swimming.

2. There will be significant relationship between Psychological (behavioural) Variables recorded before commencing instructions in swimming and learning scores in front crawl stroke swimming.

3. The Physiological Variables recorded before commencing instructions in swimming will have significant relationship to learning scores in front crawl stroke swimming.

**Definitions and Explanation of Terms**

**Front Crawl Stroke**

1. The front crawl is the stroke referred to as "freestyle" in competitive swimming and is presently the fastest stroke man swims.\(^{25}\)

2. In front crawl swimming the person appears to be crawling like a baby, reacting out with one hand at a time. The swimmer lies flat on the water face down, the arms are pulled alternately from front to back down the imaginary centre line of the body up to the thigh and are recovered out of the water to produce another pull. Both legs move up and down alternately. The number of leg beats to one arm cycle - left and right - varies from 2 to 6 as per the build of the swimmer and the distance he swims.  

The definition given by Spitz and Le Mond is found suitable and acceptable for the purpose of this study.

**Anthropometric Variables**

"Anthropometric variables are diamentions of the structure of the human body taken at specific sites to give measures of length, girth and width."  

---


The description of the specific anthropometric variables selected in this study are given while describing the procedure in Chapter III.

Level of Aspiration

1. Travers\textsuperscript{28} in his definition states that "level of aspiration is the level of future performance on a similar task which an individual expects to reach."

2. Frank\textsuperscript{29} has defined level of aspiration as "the level of future performance in a familiar task which an individual, knowing his level of past performance in that task, explicitly undertakes to reach."

The definition given by Frank has been considered suitable for the purpose of this study.


Intelligence

1. Good\(^{30}\) defines intelligence as "the ability to make successful and rapid adaptation to new situation and to learn from experiences; capacity to integrate experience, and as commonly used in measurement and testing, a degree of ability represented by performance on a group of tests selected, because they have proved their practical value in the prediction of success in academic work and in some vocations."

2. Intelligence may be defined as "the capacity to meet novel situations, or to learn to do so, by new adaptive responses."\(^{31}\)

3. Intelligence according to Wechsler\(^{32}\) is "the aggregate or global capacity of an individual to act


purposefully, to think rationally and to deal effectively with his environment."

The definition given by Good is considered most appropriate for the purpose of this study.

Concentration

1. Concentration may be defined as "the act of focussing of attention upon a task or problem or upon certain elements of an experience." \(^{33}\)

2. "The conscience and intensive application of mental or physical forces, or both, in an effort to perform a task or activity or to solve a problem." \(^{34}\)

The first definition is found suitable and acceptable for the purpose of this study.

Body Fat

1. "Fat is the most variable tissue in the body and is distributed throughout the body primarily under the skin and in the abdominal cavity." \(^{35}\)

\(^{33}\) Good, Dictionary of Education, p.90.

\(^{34}\) Ibid.

2. Skinfold thickness gives an estimation of total body fat, in as much as fifty percent of total body fat lies immediately under the skin.\(^\text{36}\)

For the purpose of this study the definition given by Mayer is considered more appropriate.

Body Density

The density of any substance may be defined as "the mass per unit volume."\(^\text{37}\)

Vital Capacity

1. Vital capacity is defined as "the largest volume of air that can be exhaled after deepest possible inhalation."\(^\text{38}\)


2. Cureton\textsuperscript{39} defines vital capacity as "the maximum volume of air that can be expired after taking full inspiration."

The definition given by Cureton is found more suitable and acceptable for the purpose of this study.

Aerobic Capacity

1. "It is the capacity by which metabolic demands can be met by the oxygen transport system, oxygen supplied by respiration during activity provides sufficient energy for executing the activities."\textsuperscript{40}

2. Aerobic work may be defined as "Work in which the amount of oxygen taken in and used by the body is sufficient to provide the energy necessary for the performance of the tasks."\textsuperscript{41}

For the purpose of this study the definition given by Hockey is found suitable and acceptable.


\textsuperscript{40}Kerry E. Ragg, "The Effects of Selected Recovery Period During Training on Metabolic Energy Sources" University Microfilm International (Ohio: State University Press, 1972),p.4.

Power

1. According to Clarke\textsuperscript{42} "Muscular power is the ability to release maximum muscular force in an explosive manner, that is in the shortest possible time."

2. According to Barrow and McGee\textsuperscript{43} "Power is the capacity of the individual to bring into play maximum muscle contraction at the fastest rate of speed."

The definition given by Clarke is considered more applicable for the purpose of this study.

Strength

1. "It is the force that a muscle or muscle group can exert against resistance in one maximal effort."

2. Strength may be defined as "the muscular force exerted against movable and immovable objects."\textsuperscript{45}

\textsuperscript{42}Clarke, Application of Measurement to Health and Physical Education, p.173.


The definition given by Johnson and Nelson is found more suitable and acceptable for this study.

Flexibility

1. "It is the ability of an individual to move the body and its parts through as wide a range of motion as possible without undue strain to the articulations and muscle attachments."\textsuperscript{46}

2. Flexibility may be defined as "the functional capacity of the joints to move through a full range of movement."\textsuperscript{47}

For this study the definition given by Hockey is found more suitable and acceptable.

Significance of the Study

Children learn at varying rates and all do not adjust to the school physical education programme with same ease and speed. Everyone has his own optional learning rate. This variation in learning capacity of

\textsuperscript{46}Tbid., p.76.

\textsuperscript{47}Hockey, Physical Fitness: The Pathway to Healthful Living, p.21.
the children has been a matter of great concern to physical education teachers. Their concern is stimulated by the growing realization of the importance of motor skills in daily life and by the crowded curriculum in today's schools. Therefore, serious efforts are to be made to ensure that maximum learning occurs in the time available for skill instruction. It will allow the coverage of more activities in the school programme and also the efficient methods will enable each child to attain a higher degree of skill. Further, it is likely that the individual will develop a more positive attitude toward the particular activity. Certainly the individual who has attained early and rapid success, in such activity like swimming, is likely to enjoy it more than the individual who has had a long and laborious learning experience and who tends to avoid participation as a result. Therefore, to promote enjoyment, fitness and the other benefits of greater participation, efficiency in teaching and learning of motor skills is essential.

It has been felt by the researcher, who has been working in the field of teaching and coaching swimming for the last one decade, that, if an advance evaluation of the factors effecting learning can be made then some
of the students' difficulties in adjusting to the swimming learning programme can be anticipated by the teacher early enough to assist the children in making proper adjustments for better learning of swimming.

The present study may indicate some of the anthropometric, behavioural and physiological variables as good predictors for success in learning the basic swimming stroke. Such variables would make it possible to distinguish slow learners from fast learners, and therefore, to be able to classify students into homogenous groups on the basis of their ability to learn how to swim. If the traits involved in learning swimming can be identified it might be possible, by improving these traits, to improve the ability to learn swimming.

The results of the study are likely to enable the sports scientists, swimming coaches and physical teachers to accumulate the evidences for building a more scientific basis for selecting subjects with desirable endowments as early in their lives as possible for shaping them into good swimmers through a sound training programme.
The study may also motivate other swimming loving people to take up similar research studies so that swimming in India may become a more scientific sport.