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# Fitness levels of children from seven to twelve years at a government primary school in Western Australia

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# FITNESS LEVELS OF CHILDREN FROM SEVEN TO TWELVE YEARS AT A GOVERNMENT PRIMARY SCHOOL IN WESTERN AUSTRALIA

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# USE OF THESIS

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Susan McCarrey

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## Abstract

A School Development Plan is a process by which a school can function and develop school-based curricula. Performance indicators should be established for all subject and administrative areas within the school. These indicators need to be assessed and evaluated by the use of a Management Information System (MIS) designed to suit each area of the school.

To establish performance criteria and a MIS in physical education, it is important to determine the level at which the children are performing. This study was designed to assess the fitness levels of all children aged 7 to 12 years attending a selected school and to use the results as a base for the development of physical education performance indicators, and a MIS which will consist of baseline data against which future assessments can be made. A school-based physical education programme will be developed using the results of this study to isolate areas of need within the school.

Fitness assessment was carried out using the Australian Schools Fitness Test (Pyke, 1986). The results were analysed to determine priority areas across age groups and between boys and girls. A statistical analysis was also made between

the results of this study and Australian norms developed by Pyke in 1985 from the Australian Health and Fitness Survey.

The level of fitness of children attending the selected school was found to be of a low standard, particularly in cardiovascular and muscular strength and endurance activities. Girls performed at lower levels than boys in all areas of fitness except flexibility. The flexibility of all children declined during the primary school years.

# CHAPTER 1

# INTRODUCTION

The importance of establishing sound fitness levels and lifestyle habits during childhood to prevent hypokinetic diseases such as coronary heart disease, high cholesterol levels, high blood pressure and obesity has been well documented (Biddle & Biddle, 1989; Malina & Bouchard, 1991; Pyke, 1980; Seefeldt, 1984; Willee, 1977). A daily physical education programme, incorporating fitness sessions, can improve the health status of children without any decrease in academic performance as a result of the added time involved in physical activity (Dwyer et al., 1983; Watkins & Tester, 1988).

## The Problem

The purpose of this study was to measure the physical fitness of children aged 7 to 12 years attending Hilton Primary School, a government school in Western Australia. The results of the study would then be used to develop priorities for physical education within the school.

In recent years the nature of educational planning in Western Australia has changed. The Ministry of Education has

devolved decision-making to schools with the result that schools have become more self-determining in their planning, educational programming, allocation of resources and monitoring of performance.

In 1989, the Ministry of Education and the State School Teachers' Union of Western Australia presented a Memorandum of Agreement to all government schools outlining the need to prepare a School Development Plan (State School Teachers' Union of Western Australia, 1990). A policy was issued in which the following were outlined as essential components of a School Development Plan:

* the purpose of the school;
* indicators of the school's performance;
* methods of monitoring the school's performance;
* local and Ministry priorities that need addressing;
* strategic plans to address these priorities; and
* the allocation of school resources to ensure effective outcomes.

(Western Australian Ministry of Education, 1989).

The following model was developed by the Schools Development Group (1990) to illustrate the progression of the elements of a School Development Plan (Figure 1).

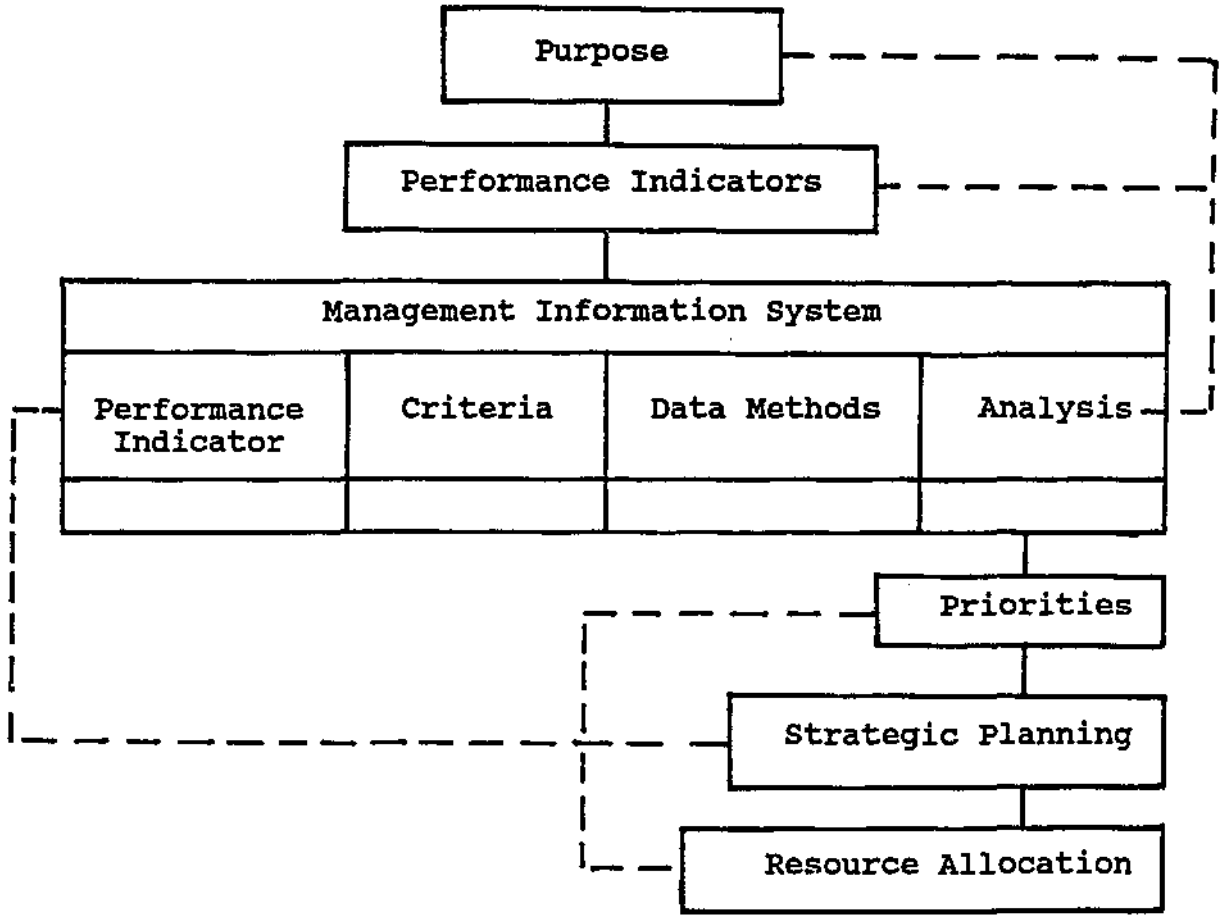



Figure 1. A model of a School Development Plan illustrating the relationship between its essential elements. (Schools Development Group, 1990, p. 6).

The "purpose of the school" is a statement which includes a set of aspirations about student outcomes. The statement, according to the Western Australian Ministry of Education (1989), should include the cognitive, social, physical and personal aspects of the children's development.

A school's performance indicators are broad statements describing desired student outcomes that relate directly to the school's purpose. These statements refer to student outcomes rather than curriculum or administrative matters.

The Management Information System (MIS) is the process of monitoring the extent to which the school achieves its stated purpose and performance indicators. The Schools Development Group (1990, p.14) outlined four stages involved in a school's MIS:

* Taking each performance indicator and asking what do we "exactly" mean by it?
* Generating appropriate student outcome criteria for each performance indicator;
* Collecting information on the criteria;
* Analysing the information collected to determine areas of strength and weakness.

Data collected from the MIS are used to isolate school priority areas. These priorities become the basis for school planning and resource allocation.

As the Physical and Health Education Specialist within the school, the researcher wanted to contribute to the School Development Plan with regard to physical education. This study developed a MIS for physical education by assessing the physical fitness of all children aged 7 to 12 years attending Hilton Primary School. The results were analysed and used to:

* determine the present level of physical fitness of children attending Hilton Primary School;
* determine the level of physical fitness compared to other similar groups of children;
* isolate priority areas within the school, which related to age, sex and fitness components;
* develop baseline data with which to compare the physical fitness of students in the future.

Background To The Study

During 1971 the Australian Youth Fitness Survey was conducted under the direction of Dr. A.W. Willee for the Australian Physical Education Association, the predecessor of the Australian Council for Health, Physical Education and Recreation (ACHPER). The survey was based on the American Association for Health, Physical Education and Recreation (AAHPER) test battery, which had been used previously in a number of countries to produce physical fitness norms for school students. Willee (1973) aimed to establish fitness norms for 13 to 17 year old boys and girls attending government secondary schools throughout Australia on each item of the AAPHER Youth Fitness Test.

In 1979, the Hon. R.J. Ellicott Q.C., the then Minister for Home Affairs, discussed with ACHPER the possibility of repeating the Australian Youth Fitness Survey. With some modifications, the test was conducted by ACHPER under the direction of Janet Pyke. It became known as the "Australian Health and Fitness Survey 1985" (Pyke, 1987). The Survey was extended to include primary school children with percentile norms being developed for fitness and performance tests for students from 7 to 15 years of age. The results indicated that many students were below desirable levels of fitness (ACHPER, 1987).

The current physical education programme at Hilton Primary School consists of 2 X 40 minute skill sessions, taken by a physical education specialist, and 1 X 60 minute sport period for children in years 4 to 7 that involves all teaching staff from those year levels. The 15 minute daily fitness session occurs intermittently on a class basis, with a few classes being involved in one or two sessions a week, but most classes not at all.

The fitness levels of children aged from 7 to 12 years at Hilton Primary School will be compared with the Australian norms developed by the ACHPER Survey in 1985. Findings will be used to develop a physical education programme based on children's needs. With the benchmark data developed, future performance on fitness items can be monitored and programme objectives determined.

## Significance Of The Study

This study was designed to measure the fitness and performance levels of children aged from 7 to 12 years at a government primary school in Western Australia. The study was deemed to be significant for the following reasons:

* The results will provide the researcher with baseline data for the development of a physical education programme appropriate to the specific fitness needs of the children.

* The results will provide the school with a set of baseline data with which to compare future fitness evaluation.

* The results will allow a comparison between children at the selected school with Australian norms developed by the Australian Health and Fitness Survey in 1985. This will provide information on the success, or otherwise, of the current fitness programme within the school (See Figure 2).

* The results will provide a comparison between girls and boys indicating possible areas of need within the programme.

* The results will provide a comparison across age levels indicating possible areas of need within the programme.

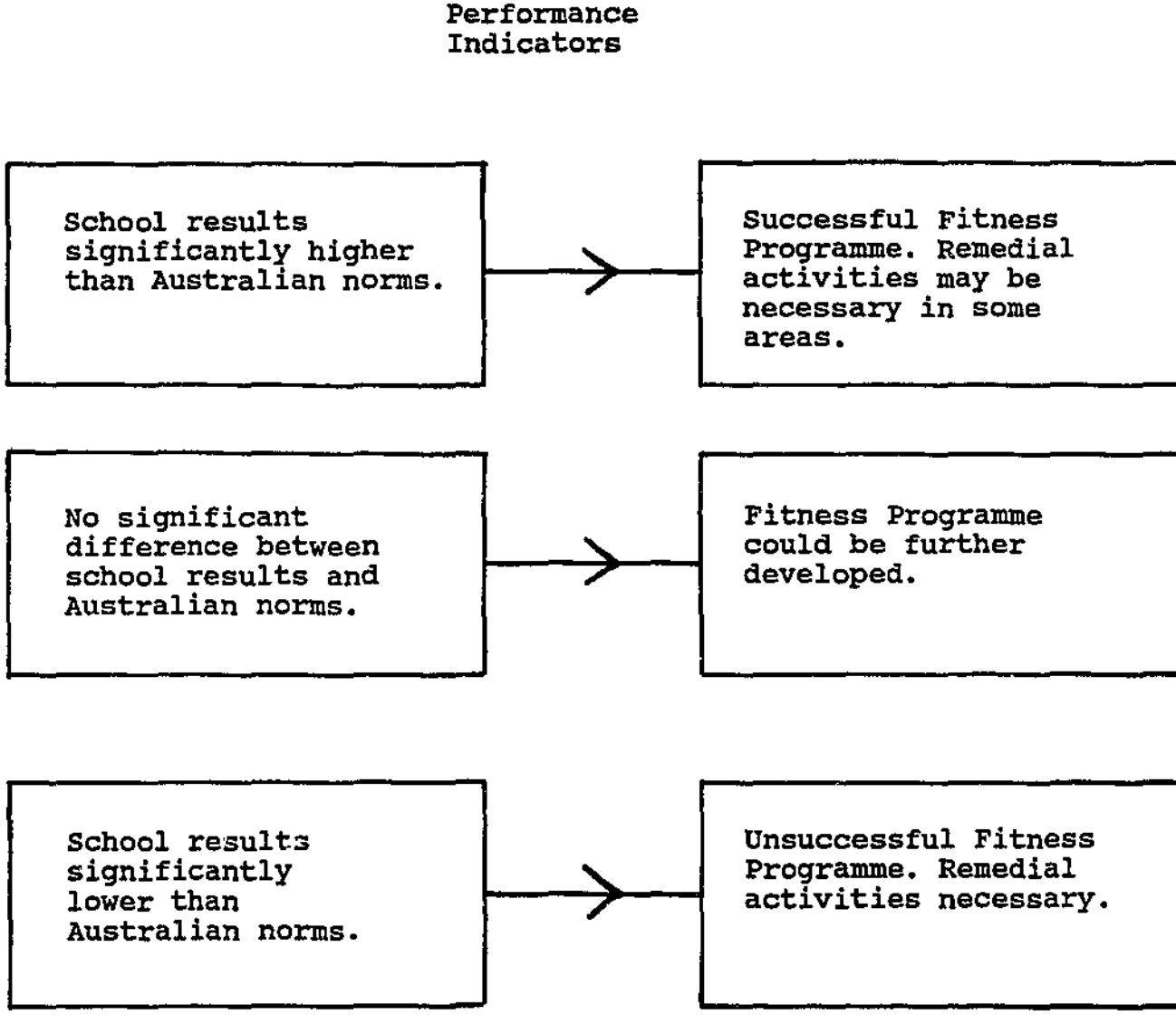



Figure 2. The significance of results obtained by comparing the physical fitness of Hilton Primary School children aged from 7 to 12 years with Australian norms developed by Pyke (1987).

## Definition Of Key Terms

### Physical Fitness

Although a variety of definitions are used, it is commonly accepted that physical fitness is a variable state indicating a person's ability to carry out daily tasks, as well as leisure activities and unforeseen emergencies. This study will adopt the definition given by Siedentop, Herkowitz and Rink (1984):

> Physical fitness is the ability to carry out daily tasks with vigor and alertness, without undue fatigue, and with ample energy to enjoy leisure-time pursuits and to meet unforeseen emergencies. (p.64)

In recent years, physical fitness has been divided into the following two forms defined by Biddle and Biddle (1989):

**Performance-Related Fitness** - the skill- or performance-related aspects of fitness more related to athletic performance including agility, balance, coordination, speed, power and reaction time.

**Health-Related Fitness** - the components of fitness that, if improved, enhance health and prevent disease. These include cardiorespiratory fitness, strength, muscular endurance, flexibility, body composition and stress management.

Components of Physical Fitness

**Agility** - the ability of a person to change direction or body position quickly and regain poise or control to proceed with another movement.

**Body Composition** - a measure of the ratio of lean body tissue to fat body tissue.

**Cardiovascular Endurance** - the work or contractions of large-muscle groups over a long period of time. Stress is placed on the heart and the circulatory and respiratory systems of the body when they must supply adequate blood and oxygen to the muscles over an extended time period.

**Coordination** - the ability to integrate muscle movements into an efficient pattern of movement.

**Flexibility** - the capacity of a joint or combination of joints to move through a potential range of motion.

**Muscular Strength** - the amount of force that can be exerted by a particular muscle or muscle group over a brief period of time.

**Muscular Endurance** - the extent to which a particular muscle or muscle group can continue to contract over a period of time.

**Power** - the capacity of the body to release maximum force or muscle contraction in the shortest possible time. A release of maximum force at maximum speed.

**Speed** - the rapidity with which one repeats successive movements of the same pattern.

## The Australian Schools Fitness Test

The present study replicated the field tests of the Australian Health and Fitness Survey conducted for the Australian Council for Health, Physical Education and Recreation (ACHPER) by the project director, Janet Pyke, in 1985 (Pyke, 1987). This survey was used to develop the Australian Schools Fitness Test (Pyke, 1986), and Australian fitness norms for children aged from 7 to 15 years.

## Overview of the Study

This chapter has presented the background of the study together with the rationale, significance of the study and definitions of key terms. The next chapter presents a review of the literature relevant to the study, and this is followed by a description of the design and methodology used throughout the research. Chapter Four presents and discusses the results with reference to similar research. The final chapter contains a summary of the study together with the findings, conclusions and recommendations for future research.

# CHAPTER 2

## LITERATURE REVIEW

In introducing the literature review, it is important to place physical fitness into the context of physical education. The following definition of physical education was supplied by the School of Human Movement Studies at the Queensland University of Technology, and accepted for a report on physical and sport education by the Senate Standing Committee on Environment, Recreation and the Arts (1992, p.3):

> Physical Education is an all-encompassing term, including fitness, skills, movement, dance, recreation, health, games and sport, plus the appropriate values and knowledge in each.

A review of literature relevant to the assessment of physical fitness in primary school aged children produced information concerning:

* A definition of physical fitness and its components.
* The benefits of physical fitness for primary school aged children.
* The relationship between fitness and the primary school physical education programme.

* The development of fitness testing.
* A comparison of girls and boys in fitness assessment.
* Biological differences between girls and boys.
* The effects of social conditioning.
* Fitness testing in Australia.
* "The Australian Health and Fitness Survey 1985" conducted by the Australian Council for Health, Physical Education and Recreation.

## Physical Fitness

Physical fitness is a variable state that alters according to the quantity and quality of physical activity with which an individual is involved. Willee (1973) and Corbin (1986) both referred to fitness as being a transient state that alters within and between individuals. Corbin (1986) further suggested that fitness can be hereditary and that one individual may be naturally fitter than another.

As individuals require different degrees of fitness according to the activities and sports they pursue, much of the research refers to fitness as it is required for daily

tasks and leisure time activities. The World Health Organisation refers to fitness generally, as the ability to perform muscular work satisfactorily (cited in Lawson, 1977). From definitions of physical fitness supplied by Willee (1973), Lawson (1977), Pyke (1980), Schurr (1980) and Siedentop, Herkowitz and Rink (1984), the attributes of physical fitness are the ability to carry out daily tasks and leisure time pursuits without undue fatigue and to be able to meet emergency situations requiring added exertion. Siedentop et al. (1984, p.64) gave the following succinct definition:

> Physical fitness is the ability to carry out daily tasks with vigor and alertness, without undue fatigue, and with ample energy to enjoy leisure-time pursuits and to meet unforeseen emergencies.

The literature varies as to the components of physical fitness, but the five components most commonly discussed are body composition, cardiovascular endurance, flexibility, muscular strength, and muscular endurance. These elements are described by Biddle and Biddle (1989) as factors of health-related fitness (HRF). Health-related because with improvement in any one of these, it is possible to enhance health and prevent disease. The importance of HRF to the well-being of our society and public health is stressed by Taggart (1987) and Biddle and Biddle (1989).

Lawson (1977) included speed of movement, muscular development and skilled performance as physical fitness components, while Pyke (1980) added coordination. In a much more extensive view, Schurr (1980) included the factors of agility, power, balance, speed and coordination. Biddle and Biddle (1989) refer to these aspects of fitness as performance-related as they relate to athletic performance and are not generally associated with health benefits.

For the purposes of this study, the definition of physical fitness given by Siedentop et al. (1984) and the components of flexibility, muscular strength, muscular endurance, power, speed and cardiovascular endurance will be accepted.

## Children's Needs and Physical Fitness

Willee (1977) referred to inactivity as a form of suicide and stated that no-one has the right to inflict inactivity on children. A strong statement, but perhaps justified when one considers the evidence in support of physical activity and fitness at a young age.

The importance of developing positive attitudes towards physical activity and fitness at a young age is outlined by Bailey (1976) and Pyke (1980). Both stressed the relationship between adult participation in physical activity and sound habits developed at an early age. Pangrazi and Hastad (1976) stated that the lifestyles of children are set by their eighth birthday. Prior to this time, dietary and exercise patterns are relatively easy to change, but become increasingly more difficult as the child matures.

Children are naturally active from birth. One only has to observe the baby kicking its legs or the toddler trying to walk. Croce and Lavay (1985) and Corbin (1986) outlined the role that technological progress and modern society has had on the reduction in time children spend engaged in vigorous physical activity.

It is often assumed that school children are physically active during lunch and recess breaks, but this assumption is not supported by research undertaken by Gilliam et al. (cited in Biddle & Biddle, 1989). The heart rate of children was monitored to see how much time was spent in high intensity activity, measured as the point at which the heart rate elevated to at least 60% of its maximum capacity. The study found that children were spending less than 2% of their time involved in high intensity activity while 80% was spent in low intensity activity. Research summarised by Malina and Bouchard (1991) concluded that there is a decrease in physical activity between the ages of two and five, with boys, on average, having higher activity levels than girls. They found that activity levels generally increased from middle childhood into early adolescence, but then began to decline.

The **growth and development benefits** of regular physical activity were supported by Dwyer et al. (1983) and Malina and Bouchard (1991). Both refer to the growing evidence that bodily changes beginning early in life have a direct relationship to coronary heart disease (CHD) in later life.

Pangrazi and Hastad (1976) and Malina and Bouchard (1991) documented the importance of exercise on a child's body physique and skeletal growth. They stated that vigorous

activity improves internal bone structure to help make the bones more resistant to breakage. Activity results in the bones growing larger in diameter and increasing in mineralization. They, and others, such as, Biddle and Biddle (1989), Parker and Bar-Or (1991), Pyke (1980), Seefeldt (1984) and Williams (1986) emphasized the importance of physical activity in the prevention of obesity.

The **physiological and medical benefits,** of regular physical activity are numerous. In a study conducted by Glass (cited in Pangrazi & Hastad, 1976) youngsters in the Iowa public schools were examined over a two year period. Of these students, 70% had s mptoms of coronary heart disease, 7% had extremely high cholesterol levels, a large percent had high blood pressure, and at least 12% were obese. These diseases, associated with a modern, increasingly sedentary lifestyle, are often referred to as hypokinetic diseases (Biddle & Biddle, 1989; Tinning & Kirk, 1991).

Strenuous physical training can influence the physiological development of all children and no adverse effects have been demonstrated. Croce and Lavay (1985) reviewed evidence of longitudinal studies that compare physically trained children with nontrained children of equal height, weight and age. The physically trained children at any age have a greater lean body mass (less fat), a greater maximal oxygen

uptake (greater aerobic fitness), and a greater maximal cardiac output (more efficient heart).

Corbin (1987) described regular physical activity as one of several important lifestyle characteristics which can contribute to health for a lifetime. He stressed the importance of fitness as a lifelong benefit associated with lifetime health, as long as children adopt the habit of regular exercise. This he described as a long-term goal for physical education programmes and physical educators.

Many researchers consider physical activity and a state of physical fitness as forms of preventive medicine in controlling heart disease and its associated problems of obesity, hypertension, strokes, and diabetes (Biddle & Biddle, 1989; Malina & Bouchard, 1991; Pyke, 1980; Seefeldt, 1984; Willee, 1977).

The link between physical activity and **cognitive and academic benefits** has, according to Shepard (cited in Pangrazi & Hastad 1976), yet to be supported by strong proof. Some studies, however, indicated a relationship between academic achievement and fitness levels.

A correlation between aerobic fitness and academic achievement in 475 high school boys was reported by Cooper

(1977). The author found that not only were the boys who performed better in the endurance test achieving higher grades, but they were absent from school less than other boys of the same age.

Studies conducted in France over a period of ten years from 1951 have developed the "1/3 time" schools, as nearly one third of the daily or weekly timetable is devoted to physical education. In 1951, Vanves Primary School, located in a suburb of Paris, introduced the new programme which stimulated a great deal of research throughout France. The Vanves' School was compared with other carefully paired control schools which continued under normal programmes. Over the ten year period, Bailey (1976), in reviewing the research, concluded that the results showed not only an increase in health, fitness, discipline and enthusiasm in the experimental schools, but also in academic results. Kirkendall (1986) in a review of related literature concluded that there is generally a moderate positive relationship between motor performance and intellectual performance.

Similar research, known as the Hindmarsh study, was conducted in South Australia between 1978 and 1980 by Dwyer et al. (1983), on 500 boys and girls aged 10. Those students involved in a fitness programme for 1 1/4 hours each day

experienced significant gains in endurance fitness and showed significant decreases in body fat compared to students in the control group. Although no academic gains were recorded, there was no decrease in performance on academic tests as a result of the increased time spent on physical activity.

Croce and Lavay (1985) described psychosocial benefits of physical activity in terms of self-concept and the relief of mental and emotional tension. A correlation exists between a child's self-concept and body image, and significant changes in these measures can occur through physical education programmes.

In relation to the development of self-concept, Pangrazi and Hastad (1976) placed a great deal of importance on the fact that all children were capable of improving their level of fitness. When improvement occurs, it has a strong impact on students' feelings of competency. Biddle and Biddle (1989) also outline the relationship between exercise and mental health factors such as the reduction of stress, anxiety, depression and the improvement of self-esteem.

A crucial point made by Corbin (1986) was that during the primary school years, importance should not be placed as much on achieving certain fitness levels, but developing a

lifetime habit of exercising regularly. As the aim is to promote an active lifestyle, Corbin emphasised successful and enjoyable experiences so that the child would continue to be active and fitness would result.

A summary of research concluded that:

* Physical activity is necessary to support normal growth in children (Malina & Bouchard, 1991).

* Inactivity as a youngster can have a bearing on mature functional capacity and consequently may be directly related to a number of adult health problems (Biddle & Biddle, 1989; Malina & Bouchard, 1991; Pyke, 1980; Seefeldt, 1984; Willee, 1977).

* Basic orientation toward experience is established early in life. If we want adult participation in physical activity it should be remembered that motivation towards activity is probably laid down at a very early age (Bailey, 1976; Pangrazi & Hastad, 1976; Pyke, 1980).

* Learning inside the classroom may be enhanced and supported by activity outside the classroom (Bailey, 1976; Kirkendall, 1986).

## Fitness and the Physical Education Programme

The concept of daily physical education has been introduced throughout Australia since 1980 in a variety of forms (Tinning, 1991). The Hindmarsh study prompted the Education Department of South Australia to introduce daily physical education and produce supportive curriculum material. The "Daily Physical Education Programme" (Education Department of South Australia, 1982), consists of sequentially developed lesson plans in all the designated areas of the physical education curriculum in levels one to seven.

The "Daily Physical Education Programme" introduced in South Australia presented fitness as a separate curriculum area from skill development. This initiated the concept of a daily 15 to 20 minute session based on developing fitness levels of children (Tinning, 1991). Kirk and Colquhoun (1989) outlined a similar programme in Queensland titled Daily 15/30 Physical Education once again isolating a daily fitness session of 15 minutes.

The impact of a daily physical education programme, incorporating fitness sessions, was investigated in Guildford, Western Australia in the early eighties (Watkins & Tester, 1988). Over a period of six years, not only were dramatic improvements recorded in the children's fitness and

skill levels, but survey results indicated that they had begun to take responsibility for their own lifestyles in this area.

The concept of daily physical education and the inclusion of fitness sessions spread across Australia and overseas (Tinning, 1991), creating a great deal of interest in the fitness assessment of children. Fitness testing was included as an integral part of the daily physical education curriculum materials produced in South Australia (Education Department of South Australia, 1982).

## Fitness Assessment

Human societies have long had an interest in the physical feats of strength, speed, power and endurance. Measurement of these capacities was generally by comparison and competition against others.

Formal measurement during the last part of the Nineteenth Century was based on anthropological and strength tests. These were concerned primarily with measuring the human body, its parts and the ability for it to lift weights and carry burdens (Mathews, 1973).

Many researchers soon realised that body size and measures of muscular strength alone did not assess an individual's power and working capacity effectively. Around 1905, strength tests were discarded, as it was felt that they did not take into account measures of endurance and heart and lung development.

In 1954, Kraus published a number of minimal muscular fitness tests along with data indicating that American school children aged between 6 and 16 years were physically inferior to their European counterparts. Kraus and Hirschland (1954) examined 4458 American and 2870 European children from Austria, Switzerland and Italy on a battery of six muscular strength tests. This caused a renewed interest in the field of measurement in the schools, with the then President Eisenhower establishing a Fitness Commission in 1956.

**Motor Fitness Tests** have been developed in great numbers since the outbreak of World War 11. These tests were originally developed for the armed forces, involving the American Army, Airforce and Navy and included pull-ups, push-ups, running and sit-ups. Using statistical methods, norms were established with which to appraise the fitness of defence personnel.

This type of test became extremely common, with the introduction of the American Alliance for Health, Physical Education, Recreation and Dance (AAHPERD) Youth Fitness Test in the 1950s initiated by President Eisenhower after the results of the Kraus-Webber Fitness Test previously mentioned (Kraft 1986). The AAHPERD Youth Fitness Test included pull-ups for boys, flexed arm hang for girls, one minute sit-ups, shuttle run, standing long jump, 50-yard dash and a 600-yard run or walk. The test was carried out in 1958, 1964-1965 and 1975. National norms for the United States of America were developed from the 1975 test. In 1980 the test was modified to become the AAHPERD Health Related Physical Fitness Test (HRPFT) and included a mile run/walk, or nine-minute run/walk, triceps and subscapular skinfold measures, timed sit-ups and sit and reach.

The inclusion of health-related aspects of physical fitness are described by Corbin and Pangrazi (1992). They explain the need to include only items thought to be associated with good health, and therefore the deletion of skill-related test items. Biddle and Biddle (1989) defined skill-related aspects of fitness as performance based activities involving factors such as agility, balance and coordination. These may include the softball throw and shuttle run used in earlier tests.

The AAHPERD HRPFT was used as the basis of the National Children and Youth Fitness Study (NCYFS) and the National Children and Youth Fitness Study 11 (NCYFS 11) conducted in 1984 and 1986 respectively by the Public Health Services of America. The NCYFS tested the fitness levels of children aged 10 to 18 years (Ross & Gilbert, 1985). The NCYFS 11 extended the original survey to include children aged 6 to 9 years (Ross & Pate, 1987).

The first Australian testing programme was conducted by Dr. A.W. Willee for the Australian Physical Education Association, the predecessor of the Australian Council for Health, Physical Education and Recreation (ACHPER) in the late 1960s. The survey was based on the American Association for Health, Physical Education, Recreation and Dance (AAHPERD) test battery. Willee (1973) aimed to establish fitness norms for 13 to 17 year old boys and girls attending government secondary schools throughout Australia on each item of the AAPHERD Youth Fitness Test.

In 1979, the then Minister for Home Affairs, the Hon. R.J. Ellicott Q.C. discussed with ACHPER the possibility of repeating the Australian Youth Fitness Survey. With some modifications the test was conducted by ACHPER under the direction of Janet Pyke. It became known as the "Australian Health and Fitness Survey 1985". The survey was extended to

include primary school children with percentile norms being developed for fitness and performance tests for students from 7 to 15 years of age (Pyke, 1987).

The purpose of the survey, as outlined by Pyke (1987), was:

* To establish percentile norms for the fitness and performance tests collected for students from 7 to 15 years of age.

* To obtain benchmark data on the fitness, health and physical performance of Australian school children during 1985 which could be used to assess change between this and future surveys.

* To assist in increasing the awareness of fitness and the health-related aspects of life-style through the publication of the Survey results and the dissemination of information through schools.

* To use the Survey results to establish a National Fitness Award Scheme. (p.2)

A total of 8484 randomly chosen students aged between 7 and 15 years inclusive, from 109 schools throughout Australia were assessed on a test battery including 11 health-related fitness and physical performance tests. These were height,

weight, arm girth, waist girth, hip girth, push-ups, sit-ups, standing long jump, sit and reach, 50 metre and 1.6 kilometre run. Additional measures of blood pressure, skinfolds, grip, shoulder and leg strength, lung function, physical work capacity, and blood lipids were taken on those students aged 9, 12 and 15 years.

The field tests of sit and reach, sit-ups, push-ups, standing long jump, 50 metre and 1.6 kilometre run were used to develop the Australian Schools Fitness Test (Pyke, 1986). These test items were chosen for the following reasons:

* The tests are reliable and valid measures of a major component of physical fitness.

* The tests require a minimal amount of equipment, space and time to administer.

* The tests are easily administered by teachers, including those not trained in physical education.

* The same tests can be used for both boys and girls of all ages.

The survey results indicated that many students were below desirable levels of fitness. Between the ages of 7 and 12 years, boys scored superior results in all test items apart

from the sit and reach flexibility test. The results indicated greater differences as age increased. On the release of the Survey Technical Report, ACHPER (1987) stated its concern that students in Australian schools were not receiving enough regular and vigorous physical activity.

Fitness Test Performance by Sex

Comparing boys and girls in earlier tests is difficult, as tests were designed and administered either, only to boys, or when girls were included they were given different test items with different administrative procedures making comparisons invalid. The original AAPHERD Fitness Test, conducted in 1958, altered certain items for use with girls and a separate set of norms were developed for boys and girls.

Physical fitness tests administered to compare sex differences comprised varying test items. However, most test items tended to fall into the categories of strength, muscular endurance, cardiovascular endurance, agility, flexibility, power, speed, balance and coordination.

Espenschade (1947) conducted research into the development of motor coordination in boys and girls, using a group of 610 children (325 girls and 285 boys) attending two

Californian schools during the years 1943-45. The subjects ranged from 10 to 16 years and were tested on the 20 items of the Brace Test covering agility, control, balance, flexibility and strength. Espenschade (1947) concluded that only slight differences occur between the sexes prior to 13.8 years of age. After this boys excel in all events with the most marked differences in "agility".

In a study presented by DiNucci in 1973, the difference between the motor fitness level of boys and girls in lower primary grades was examined. Forty eight test items used to measure muscular strength, muscular endurance, cardiovascular endurance, power, speed, agility, flexibility and balance were administered to a sample of 238 boys and 183 girls age 6 to 9 years. The boys were significantly superior to the girls in the areas of muscular strength, muscular endurance, cardiovascular endurance, power, speed and agility. Girls were significantly superior in the areas of flexibility and static balance, with no significant differences being noted on the tests for dynamic balance or modified pull-ups.

Milne, Seefeldt and Reuschlein (1976) examined gender differences of 100 males and 100 females from kindergarten and Years 1 and 2. Five motor performance items were administered, namely a 40 yard agility shuttle run, 30 yard

dash, standing long jump, sit and reach flexibility test and 400 foot run. They concluded that males were significantly better performers than females at each year level in all motor performance tests with the exception of flexibility.

Hall and Lee (1984) conducted research over the period 1977 to 1980 involving Grades 3, 4, and 5 children from an American suburban residential area. The school selected, introduced daily physical education with equal opportunity coeducational instruction in 1976. Hall and Lee administered the AAHPERD fitness test to 540 students in years 3, 4 & 5 each year for a three year period. The test included sit ups, shuttle run, 50 yard dash, broad jump and a 600 yard walk/run. The performance gap between the sexes decreased over the three year period with girls achieving better than boys on most of the test items during the year 1979-80. This indicated the value of an equal opportunity coeducational programme.

McKercher (1988) conducted a five item athletic achievement test on 800 Western Australian school children (400 boys, 400 girls) from Grades 4 to 7 during 1983. The five items were chosen as being representative of those most commonly included in an athletics programme, namely: sprint, long jump, high jump, softball throw for distance and flag (agility) race. McKercher reported that in all events boys

returned superior results to girls.

Results obtained during the 1980s by the AAHPERD fitness test, supported those found by Hall and Lee (1984) in their original testing prior to the introduction of the equal opportunity coeducational instruction. Prepubescent males outperformed females of the same age in all test items except flexibility.

Physical performance tests, administered to primary aged children during the period from 1970 through to the present day, all record sex differences, but of varying degrees. Research indicated that boys scored superior results in the areas of muscular strength, muscular endurance, cardiovascular endurance, power, speed and agility (AAHPERD, 1984; DiNucci, 1973; McKercher, 1988; Milne, Seefeldt & Reuschlein, 1976; Pyke, 1987; Richardson et al., 1980), whereas girls scored higher in areas of flexibility and balance (AAHPERD, 1984; DiNucci, 1973; Milne et al., 1976; Pyke, 1987; Richardson et al., 1980).

Sex differences in physical performance prior to puberty have been attributed to biological and environmental factors. It is here that many researchers disagree. Some attribute the differences between the sexes to structural and physiological factors (Kirk & Baker, 1979; McKercher,

1988), while others attribute the differences to environmental, social and psychological factors (Coles, 1980; Hall & Lee, 1984; Richardson et al., 1980). These two factors are considered in detail below.

Biological Differences

Differences in structural and functional capacity are partly determined by the innate biological differences between males and females (Docherty, 1980). The hormone activity during puberty activates many changes in both sexes with marked effect on physical structure, body proportions, body composition and physiological characteristics.

Many of these differences have been attributed to the production of varying levels of androgens and estrogens. Normally males have higher levels of androgens which promote greater muscle mass, larger and denser bones, and therefore increased strength and power when compared to females (Docherty, 1980; Hall & Lee, 1984). Females have higher levels of estrogens which increase fat deposits and decrease their growth period resulting in them being smaller and less muscular than males (Docherty, 1980).

These hormonal changes however, begin with the onset of puberty, indicating that very few differences should exist

prior to this stage. Much of our present day policy and legislation in regard to physical education in the primary school is based upon this evidence (Browne, 1986; Coles, 1980; Docherty, 1980; W.A. Ministry of Education, 1990).

From birth to approximately 12 years of age, boys tend to be slightly taller than girls. Due to the earlier onset of puberty in girls, this is reversed between the ages of 12 and 14 with girls being slightly taller than boys. Once boys enter their pubescent stage however, they once again take the lead and this difference remains through adult life (Docherty, 1980; Espenschade & Eckert, 1980; Siedentop et al., 1984).

Prior to the age of 12 years, there is little difference in weight between boys and girls. Girls tend to be heavier than boys between the ages of 12 and 15 years due to their earlier onset of puberty. Boys become much heavier than girls at 15 years of age, and this continues throughout adulthood (Docherty, 1980; Espenschade & Eckert, 1980; Siedentop et al., 1984).

Body proportions are similar in children from the ages of two to six years. Between 7 and 12 years, the limbs grow more than the trunk for both boys and girls, being more prominent in boys. Even during prepubertal years, girls

show a greater gain in hip width, where shoulder width gains are similar for both sexes from 6 to 10 years of age. Boys display a greater leg length relative to trunk length than girls. As boys have a longer forearm than girls, the arm length of boys is consistently longer than that of girls.

These differences become accentuated during puberty, along with the development of the typical proportional differences between men and women. It is during this stage that a girl's hip width and a boy's shoulder width increases (Docherty, 1980).

Docherty (1980, p.6) stated that the heart rate of children under the age of 11 years shows a similar gradual decrease in both boys and girls. After this age, boys show a greater rate of decrease than girls resulting in an approximate 10% difference in the resting pulse rate of men and women. During and after puberty, boys also have the ability to absorb greater amounts of lactic acid in their blood due to an increase in the alkali reserve.

Research by Docherty (1980) and Deutsch (1984) showed that after puberty, there are major differences between males and females in relation to the cardiovascular system and blood characteristics. Females have a smaller heart and lungs with less stroke volume than males. The maximum oxygen uptake

capacity per unit of haemoglobin is the same for both males and females, however, males have a greater percentage of total body haemoglobin resulting in a greater aerobic capacity.

During and after puberty, girls develop greater amounts of adipose tissue, particularly in the pelvic and thigh region, lowering their centre of gravity and affecting their maximum oxygen uptake levels (Deutsch, 1984; Docherty, 1980).

The strength of both boys and girls gradually increases prior to puberty, with girls scoring slightly lower in strength activities than boys. Due to their earlier pubescent spurt, girls show an earlier increase in strength than boys and for a brief period can actually out-perform the boys (Herkowitz, cited in Docherty, 1980). Espenschade and Eckert (1980) pointed out that once boys enter puberty, there is a considerable increase in strength resulting in a substantial difference between the sexes which remains during adulthood.

In summary, research on the biological differences between males and females, indicates that very few differences exist between boys and girls prior to puberty. After the onset of puberty hormonal changes within the body cause some considerable differences in the physical capacities of men

and women (Coles, 1980; Connel, 1986; Deutsch, 1984; Docherty, 1980; Espenschade & Eckert, 1980; Hall & Lee, 1984; Thomas & French, 1985.)

## Sociopsychological and Environmental Differences

Since few differences in the motor performance of prepubescent boys and girls can be attributed to biological reasons, many researchers such as Coles (1980), Greendorfer (1980), Sherif and Rattray (1976) and Thomas and French (1985) have attributed the differences to psychological, social and environmental reasons. The following factors are considered to have an influence on the quantity and quality of girls' involvement in sport and physical activity and therefore their performance on motor tasks.

For children to participate successfully in sport, they must possess a certain amount of competitiveness, aggressiveness and achievement orientation (Coles, 1980). This causes a major conflict with what is considered by society as traditional gender-roles and therefore behaviour. These qualities have long been considered masculine traits and are used to describe the male, not the female, who is expected to demonstrate femininity.

Research indicates a decline in motor performance in girls with an increase in age. In children under six, there is little to no difference in motor performance between girls and boys. Sex differences increase from ages 6 to 12 years with boys demonstrating greater strength, endurance and higher scores in skill-related activities (Sherif & Rattray, 1976; Thomas & Thomas, 1988). As a girl approaches pubescence she becomes more aware of what society holds as being important in a female. As Coles (1980) pointed out, a conflict arises between the characteristics she needs to be successful at sport and those she needs to be "feminine".

It has been widely accepted that boys are more competitive than girls, whereas girls tend to be more passive and less aggressive. Sherif and Rattray (1976) pointed out however that research indicated the opposite. They defined competition as:

> a social process which occurs when the person's activities are directed more or less consistently toward meeting a standard or achieving a goal in which performance by a person or by a group is compared and evaluated relative to that of selected other persons or groups. (p.105)

Sherif and Rattray (1976) found that girls were just as competitive as boys in activities they value. As sport or physical activity was not high on their list of importance, they did not consider it worth the competition, whereas the

area of academia was.

Much of the above also applies to aggression, another characteristic believed to be more prevalent in boys than in girls, and one considered necessary for success in sport. It has been suggested by Coles (1980) that girls are aggressive but demonstrate their aggression in different ways to boys. Research also indicates that females show greater levels of aggression when in a competitive athletic situation, but in every day situations, athletic and nonathletic females show similar levels of aggression.

Independence is another characteristic that females are assumed not to possess in high levels, but which is considered necessary for success in sport. The same can be said for achievement orientation in relation to sport and physical activity (Coles, 1980). Girls do achieve, and can show levels of independence, but sport does not offer too many avenues of success for girls. Boys will usually receive greater admiration and reward for success or even attempted success in sport than girls. Therefore, success in sport could be related more to positive reinforcement (Coles, 1980; Sherif & Rattray, 1976).

The values placed upon the above characteristics and their importance to boys and girls are developed by society and

passed on to children through adult models. Such role models presented to children in the home and in the community greatly affect the decisions children will make about their involvement in different activities.

Indeed it is possible, that differing behaviours between the sexes can be greatly affected by differential treatment, social interests and influences (Sherif & Rattray, 1976). The developing child is influenced by specific groups, such as family, peers, teachers and members of the community, who have been identified as critical elements in the process of socialisation and the development of perceived gender roles (Greendorfer, 1980). These factors must be taken into account when examining sport role socialisation and participation in sport and physical activity of children.

Differential treatment within the family begins before the child is born. Gifts bought for the baby often differ according to the sex of the child. Boys are often encouraged to play with sport-orientated toys, such as cricket bats and footballs, whereas girls are generally given more "feminine" toys such as dolls and tea sets (Thomas & Thomas, 1988).

The role models presented in the family are extremely important. Research indicates that the greater the parental involvement in sport, the greater the degree of sports role

socialisation in children (Coles, 1980; Greendorfer, 1980). Research undertaken by Coles (1980) indicated that it is the male parent who is primarily involved in sport which positively influences the male child's involvement in sport. Female subjects indicated they were encouraged to play sport to a much lesser degree and were restricted to sports seen as "suitable" for a girl, such as tennis and netball.

Studies by Bott (1955) and Minuchin (1965), (cited in Coles, 1980), indicated the importance of social class on gender role learning. Their research found that in a working class home, roles were defined and the husband/wife relationship was sex segregated with a clear differentiation of tasks and activities.

In middle and high economic status families with both parents being well educated, there was a minimum of role differentiation with many tasks and activities being carried out together. In this situation no clear role models existed and children were found to show less gender role identification.

As it appears that there is a relationship between gender role learning and involvement of boys and girls in sport, it would be expected that in a working class environment "appropriate" boys' sports, such as football, and

"appropriate" girls' sports, such as netball, would be more clearly defined (Coles, 1980).

What is seen as appropriate behaviour for a child's sex is also greatly influenced by the ethnicity of the family. Research indicates that many cultures, particularly Mediterranean immigrants, have very defined gender roles within the family (Coles, 1980). As in the case of the working class environment, different cultures have an effect on sports socialisation.

The peer group is another important group to influence a child's sport socialisation. As the child becomes older and spends more time with his/her peer group, the influence of the peer group becomes greater. Activities deemed as important by one's peers will greatly increase the likelihood of a child's involvement in those activities.

The maintenance of status amongst peers represents an important aspect in the development of self-confidence of the young. Activities viewed as low status by peers will discourage involvement. With the approach of adolescence, involvement of girls in physical activity decreases. In research conducted by Coles (1980), in which Victorian adolescent girls were asked which areas they would most like to be successful, 6.09% chose sport, 39.80% social life

and 54% careers. Sherif and Rattray (1976) indicated a decline in participation of girls in physical activity with the onset of adolescence due to girls choosing more "feminine" activities so as not to be labelled a "tomboy".

The role model supplied by the teacher is also of great importance, and it is important that all children are given equal opportunity and are treated equally in the area of physical education. This is a difficult task when all the previous factors are considered. Children arrive at school with values and attitudes already established, making it difficult for the teacher to overcome these.

As primary teachers are with their class of children for almost all of every school day, they have a marked influence on their students, both positively and negatively. The majority of primary school teachers are female, and most say they dislike sport and physical education classes (Coles, 1980). This attitude can be related to the teacher's own experiences with physical education and sport and it may not provide girls with a role model to encourage participation in sport.

School policies and the school environment will also have an effect on children's involvement in sport and physical activity. A school with very little physical education will

not encourage participation. Since the introduction of equal opportunity laws, many policies have changed, so that on the formal level the school can be regarded as providing equal experiences for both sexes. However, on the informal level, often referred to as the hidden curriculum, children of each sex are treated quite differently, reinforcing traditional gender roles (Coles, 1980; Sherif & Rattray, 1976).

## Conclusion

In conclusion, the review of literature has presented a background to the development of fitness testing and the value of physical activity and fitness for children. A great deal of fitness testing has been carried out in the United States of America and many European countries, such as France and Scandinavia. Fitness testing in Australia has increased since the Australian Youth Fitness Survey conducted by Willee in 1971.

The Australian Health and Fitness Survey directed by Pyke in 1985 was a comprehensive, nationwide study that allowed the development of Australian fitness norms for children aged 7 to 15 years. This resulted in the Australian Schools Fitness Test developed by Pyke in 1986, which provided Australian schools with a standard test that is relatively easy to administer to small groups for the assessment of children's fitness levels.

# CHAPTER 3

# RESEARCH DESIGN

An outline of the research conducted is presented in this chapter. The design and purpose of the study are followed by a statement of the research questions and research hypotheses. The procedures used are stated, including the selection of the study group and test battery. Data collection procedures, ethical considerations and the limitations of the study conclude the chapter.

## Design of the Study

This study is a descriptive case study which involves research at a selected school. The research questions and research hypotheses were formulated to develop baseline data on the physical fitness levels of children aged 7 to 12 years. These data will be used to assist in the development of a school development plan and physical education programme.

The fitness test applied was a direct replication of the Australian Schools Fitness Test (Pyke, 1986) based on the Australian Health and Fitness Survey conducted in 1985 (Pyke, 1987).

The research was conducted using a team of 30 Year 11 students from a local government secondary school who were involved in the Physical Education Studies course. During the testing day, the Year 11 students were supervised by an adult team of six, comprising the researcher, two secondary school physical education teachers, a part-time student from Edith Cowan University and the researcher's parents, to ensure standardisation of measurement.

Purpose of the Study

This study sought to determine:

* the physical fitness of children aged 7 to 12 years attending Hilton Primary School.

* areas of need within the fitness component of the school physical education programme from a comparison with Australian norms.

The results of the study were intended to be used to:

* develop a physical education programme suitable to the physical capabilities of each group of children.

* develop a strategic plan to address priority areas within physical education.

* monitor the physical fitness of Hilton Primary School children as part of the School Development Plan.

Research Questions

The research addressed the following questions:

1. Is there a difference in fitness levels across ages at the selected school as determined by the Australian Schools Fitness Test?

2. Is there a difference in fitness levels between boys and girls at the selected school as determined by the Australian Schools Fitness Test?

3. What are the differences between children attending the selected school and the Australian norms as determined by the Australian Schools Fitness Test on the following components of fitness?

    * Flexibility
    * Muscular strength and endurance
    * Muscle Power
    * Speed
    * Cardiovascular endurance

4. What are the areas of need by age and sex within the school physical education programme with reference to the fitness components?

Research Hypotheses

The research hypotheses, stated in the null form, follow:

1. There is no significant difference in physical fitness across age in a selected Western Australian government primary school as determined by the Australian Schools Fitness Test items.

2. There is no significant difference in physical fitness between boys and girls aged 7 to 12 in a selected Western Australian government primary school as determined by the Australian Schools Fitness Test items.

3. There is no significant difference between results for boys obtained from a Western Australian government primary school and Australian norms developed by the Australian Health and Fitness Survey (1985).

4. There is no significant difference between results for girls obtained from a Western Australian government primary school and Australian norms developed by the Australian Health and Fitness Survey conducted in 1985 (Pyke, 1987).

Study Group

The study group for the research was the student population from Hilton Primary School, a government school in Western Australia.

The student population of 166 children who matched the age criteria were tested. All children attending the selected school who were aged 7 to 12 years on or before June 30th 1990 were involved. This was consistent with the date used by the Australian Health and Fitness Survey (Pyke, 1987). Children aged 6 years were not tested in the Australian survey or the present study.

The students were tested using the Australian Schools Fitness Test (Pyke 1986) during the last week of June 1990.

Battery of Test Items

Physical fitness was tested using the Australian Schools Fitness Test (Pyke, 1986). Comparisons were made between the selected school and Australian norms by using Australian percentiles, means and standard deviations developed by Pyke during the 1985 Survey (See Appendix A for a copy of the results obtained in the 1985 Survey).

The Australian Schools Fitness items were chosen as they provided a tested profile of children's fitness and performance on the components; speed, flexibility, endurance, muscle strength and endurance and muscle power. The validity and reliability of the test had already been determined by Pyke (1985) during its use on a national basis. The test requires minimal equipment and time to administer making it suitable for use in the primary school.

The Australian Schools Fitness Test consists of the following test items:

Sit and Reach

Lower back and hamstring flexibility.

The distance children can reach beyond their feet with straight legs is measured in centimetres.

Sit - Ups

Abdominal muscular strength and endurance.

The number of correctly executed sit-ups to a taped cadence over a period of five minutes is recorded.

Standing Long Jump

Leg power.

The distance in centimetres is measured for a standing long jump taking off and landing with two feet.

Push - Ups

Upper body muscular strength and endurance.

The number of correctly executed push-ups are recorded for a period of 30 seconds.

50 Metre Run

Sprinting speed.

The time taken, to the nearest 1/100th of a second, for a 50 metre sprint. The track is set at right angles to the wind.

1.6 Kilometre Run

Cardiovascular endurance.

Students complete eight laps of a circle with a 200 metre circumference. The number of minutes taken to finish the course is recorded.

The test battery used was the performance section of The Australian Schools Fitness Test and therefore the same testing protocols and procedures were used (See Appendix B for a detailed copy of testing protocols).

Research Procedures

The school Principal was involved informally during the developmental stages of the study. Approval in written form was gained to conduct the research (See Appendices C & D). The Principal was kept informed as the research progressed. A final copy of the research report with recommendations for the areas of emphasis related to physical fitness in the physical education programme were submitted once testing was completed and results analysed. These recommendations were implemented and the testing procedure repeated in 1991 and 1992. A final copy of the research report will be presented to the school.

Prior to gaining consent from the subjects and their parents, both groups were fully informed about the precise nature and purpose of the research (See Appendix E). Both subject and parent were informed as to the test items to be utilized and the use of results to develop a school programme. Both subject and parent were informed of procedures for confidentiality of results and their right to withdraw at any time if they so desired.

Children were made familiar with the activities prior to the commencement of testing. The battery of tests were taught to all children in Years 2 to 7 at the school during normal

physical education lessons. Students had each test item demonstrated to them followed by an activity-based practice session. The researcher conducted all of these lessons using the testing protocols outlined in the 1985 Survey.

The researcher conducted all team training and each data collector was assigned a specific task for the entire testing period. The group of year 11 students were trained using the video tape and booklet of testing protocols used in the 1985 Survey. During the training session, each student was allocated the specific test item and taken through the associated procedures and protocols by the researcher. The supervising adult team was trained using the same format as the student team.

Testing was conducted over one school day from 9:00am to 3:00pm. Students were tested in class groups of between 25 and 30 in a single age group. Testing was completed before students returned to their class.

Subjects were requested to dress in a sports skirt or shorts with a shirt and gym shoes. The children were not involved in any form of exercise on the morning or afternoon prior to testing.

All subjects were put through the same warm-up routine before the test commenced and the same warm down at its conclusion, with all students completing the test items in the following order:

Sit and Reach

Sit-ups

Standing Long Jump

Push-ups

50 Metre Run

1.6 Kilometre Run

Students were given their own labelled data sheet which they carried from one testing station to the next. These were used for recording by a member of the data collection team. Times were recorded by the data collection team to the nearest 100th of a second.

Before students were returned to their class, data collection sheets were examined to be certain that all tests were attempted and results entered. All results were then recorded on a master sheet.

The researcher was known to all the students and data collection team. All students were addressed by their first name to make them feel at ease. They were encouraged to do their best in all tests without pressure being applied.

## Data Collection Procedures

During the testing procedure, each subject was given a Student Record Form. Recorded on the form was an identification number for each student, the subject's age in years, sex, date of birth and the results for each of the six test items. The identification number and personal information were recorded on the sheet by the researcher prior to the testing date. Results were recorded by a member of the testing team as the student progressed through each item (See Appendix F for a copy of the Student Record Form).

An Overall Data Sheet was used to collate all records and information. Subjects were listed under their identification number with all information being recorded in numerical form for use in statistical analysis (See Appendix G for a copy of the Overall Data Sheet).

## Ethical Considerations

1. All children and their parents were fully informed about the precise nature and purpose of the research. Both subject and parent were informed of procedures for confidentiality of results and their right to withdraw at any time if they so wish.

2. During the testing procedure, children had their results recorded on a record sheet identified by a number. The researcher was the only person to have a copy of the subjects' names.

3. The name of the school has been printed in the research report with the permission of the Principal and staff.

Limitations of the Study

The following limitations on results were acknowledged:

* Testing was carried out during a single school day as the timetable did not allow for testing to take place at the same time of the day for all children. Testing in the Australian Health and Fitness Survey was carried out at different periods during the day.

* Body composition measures and laboratory tests used in the Australian Health and Fitness Survey were not carried out due to the cost, and the facilities and equipment required.

* It is not possible to generalize conclusions of the study to other children in other schools as the sample was not a true representation of the general population.

* The subgroups of boys aged 9, and girls and boys aged 12, had a total number of less than 10 children each due to a low school enrolment in these areas.

* The sit-up and push-up test items involved the team member making a decision as to the correct execution of these activities, which became difficult with the younger children. As the same member of the research team conducted the one activity with all Western Australian subjects, a comparison of these results would not be affected. Some inconsistencies may occur when the results of this study are compared with the Australian norms on these two activities.

# CHAPTER 4

# RESULTS AND DISCUSSION

The results and discussion chapter outlines the data analysis techniques used in this study and presents the results with a discussion on related research.

## Data Analysis Techniques

The researcher replicated the field tests from the Australian Health and Fitness Survey in all ways apart from sampling techniques, which were carried out randomly throughout Australian Schools. This allowed a statistical comparison of results obtained in this study with Australian norms.

The study set out to test differences between age and sex across the two studies for significance, utilizing the Null Hypothesis (Ho) that:

$$\bar{X}1 - \bar{X}2 = 0$$

In order to determine the significance of the results gained, an Independent Samples $t$ - test was applied for each set of results using the SAS computer programme. Statistical analysis was also conducted across the six age groups using

Analysis of Variance (Duncan model) to determine any significant differences in results.

Significance testing was based on 95% confidence limits ($\alpha = 0.05$) such that if an observed result fell outside the range $\pm$ 1.96 $\sigma$ there is only a 5% possibility that such a result could have occurred solely by chance. As it was not possible to determine whether any difference would be positive or negative, a two-tailed test was used.

Results

The results of the Australian Schools Fitness Test applied to children aged 7 to 12 years attending Hilton Primary School are presented for each of the following six test items:

* Sit and Reach
* Sit-Ups
* Standing Long Jump
* Push-Ups
* 50m Sprint
* 1.6km Run

Age and sex differences are presented for the six test items, with a comparison between the selected school and the Australian norms.

Sit and Reach Test.

No significant differences were recorded between age groups in lower back and hamstring flexibility. The absolute scores indicate a higher level of flexibility in the 7,8,9 and 12 year olds than those aged 10 and 11 (Table 1).

Table 1

Results of the Sit and Reach Test for W.A. Students by Age

| Age | N | Mean cm | Duncan Grouping |
|---|---|---|---|
| 7 | 31 | 4.8 | A |
| 9 | 28 | 4.6 | A |
| 8 | 35 | 4.1 | A |
| 12 | 15 | 3.2 | A |
| 10 | 26 | 1.9 | A |
| 11 | 31 | 1.9 | A |

Note. Means having the same Duncan grouping are not significantly different at the .05 level of probability.

Pyke's survey (1987) produced similar results, showing a decline in flexibility through to age 10 in the girls and 12 in the boys. Although results began to improve after these ages, there was not the same sudden increase found in the present study (Table 2). The decline and then increase in flexibility is supported in similar research, with a continued increase in flexibility being indicated during adolescence (Pyke, 1987; Ross & Gilbert, 1985; Ross & Pate, 1987).

The substantial increase in flexibility in the 12 year olds, can be attributed to the results obtained from the girls rather than both groups (Table 2). As the number of 12 year old girls tested was only six, it is possible that a number of these girls were extremely flexible which increased the mean score.

A comparison between boys and girls attending Hilton Primary School produced a number of differences. Girls aged 7, 9 and 11 years were significantly more flexible, at the .001 level of probability, than their male counterparts. Eight and 12 year old girls were also significantly more flexible than boys of the same age, at the .01 level of probability (Table 2). This is consistent with results obtained by Pyke (1985) where girls scored higher results than boys in all age groups.

Although the absolute score for 10 year old girls was higher than that of the boys, there was no significant difference between boys and girls at this age level attending the selected school. This result is not supported by research in this area, which indicates that girls are more flexible than boys at this age (DiNucci, 1973; Pyke, 1987; Ross & Gilbert, 1985; Ross & Pate, 1987).

Table 2

Results of the Sit and Reach Test for WA Students by Age and Sex

| W.A. Boys | | | | W.A. Girls | | | | |
|---|---|---|---|---|---|---|---|---|
| Age | N | Mean cm | SD | Age | N | Mean cm | SD | P |
| 7 | 14 | 2.1 | 5.7 | 7 | 17 | 7.0 | 5.6 | *** |
| 8 | 13 | 1.9 | 7.7 | 8 | 22 | 5.4 | 4.9 | ** |
| 9 | 9 | 0.2 | 6.9 | 9 | 19 | 6.6 | 5.6 | *** |
| 10 | 13 | 1.4 | 5.6 | 10 | 13 | 2.5 | 6.4 | NSD |
| 11 | 12 | -2.2 | 4.8 | 11 | 19 | 4.4 | 7.8 | *** |
| 12 | 9 | 1.0 | 7.2 | 12 | 6 | 6.5 | 5.6 | ** |

Note. ** Girls' performance is significantly higher than boys ($p < .01$)

*** Girls' performance is significantly higher than boys ($p < .001$)

When the results for the Western Australian children were compared with the Australian norms established in the Australian Health and Fitness Survey, significant differences were recorded. Ten year old girls and 11 year old boys from Western Australia were significantly less flexible when compared with the Australian results at the .01 and .001 levels of probability respectively (Table 3). This indicates an area of need within the school.

Only seven year old girls were significantly more flexible than girls of the same age in the Australian survey ($p < .01$ and $p < .05$ respectively). No other significant differences were recorded.

Table 3

Results of the Sit and Reach Test for WA Students and Australian Students by Age and Sex

| W.A. Students | | | | Australian Students | | | | |
|---|---|---|---|---|---|---|---|---|
| Age | N | Mean cm | SD | Age | N | Mean cm | SD | P |
| | | | Boys | | | | | |
| 7 | 14 | 2.1 | 5.7 | 7 | 475 | 2.8 | 5.1 | NSD |
| 8 | 13 | 1.9 | 7.7 | 8 | 490 | 2.4 | 5.3 | NSD |
| 9 | 9 | 0.2 | 6.9 | 9 | 482 | 1.3 | 5.6 | NSD |
| 10 | 13 | 1.4 | 5.6 | 10 | 492 | 0.9 | 5.8 | NSD |
| 11 | 12 | -2.2 | 4.8 | 11 | 489 | 0.4 | 5.9 | --- |
| 12 | 9 | 1.0 | 7.2 | 12 | 494 | 0.4 | 6.4 | NSD |
| | | | Girls | | | | | |
| 7 | 17 | 7.0 | 5.6 | 7 | 478 | 5.3 | 5.2 | ++ |
| 8 | 22 | 5.4 | 4.9 | 8 | 496 | 5.8 | 5.2 | NSD |
| 9 | 19 | 6.6 | 5.6 | 9 | 487 | 5.3 | 6.2 | + |
| 10 | 13 | 2.5 | 6.4 | 10 | 497 | 4.7 | 6.2 | -- |
| 11 | 19 | 4.4 | 7.8 | 11 | 483 | 5.1 | 6.5 | NSD |
| 12 | 6 | 6.5 | 5.6 | 12 | 489 | 6.0 | 6.9 | NSD |

Note. -- WA children significantly lower in performance ($p < .01$)

--- WA children significantly lower in performance ($p < .001$)

\+ WA children significantly higher in performance ($p < .05$)

++ WA children significantly higher in performance ($p < .01$)

Sit - Ups.

In results obtained from the Western Australian children on the sit-up test, 7, 8 and 9 year olds were significantly lower in performance than the 10 and 12 year olds at the .001 level of probability (Table 4). Absolute mean scores indicate an increase in muscle strength and endurance with age, although 8 and 10 year olds recorded a higher mean score than children 9 and 11 years of age respectively.

The Australian Survey results demonstrate a similar increase in abdominal muscular strength and endurance with age. Mean scores increase with each age group, the largest difference being between the 9 and 10 year olds as it was with the Western Australian results. This trend is comparable to research conducted by the United States Department of Health and Human Services (Ross & Gilbert, 1985; Ross & Pate, 1987).

Table 4

Results of the Sit-Up Test for W.A. Students by Age

| Age | N | Mean | Duncan Grouping | |
|---|---|---|---|---|
| 12 | 15 | 37.7 | A | |
| 10 | 26 | 31.3 | A | |
| 11 | 31 | 29.3 | A | B |
| 8 | 35 | 19.1 | | B |
| 9 | 28 | 19.1 | | B |
| 7 | 31 | 19.0 | | B |

Note. Means having the same Duncan grouping are not significantly different at the .05 level of probability.

No significant differences were recorded between Western Australian boys and girls aged 7 and 8 years (Table 5). The 9 year old age group indicated girls were significantly higher in performance than their male counterparts at the .01 level of probability. This was due more to the poor performance of the 9 year old boys than to a good performance by girls of the same age as can be seen when the results were compared against the Australian norms. Boys were significantly higher in performance than girls in the 10, 11 and 12 year old age groups. The 10 and 12 year old boys performed significantly better at the .001 level of probability, and the 11 year olds at the .05 level.

Girls and boys aged 7 and 8 years performed at similar levels on the Australian Test, with boys over age 8 improving more rapidly than girls. Similar results were reported by DiNucci (1973), Hall & Lee (1984), Ross & Gilbert (1985), and Ross & Pate (1987).

Table 5

Results of the Sit-Up Test for WA Students by Age and Sex

| W.A. Boys | | | | W.A. Girls | | | | |
|---|---|---|---|---|---|---|---|---|
| Age | N | Mean | SD | Age | N | Mean | SD | P |
| 7 | 14 | 19.9 | 24.3 | 7 | 17 | 18.4 | 14.6 | NSD |
| 8 | 13 | 18.7 | 15.4 | 8 | 22 | 19.3 | 9.4 | NSD |
| 9 | 9 | 15.7 | 11.2 | 9 | 19 | 20.7 | 12.6 | ** |
| 10 | 13 | 38.7 | 30.2 | 10 | 13 | 24.0 | 14.0 | +++ |
| 11 | 12 | 31.2 | 8.3 | 11 | 19 | 28.1 | 13.3 | + |
| 12 | 9 | 44.6 | 29.2 | 12 | 6 | 27.5 | 9.7 | +++ |

Note. ** Girls' performance is significantly higher than boys ($p < .01$)

\+ Boys' performance is significantly higher than girls ($p < .05$)

\+++ Boys' performance is significantly higher than girls ($p < .001$)

A comparison of results between Australian students and Western Australian students produced a number of significant differences (Table 6). Western Australian 7 year old boys and girls were significantly higher in performance than Australian students of the same age and sex at the .01 level of probability.

Eight year old girls from Western Australia performed significantly lower than their Australian counterparts at the .01 level of probability. Boys aged 9, 11 and 12 years and girls aged between 9 and 12 years from Western Australia were all significantly lower in performance than Australian students at the .001 level of probability, indicating poor abdominal strength and endurance in these groups of children.

Table 6

Results of the Sit-Up Test for WA Students and Australian Students by Age and Sex

| W.A. Students | | | | Australian Students | | | | |
|---|---|---|---|---|---|---|---|---|
| Age | N | Mean | SD | Age | N | Mean | SD | P |
| | | | Boys | | | | | |
| 7 | 14 | 19.9 | 24.3 | 7 | 475 | 15.2 | 14.5 | ++ |
| 8 | 13 | 18.7 | 15.4 | 8 | 490 | 20.9 | 18.0 | NSD |
| 9 | 9 | 15.7 | 11.2 | 9 | 482 | 28.7 | 21.7 | --- |
| 10 | 13 | 38.7 | 30.2 | 10 | 492 | 38.6 | 27.2 | NSD |
| 11 | 12 | 31.2 | 8.3 | 11 | 489 | 45.3 | 30.8 | --- |
| 12 | 9 | 44.6 | 29.2 | 12 | 494 | 52.6 | 31.4 | --- |
| | | | Girls | | | | | |
| 7 | 17 | 18.4 | 14.6 | 7 | 478 | 15.6 | 14.4 | ++ |
| 8 | 22 | 19.3 | 9.4 | 8 | 496 | 21.7 | 19.2 | -- |
| 9 | 19 | 20.7 | 12.6 | 9 | 487 | 26.0 | 20.3 | --- |
| 10 | 13 | 24.0 | 14.0 | 10 | 497 | 33.7 | 24.9 | --- |
| 11 | 19 | 28.1 | 13.3 | 11 | 483 | 37.6 | 27.7 | --- |
| 12 | 6 | 27.5 | 9.7 | 12 | 489 | 38.6 | 25.9 | --- |

Note. -- WA children significantly lower in performance ($p < .01$)

--- WA children significantly lower in performance ($p < .001$)

++ WA children significantly higher in performance ($p < .01$)

Standing Long Jump.

Absolute mean scores for the Western Australian children on the test for muscle power indicated an increase in performance as age increased. This trend was also evident in the Australian Health and Fitness Survey and other related research (Hall & Lee, 1984).

The following significant differences were recorded between age groups from the Western Australian school at the .001 level of probability:

* Students aged 12 years were significantly higher in performance than all other age groups.

* Students aged 7 years were significantly lower in performance than all other age groups.

* 7, 8 and 9 year old students were significantly lower in performance than students aged 11 years (Table 7).

Table 7

Results of the Standing Long Jump Test for WA Students by Age

| Age | N | Mean cm | Duncan Grouping | |
|---|---|---|---|---|
| 12 | 15 | 160.1 | A | |
| 11 | 31 | 147.3 | B | |
| 10 | 26 | 139.2 | B | C |
| 9 | 28 | 132.4 | | C |
| 8 | 35 | 129.4 | | C |
| 7 | 31 | 117.8 | D | |

Note. Means having the same Duncan grouping are not significantly different at the .05 level of probability.

A comparison between girls and boys on the standing long jump resulted in 7, 8, 10 and 11 year old boys performing at a significantly higher level than girls of the same age. Although no significant difference was recorded for the 9 and 12 year old age groups, absolute mean scores were higher for boys in both areas (Table 8).

The Australian Fitness Survey produced similar results, with the mean scores for girls at a lower level of performance than boys in all age groups (Table 9). The leg power of both girls and boys improved steadily as age increased in both

the Australian and Western Australian studies. These trends are supported by DiNucci (1973) and Hall & Lee (1984).

Table 8

Results of the Standing Long Jump Test for WA Students by Age and Sex

| W.A. Boys | | | | W.A. Girls | | | | |
|---|---|---|---|---|---|---|---|---|
| Age | N | Mean cm | SD | Age | N | Mean cm | SD | P |
| 7 | 14 | 120.6 | 25.0 | 7 | 17 | 115.6 | 22.6 | + |
| 8 | 13 | 132.1 | 20.5 | 8 | 22 | 127.8 | 17.4 | + |
| 9 | 9 | 133.2 | 19.9 | 9 | 19 | 131.9 | 21.6 | NSD |
| 10 | 13 | 144.5 | 15.3 | 10 | 13 | 133.8 | 15.1 | +++ |
| 11 | 12 | 153.0 | 19.5 | 11 | 19 | 143.7 | 18.6 | +++ |
| 12 | 9 | 161.8 | 21.8 | 12 | 6 | 157.5 | 14.0 | NSD |

Note. + Boys' performance is significantly higher than girls ($p < .05$)

+++ Boys' performance is significantly higher than girls ($p < .001$)

The Western Australian students scored well when compared with the results of the Australian survey on the standing long jump. Boys aged 8 years and girls aged 7, 8, 9 and 12 years all scored significantly higher results than their Australian counterparts at the .001 level of probability. Twelve year old boys also scored significantly higher results than the Australian boys of the same age ($p < .01$), (Table 9).

Table 9

Results of the Standing Long Jump Test for WA Students and Australian Students by Age and Sex

| W.A. Students | | | | Australian Students | | | | |
|---|---|---|---|---|---|---|---|---|
| Age | N | Mean cm | SD | Age | N | Mean cm | SD | P |
| | | | Boys | | | | | |
| 7 | 14 | 120.6 | 25.0 | 7 | 475 | 119.5 | 17.7 | NSD |
| 8 | 13 | 132.1 | 20.5 | 8 | 490 | 126.3 | 18.2 | +++ |
| 9 | 9 | 133.2 | 19.9 | 9 | 482 | 135.1 | 19.1 | NSD |
| 10 | 13 | 144.5 | 15.3 | 10 | 492 | 145.5 | 18.5 | NSD |
| 11 | 12 | 153.0 | 19.5 | 11 | 489 | 151.0 | 19.6 | NSD |
| 12 | 9 | 161.8 | 21.8 | 12 | 494 | 156.3 | 22.4 | ++ |
| | | | Girls | | | | | |
| 7 | 17 | 115.6 | 22.6 | 7 | 478 | 105.9 | 18.3 | +++ |
| 8 | 22 | 127.8 | 17.4 | 8 | 496 | 119.2 | 18.1 | +++ |
| 9 | 19 | 131.9 | 21.6 | 9 | 487 | 127.4 | 18.7 | +++ |
| 10 | 13 | 133.8 | 15.1 | 10 | 497 | 135.2 | 19.2 | NSD |
| 11 | 19 | 143.7 | 18.6 | 11 | 483 | 142.5 | 22.1 | NSD |
| 12 | 6 | 157.5 | 14.0 | 12 | 489 | 148.3 | 21.6 | +++ |

Note. ++ WA children significantly higher in performance ($p < .01$)

+++ WA children significantly higher in performance ($p < .001$)

Push - Ups.

An analysis of variance across all age groups for the Western Australian Study produced no significant differences in upper body muscle strength and endurance. In absolute terms, 8, 9 and 10 year olds recorded mean scores higher in performance than those for 7, 11 and 12 year olds (Table 10).

The mean scores for the Australian Survey (Table 12), as with the WA Study, are irregular and set no particular trends.

Table 10

Results of the Push-Up Test for W.A. Students by Age

| Age | N | Mean | Duncan Grouping |
|---|---|---|---|
| 8 | 35 | 11.3 | A |
| 9 | 28 | 10.9 | A |
| 10 | 26 | 10.5 | A |
| 7 | 31 | 9.6 | A |
| 12 | 15 | 9.2 | A |
| 11 | 31 | 8.1 | A |

Note. Means having the same Duncan grouping are not significantly different at the .05 level of probability.

Western Australian boys were significantly higher in performance than their female counterparts in all age groups on the push-up test. Eight and 12 year old boys scored significantly higher at the .01 level of probability with all other age groups at the .001 level (Table 11).

The 11 and 12 year old girls from the selected school did not perform well on the push-up test, with the girls' results showing a decrease in performance with an increase in age. Some decrease in performance was evident in the boys' results, but not to the same extent as the girls. This decrease in performance as the girls get closer to adolescence is also evident in similar research (Pyke, 1987; Ross & Gilbert, 1985; Ross & Pate, 1987).

Girls performing significantly lower than boys in all age groups in upper body strength and endurance indicates a need to review the types of activities in which girls are involved to improve this area of fitness.

Table 11

Results of the Push-Up Test for WA Students by Age and Sex

| W.A. Boys | | | | W.A. Girls | | | | |
|---|---|---|---|---|---|---|---|---|
| Age | N | Mean | SD | Age | N | Mean | SD | P |
| 7 | 14 | 11.7 | 6.1 | 7 | 17 | 7.9 | 3.6 | +++ |
| 8 | 13 | 13.2 | 6.6 | 8 | 22 | 10.1 | 3.0 | ++ |
| 9 | 9 | 14.0 | 6.2 | 9 | 19 | 9.4 | 5.2 | +++ |
| 10 | 13 | 12.8 | 5.5 | 10 | 13 | 8.2 | 4.9 | +++ |
| 11 | 12 | 10.0 | 3.3 | 11 | 19 | 6.9 | 3.5 | +++ |
| 12 | 9 | 11.2 | 6.3 | 12 | 6 | 6.2 | 4.4 | ++ |

Note. ++ Boys' performance is significantly higher than girls ($p < .01$)

+++ Boys' performance is significantly higher than girls ($p < .001$)

Western Australian girls and boys aged 10, 11 and 12 years and Western Australian girls aged 7 and 8 years demonstrated a significantly lower level of upper body strength and endurance than students of the same age and sex in the Australian survey. Boys aged 10, 11 and 12 years performed at a lower level than the Survey results ($p < .01$, $p < .001$, $p < .01$ respectively). Girls aged 12 years performed significantly lower than their Australian counterparts at the .05 level of probability. Girls aged 8 years and boys aged 10 and 12 years scored lower at the .01 level with boys aged 11 years and girls aged 7, 10 and 11 years at the .001 level of probability.

No significant differences were recorded for boys aged 7, 8 and 9 years and girls aged 9 years when results from the selected school were compared with the Australian Survey. In no age group did the children from the selected school perform significantly better than their Australian counterparts (Table 12).

Table 12

Results of the Push-Up Test for WA Students and Australian Students by Age and Sex

| W.A. Students | | | | Australian Students | | | | |
|---|---|---|---|---|---|---|---|---|
| Age | N | Mean | SD | Age | N | Mean | SD | P |
| | | | Boys | | | | | |
| 7 | 14 | 11.7 | 6.1 | 7 | 475 | 12.7 | 4.2 | NSD |
| 8 | 13 | 13.2 | 6.6 | 8 | 490 | 13.7 | 4.7 | NSD |
| 9 | 9 | 14.0 | 6.2 | 9 | 482 | 13.3 | 4.8 | NSD |
| 10 | 13 | 12.8 | 5.5 | 10 | 492 | 14.9 | 5.0 | -- |
| 11 | 12 | 10.0 | 3.3 | 11 | 489 | 14.1 | 5.6 | --- |
| 12 | 9 | 11.2 | 6.3 | 12 | 494 | 14.4 | 5.3 | -- |
| | | | Girls | | | | | |
| 7 | 17 | 7.9 | 3.6 | 7 | 478 | 10.2 | 5.1 | --- |
| 8 | 22 | 10.1 | 3.0 | 8 | 496 | 11.2 | 5.4 | -- |
| 9 | 19 | 9.4 | 5.2 | 9 | 487 | 10.3 | 5.5 | NSD |
| 10 | 13 | 8.2 | 4.9 | 10 | 497 | 10.6 | 5.4 | --- |
| 11 | 19 | 6.9 | 3.5 | 11 | 483 | 9.4 | 6.2 | --- |
| 12 | 6 | 6.2 | 4.4 | 12 | 489 | 9.0 | 6.7 | - |

Note. - WA children significantly lower in performance ($p < .05$)

-- WA children significantly lower in performance ($p < .01$)

--- WA children significantly lower in performance ($p < .001$)

50 Metre Sprint.

Mean scores for the Western Australian children on the 50 metre sprint indicated an increase in speed as age increased. The Australian Health and Fitness Survey (Table 15), as with other research, produced similar findings (Hall & Lee, 1984; Pangrazi & Corbin, 1990; Pyke, 1987; Ross & Gilbert, 1985; Ross & Pate, 1987).

Significant differences were recorded across age groups at the .001 level of probability. Seven year olds performed significantly lower than all other age groups. Children aged 8 and 9 years scored significantly lower than those aged 11 and 12 years, while 10 year olds performed at a lower level than 12 year olds (Table 13).

Table 13

Results of the 50 Metre Sprint Test for W.A. Students by Age

| Age | N | Mean Sec. | Duncan Grouping | |
|---|---|---|---|---|
| 7 | 31 | 11.34 | A | |
| 8 | 35 | 10.10 | B | |
| 9 | 28 | 9.89 | B | |
| 10 | 26 | 9.47 | B | C |
| 11 | 31 | 8.99 | D | C |
| 12 | 15 | 8.67 | D | |

Note. Means having the same Duncan grouping are not significantly different at the .05 level of probability.

No significant differences were recorded between Western Australian girls and boys on the 50 metre sprint test (Table 14).

Both the Australian survey results and those from the selected school show an increase in performance with an increase in age for both boys and girls (Table 15).

Table 14

Results of the 50 Metre Sprint Test for WA Students by Age and Sex

| W.A. Boys | | | | W.A. Girls | | | | |
|---|---|---|---|---|---|---|---|---|
| Age | N | Mean Sec. | SD | Age | N | Mean Sec. | SD | P |
| 7 | 14 | 11.57 | 2.75 | 7 | 17 | 11.14 | 1.82 | NSD |
| 8 | 13 | 10.17 | 0.85 | 8 | 22 | 10.06 | 0.69 | NSD |
| 9 | 9 | 9.87 | 0.99 | 9 | 19 | 9.90 | 0.59 | NSD |
| 10 | 13 | 9.23 | 0.67 | 10 | 13 | 9.71 | 0.98 | NSD |
| 11 | 12 | 8.84 | 0.52 | 11 | 19 | 9.09 | 0.68 | NSD |
| 12 | 9 | 8.66 | 0.91 | 12 | 6 | 8.69 | 0.29 | NSD |

Few significant differences were recorded when Western Australian students were compared with students involved in the Australian survey. Boys aged 7 and 8 years from the selected school performed significantly lower at the .05 level of probability than their Australian counterparts. No other significant differences were recorded. Absolute mean scores for all other age groups indicate very similar results between Western Australian students and the Australian norms (Table 15).

Table 15

Results of the 50 Metre Sprint Test for WA Students and Australian Students by Age and Sex

| W.A. Students | | | | Australian Students | | | | |
|---|---|---|---|---|---|---|---|---|
| Age | N | Mean Sec. | SD | Age | N | Mean Sec. | SD | P |
| | | | Boys | | | | | |
| 7 | 14 | 11.57 | 2.75 | 7 | 475 | 10.03 | 1.96 | - |
| 8 | 13 | 10.17 | 0.85 | 8 | 490 | 9.58 | 1.65 | - |
| 9 | 9 | 9.87 | 0.99 | 9 | 482 | 9.29 | 1.27 | NSD |
| 10 | 13 | 9.23 | 0.67 | 10 | 492 | 8.98 | 0.92 | NSD |
| 11 | 12 | 8.84 | 0.52 | 11 | 489 | 8.87 | 1.08 | NSD |
| 12 | 9 | 8.66 | 0.91 | 12 | 494 | 8.68 | 1.00 | NSD |
| | | | Girls | | | | | |
| 7 | 17 | 11.14 | 1.82 | 7 | 478 | 10.58 | 1.92 | NSD |
| 8 | 22 | 10.06 | 0.69 | 8 | 496 | 9.98 | 1.75 | NSD |
| 9 | 19 | 9.90 | 0.59 | 9 | 487 | 9.64 | 1.44 | NSD |
| 10 | 13 | 9.71 | 0.99 | 10 | 497 | 9.31 | 1.21 | NSD |
| 11 | 19 | 9.09 | 0.68 | 11 | 483 | 9.17 | 0.97 | NSD |
| 12 | 6 | 8.69 | 0.29 | 12 | 489 | 8.89 | 1.09 | NSD |

Note. - WA children significantly lower in performance ($p < .05$)

1.6 Kilometre Run.

The time taken to complete the 1.6km run by the students attending the Western Australian school decreased as their age increased. A similar trend is indicated in the Australian Survey and related research (Hall & Lee, 1984; Pyke, 1987; Ross & Gilbert, 1985; Ross & Pate, 1987). These results show that cardiovascular endurance has increased with age in both boys and girls.

Students aged 7, 8, 9 and 10 years performed at a significantly lower level than those aged 12 at the Western Australian school. The 7 and 8 year olds also performed at a significantly lower level than the 11 year olds (Table 16).

Table 16

Results of the 1.6 Kilometre Run for W.A. Students by Age

| Age | N | Mean Min. | Duncan Grouping | |
|---|---|---|---|---|
| 7 | 31 | 11.54 | A | |
| 8 | 35 | 11.29 | A | |
| 9 | 28 | 10.85 | A | B |
| 10 | 26 | 10.48 | A | B |
| 11 | 31 | 9.88 | C | B |
| 12 | 15 | 9.28 | C | |

Note. Means having the same Duncan grouping are not significantly different at the .05 level of probability.

A comparison of results between Western Australian girls and Western Australian boys produced significant differences in the 9 and 10 year old age groups only. Boys age 9 and 10 years performed at significantly higher levels than girls of the same age ($p < .001$ and $p < .01$ respectively). Absolute mean scores for all other age groups indicate similar results for both boys and girls (Table 17).

The Australian Survey mean scores indicate a slightly better performance by boys in all age groups (Table 18), as did research by Hall & Lee (1984), Ross & Gilbert (1985), and Ross & Pate (1987).

Table 17

Results of the 1.6 Kilometre Run for WA Students by Age and Sex

| W.A. Boys | | | | W.A. Girls | | | | |
|---|---|---|---|---|---|---|---|---|
| Age | N | Mean Min. | SD | Age | N | Mean Min. | SD | P |
| 7 | 14 | 11.37 | 3.52 | 7 | 17 | 11.68 | 1.60 | NSD |
| 8 | 13 | 10.98 | 1.92 | 8 | 22 | 11.48 | 1.36 | NSD |
| 9 | 9 | 8.98 | 1.43 | 9 | 19 | 11.74 | 1.73 | +++ |
| 10 | 13 | 9.40 | 1.68 | 10 | 13 | 11.56 | 2.10 | ++ |
| 11 | 12 | 9.94 | 2.46 | 11 | 19 | 9.84 | 1.40 | NSD |
| 12 | 9 | 8.87 | 1.59 | 12 | 6 | 9.91 | 1.32 | NSD |

Note. ++ Boys' performance is significantly higher than girls ($p < .01$)

+++ Boys' performance is significantly higher than girls ($p < .001$)

A comparison between the Western Australian students and results from the Australian survey on the 1.6km run indicated that the WA students performed at a significantly lower level in a number of areas (Table 18). Boys aged 7, 8, and 11 years and girls aged 8, 9 and 10 years all performed at a significantly lower level than their Australian counterparts ($p < .001$). Boys aged 10 years and girls aged 7 years also performed at significantly lower levels ($p < .01$ and $p < .05$ levels repectively).

Results for boys aged 9 and 12 years and girls aged 11 and 12 years recorded no significant differences, but in all cases the absolute mean scores indicated a lower level of cardiovascular endurance for the Western Australian students (Table 18).

Table 18

Results of the 1.6 Kilometre Run for WA Students and Australian Students by Age and Sex

| W.A. Students | | | | Australian Students | | | | |
|---|---|---|---|---|---|---|---|---|
| Age | N | Mean Min. | SD | Age | N | Mean Min. | SD | P |
| | | | Boys | | | | | |
| 7 | 14 | 11.37 | 3.52 | 7 | 475 | 9.29 | 2.35 | --- |
| 8 | 13 | 10.98 | 1.92 | 8 | 490 | 9.07 | 2.15 | --- |
| 9 | 9 | 8.98 | 1.43 | 9 | 482 | 8.42 | 2.04 | NSD |
| 10 | 13 | 9.40 | 1.68 | 10 | 492 | 8.14 | 1.45 | -- |
| 11 | 12 | 9.94 | 2.46 | 11 | 489 | 8.15 | 1.49 | --- |
| 12 | 9 | 8.87 | 1.59 | 12 | 494 | 8.03 | 1.43 | NSD |
| | | | Girls | | | | | |
| 7 | 17 | 11.68 | 1.60 | 7 | 478 | 11.00 | 2.53 | - |
| 8 | 22 | 11.48 | 1.36 | 8 | 496 | 10.16 | 2.35 | --- |
| 9 | 19 | 11.74 | 1.73 | 9 | 487 | 9.55 | 2.36 | --- |
| 10 | 13 | 11.56 | 2.10 | 10 | 497 | 9.37 | 2.24 | --- |
| 11 | 19 | 9.84 | 1.40 | 11 | 483 | 9.37 | 2.27 | NSD |
| 12 | 6 | 9.91 | 1.32 | 12 | 489 | 9.24 | 2.10 | NSD |

Note. - WA children significantly lower in performance ($p < .05$)

-- WA children significantly lower in performance ($p < .01$)

--- WA children significantly lower in performance ($p < .001$)

# CHAPTER 5
# CONCLUSION

This chapter presents concluding statements for the study under the headings: summary of research, major findings, recommendations, action taken as a result of recommendations and concluding comments.

## Summary of Research

The purpose of this study was to measure the fitness levels of children aged 7 to 12 years attending Hilton Primary School, a government school in Western Australia. The results of the study will be used to develop school priorities for physical education as a part of the School Development Plan.

Fitness levels were assessed by replicating the field tests from the Australian Health and Fitness Survey conducted for the Australian Council for Health, Physical Education and Recreation by the project director, Janet Pyke, in 1985.

These later became known as the Australian Schools Fitness Test (Pyke, 1986). Hilton Primary School students were tested in the following activities:

| | | |
|---|---|---|
| Sit and Reach | - | lower back and hamstring flexibility |
| Sit-ups | - | abdominal muscular strength and endurance |
| Standing long jump | - | leg power |
| Push-ups | - | upper body muscular strength and endurance |
| 50m run | - | sprinting speed |
| 1.6km run | - | cardiovascular endurance |

Results were analysed to determine differences between between Western Australian students in this study and Australian norms.

Major Findings

The major findings of this study will be presented within the framework of the research questions on which the research was based. The major findings will reject all four of the research hypotheses.

Question 1 : Is there a difference in fitness levels across ages at the selected school as determined by the Australian Schools Fitness Test?

Significant differences across age groups were recorded in abdominal and upper body muscle strength and endurance, leg power, and cardiovascular endurance. Lower back and hamstring flexibility and sprinting speed were the only two fitness components not to record significant differences. Results obtained on the six test items isolated the following priority areas:

* lower back and hamstring flexibility decreased between the ages of 7 and 11 years with boys aged 11 and girls aged 10 recording particularly low results;

* nine year old boys performed poorly on a test for abdominal muscular strength and endurance. This same group of children however, recorded very good results in cardiovascular fitness;

* upper body muscular strength and endurance decreased in children aged 11 and 12 years with particularly low results being recorded by the girls.

Question 2 : Is there a difference in fitness levels between boys and girls at the selected school as determined by the Australian Schools Fitness Test?

Significant differences were recorded between girls and boys in lower back and hamstring flexibility, abdominal strength and endurance, leg power, upper body strength and endurance and cardiovascular endurance. The fitness component of sprinting speed was the only area where no significant differences were recorded. Boys generally performed at a higher level than girls in all areas except lower back and hamstring flexibility where girls recorded superior results. The following major points presented themselves:

* boys performed at a lower level than girls in all age groups on the test for lower back and hamstring flexibility;

* girls recorded particularly poor results in the tests for muscular strength and endurance and leg power.

As it has been established that very few structural and physiological differences exist between prepubescent boys and girls (Docherty, 1980; Espenschade & Eckert, 1980; Hall & Lee, 1984; Siedentop et al., 1984), the following sociopsychological and environmental influences may have affected the sex differences:

* gender-role differentiation is more defined in low socioeconomic areas such as Hilton;

* school and community role models establish behaviours considered "masculine" and "feminine", with sport orientated characteristics often being considered "masculine";

* expectations of physical performance is often different for girls and boys.

Although research supports the possible effects of these sociopsychological and environmental influences on the physical performance of boys and girls prior to puberty (Coles, 1980; Hall & Lee, 1984; Richardson et al., 1980), further research would need to be conducted to establish reasons for the lower performance by Hilton Primary School girls on 5 out of the 6 test items.

Question 3 : What are the differences between children attending the selected school and the Australian norms as determined by the Australian Schools Fitness Test on the following components of fitness?

* Flexibility
* Muscular strength and endurance
* Muscle power
* Speed
* Cardiovascular endurance

Significant differences were recorded between Hilton Primary School children and the Australian norms established by Pyke in 1985 in all six of the test items. Although results varied within each test item according to sex and age, Hilton Primary school children performed generally at a lower level or at similar levels to students in the Australian survey in lower back and hamstring flexibility, muscle strength and endurance, sprinting speed and cardiovascular endurance. Only on the test for leg power did the Hilton children perform at a higher level. It is essential to note when considering the following points, that the results from the Australian Health and Fitness Survey indicated many Australian children were below desirable levels of fitness (ACHPER, 1987):

* Results of Hilton Primary School children were low in tests for cardiovascular endurance and muscle strength and endurance when compared with Australian norms;

* Hilton children performed well on the test for leg muscle power, when compared with Australian norms.

Question 4 : What are the areas of need by age and sex within the school physical education programme with reference to the fitness components?

The results of this study have produced the following priority areas within the Hilton Primary School physical education programme:

* the decline in lower back and hamstring flexibility of both girls and boys during their primary school years;

* the inferior lower back and hamstring flexibility levels of boys;

* the low performance levels of girls on all the components of fitness except lower back and hamstring flexibility;

* the generally poor fitness levels of girls and boys, particularly in the areas of cardiovascular endurance, and muscular strength and endurance.

Recommendations

The following recommendations have been formulated from the results of this study. With the introduction of these recommendations, it is hoped that the fitness levels of children attending Hilton Primary School will improve.

Recommendation 1 : That a Daily Fitness Programme will be introduced that involves all classes and teaching staff within the school. This programme will be designed to develop the fitness components of flexibility, speed, power, cardiovascular endurance and muscular strength and endurance.

Recommendation 2 : That a physical education policy be developed as a component of the Hilton Primary School Development Plan.

Recommendation 3 : That physical education performance criteria and student outcomes be established as a base for the physical education programme and that these incorporate the fitness elements.

Recommendation 4 : That fitness assessment be conducted each year to establish the success or otherwise of the Daily Fitness Programme, in order to isolate priority areas within the programme and set future goals.

Action Taken as a Result of Recommendations

As a result of this study, the following action was taken by the researcher, who is the Physical Education Specialist, the Administration and other teaching staff of Hilton Primary School.

1. The following performance indicator was established as a priority area within the Hilton Primary School development plan:

   A concern for and an understanding of how to achieve physical and emotional health and well-being.

2. Physical education performance indicators were established as a part of the School Development Plan. These indicators provide a broad outline on which to develop the physical education programme and aim student achievement of knowledge attitude and skills (See Appendix H for the physical education performance indicators).

3. Student outcomes were established as a base for the physical education programme including the fitness component. These provide specific criteria by which student achievement can be monitored. Students' progess against the outcomes are evaluated twice yearly (See Appendix I for the physical education student outcomes).

4. A submission was made to gain funding through the Priority Schools Programme to establish a Daily Fitness Programme as a school priority area. This funding was granted in 1991 (See Appendix I for an extract from the 1991 and 1992 Priority Schools Programme submissions).

5. A Daily Fitness Programme was established, involving all classes and teaching staff throughout the school, which incorporated activities based on the major fitness components. Children were taught and encouraged to use stretching exercises as a warm-up and warm-down to increase flexibility in all areas, particularly the

lower back and hamstrings. The fitness sessions consisted of a variety of activities to improve cardiovascular fitness.

6. Fitness assessment was repeated in November 1991 for all children aged 7 to 12 years at Hilton Primary School. The Australian Schools Fitness Test was conducted and improvements were evident in flexibility, muscular strength and endurance and cardiovascular endurance. Particular improvements were found in cardiovascular endurance with an improvement in mean scores in all age groups. A reduction in the difference between scores recorded for boys and girls was also evident. The 1.6km run was again repeated in November 1992 to assess cardiovascular endurance with improvements being recorded in four of the six age groups.

## Concluding Comments

This study has resulted in a number of changes in the physical education programme at the selected School. The students are more physically active and improvements have been seen in many areas of physical performance. A Management Information System has been established by which the physical performance of students can be assessed in the future.

Although the findings of this study cannot be generalised beyond Hilton Primary School, it is hoped that the results may add to the growing body of knowledge in support of a Daily Fitness Programme within schools.

# Appendix A

## Results From the Australian Health and Fitness Survey
(Pyke, 1987. p.52-57)

SIT AND REACH (CM) — BOYS

| Percentiles | Age | | | | | | | | | Percentiles |
|---|---|---|---|---|---|---|---|---|---|---|
| | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | |
| 95 | 11 | 11 | 11 | 10 | 9 | 10 | 12 | 14 | 17 | 95 |
| 90 | 9 | 9 | 8 | 8 | 8 | 8 | 10 | 12 | 14 | 90 |
| 85 | 8 | 8 | 7 | 7 | 7 | 7 | 8 | 10 | 12 | 85 |
| 80 | 7 | 7 | 6 | 6 | 6 | 6 | 7 | 9 | 10 | 80 |
| 75 | 6 | 6 | 5 | 5 | 5 | 5 | 6 | 8 | 9 | 75 |
| 70 | 6 | 5 | 4 | 4 | 4 | 4 | 5 | 7 | 8 | 70 |
| 65 | 5 | 5 | 3 | 3 | 3 | 3 | 4 | 6 | 7 | 65 |
| 60 | 5 | 4 | 3 | 3 | 2 | 2 | 3 | 5 | 5 | 60 |
| 55 | 4 | 3 | 2 | 2 | 1 | 1 | 2 | 4 | 4 | 55 |
| 50 | 3 | 3 | 1 | 1 | 1 | 0 | 2 | 3 | 3 | 50 |
| 45 | 3 | 2 | 1 | 0 | 0 | -1 | 0 | 2 | 2 | 45 |
| 40 | 2 | 1 | 0 | 0 | 0 | -1 | 0 | 1 | 1 | 40 |
| 35 | 1 | 0 | -1 | -1 | -1 | -2 | -1 | 0 | 0 | 35 |
| 30 | 0 | 0 | -2 | -2 | -2 | -3 | -2 | -1 | -1 | 30 |
| 25 | 0 | -1 | -2 | -3 | -3 | -4 | -3 | -2 | -2 | 25 |
| 20 | -1 | -2 | -3 | -4 | -4 | -5 | -5 | -3 | -4 | 20 |
| 15 | -2 | -3 | -5 | -5 | -6 | -6 | -6 | -5 | -5 | 15 |
| 10 | -4 | -5 | -6 | -7 | -7 | -7 | -8 | -7 | -7 | 10 |
| 5 | -6 | -7 | -8 | -10 | -10 | -10 | -10 | -10 | -10 | 5 |
| Mean | 2.8 | 2.4 | 1.3 | 0.9 | 0.4 | 0.4 | 1.1 | 2.6 | 3.3 | Mean |
| Std. Dev. | 5.1 | 5.3 | 5.6 | 5.8 | 5.9 | 6.4 | 6.6 | 7.2 | 7.9 | Std. Dev. |

SIT AND REACH (CM) — GIRLS

| Percentiles | Age | | | | | | | | | Percentiles |
|---|---|---|---|---|---|---|---|---|---|---|
| | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | |
| 95 | 13 | 14 | 15 | 14 | 15 | 17 | 20 | 21 | 21 | 95 |
| 90 | 12 | 12 | 13 | 12 | 13 | 15 | 17 | 19 | 19 | 90 |
| 85 | 11 | 11 | 11 | 11 | 12 | 13 | 16 | 17 | 18 | 85 |
| 80 | 10 | 10 | 11 | 10 | 11 | 12 | 15 | 16 | 17 | 80 |
| 75 | 9 | 9 | 10 | 9 | 10 | 11 | 14 | 15 | 16 | 75 |
| 70 | 8 | 8 | 9 | 8 | 9 | 10 | 13 | 14 | 14 | 70 |
| 65 | 8 | 8 | 8 | 8 | 8 | 9 | 12 | 13 | 13 | 65 |
| 60 | 7 | 7 | 7 | 7 | 7 | 8 | 10 | 13 | 12 | 60 |
| 55 | 7 | 6 | 7 | 6 | 6 | 7 | 9 | 12 | 12 | 55 |
| 50 | 6 | 6 | 6 | 6 | 5 | 6 | 8 | 11 | 11 | 50 |
| 45 | 5 | 5 | 5 | 5 | 4 | 5 | 7 | 10 | 10 | 45 |
| 40 | 5 | 5 | 4 | 4 | 4 | 4 | 7 | 9 | 9 | 40 |
| 35 | 4 | 4 | 3 | 3 | 3 | 3 | 6 | 8 | 8 | 35 |
| 30 | 3 | 3 | 3 | 2 | 2 | 2 | 5 | 7 | 6 | 30 |
| 25 | 2 | 2 | 2 | 0 | 1 | 1 | 4 | 6 | 5 | 25 |
| 20 | 1 | 1 | 0 | -1 | 0 | 0 | 3 | 5 | 5 | 20 |
| 15 | 0 | 1 | -1 | -2 | -2 | -1 | 2 | 3 | 3 | 15 |
| 10 | -2 | 0 | -3 | -4 | -3 | -3 | 0 | 0 | 1 | 10 |
| 5 | -4 | -3 | -5 | -6 | -6 | -6 | -4 | -4 | -2 | 5 |
| Mean | 5.3 | 5.8 | 5.3 | 4.7 | 5.1 | 6.0 | 8.5 | 10.2 | 10.3 | Mean |
| Std. Dev. | 5.2 | 5.2 | 6.2 | 6.2 | 6.5 | 6.9 | 7.0 | 7.5 | 7.2 | Std. Dev. |

## SIT-UPS — BOYS

| Percentiles | Age | | | | | | | | | Percentiles |
|---|---|---|---|---|---|---|---|---|---|---|
| | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | |
| 95 | 40 | 59 | 78 | 100 | 100 | 100 | 100 | 100 | 100 | 95 |
| 90 | 32 | 44 | 55 | 100 | 100 | 100 | 100 | 100 | 100 | 90 |
| 85 | 25 | 35 | 45 | 67 | 100 | 100 | 100 | 100 | 100 | 85 |
| 80 | 22 | 30 | 41 | 55 | 76 | 100 | 100 | 100 | 100 | 80 |
| 75 | 19 | 26 | 38 | 50 | 64 | 83 | 100 | 100 | 100 | 75 |
| 70 | 17 | 24 | 35 | 45 | 55 | 72 | 100 | 100 | 99 | 70 |
| 65 | 16 | 22 | 32 | 40 | 51 | 60 | 100 | 100 | 80 | 65 |
| 60 | 14 | 20 | 29 | 37 | 46 | 54 | 80 | 85 | 70 | 60 |
| 55 | 13 | 19 | 27 | 34 | 41 | 50 | 72 | 76 | 65 | 55 |
| 50 | 12 | 17 | 24 | 32 | 38 | 45 | 63 | 71 | 60 | 50 |
| 45 | 10 | 15 | 21 | 30 | 33 | 42 | 57 | 62 | 57 | 45 |
| 40 | 10 | 13 | 19 | 27 | 30 | 38 | 52 | 57 | 53 | 40 |
| 35 | 8 | 12 | 18 | 24 | 27 | 34 | 48 | 52 | 50 | 35 |
| 30 | 7 | 10 | 15 | 21 | 23 | 30 | 44 | 49 | 46 | 30 |
| 25 | 6 | 9 | 13 | 19 | 21 | 26 | 40 | 44 | 42 | 25 |
| 20 | 5 | 7 | 11 | 17 | 19 | 23 | 35 | 39 | 38 | 20 |
| 15 | 4 | 5 | 9 | 15 | 15 | 20 | 31 | 34 | 33 | 15 |
| 10 | 2 | 4 | 7 | 10 | 11 | 16 | 24 | 27 | 29 | 10 |
| 5 | 0 | 2 | 4 | 6 | 6 | 11 | 19 | 20 | 19 | 5 |
| Mean | 15.2 | 20.9 | 28.7 | 38.6 | 45.3 | 52.6 | 65.9 | 68.5 | 64.9 | Mean |
| Std. Dev. | 14.5 | 18 0 | 21.7 | 27.2 | 30.8 | 31.4 | 30.3 | 29.4 | 28.7 | Std. Dev. |

## SIT-UPS — GIRLS

| Percentiles | Age | | | | | | | | | Percentiles |
|---|---|---|---|---|---|---|---|---|---|---|
| | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | |
| 95 | 40 | 60 | 69 | 100 | 100 | 100 | 100 | 100 | 100 | 95 |
| 90 | 30 | 43 | 50 | 67 | 100 | 85 | 85 | 91 | 74 | 90 |
| 85 | 26 | 36 | 43 | 57 | 67 | 62 | 68 | 64 | 61 | 85 |
| 80 | 24 | 32 | 37 | 50 | 55 | 56 | 58 | 56 | 52 | 80 |
| 75 | 20 | 29 | 33 | 44 | 48 | 50 | 52 | 50 | 47 | 75 |
| 70 | 19 | 26 | 30 | 40 | 42 | 44 | 49 | 48 | 44 | 70 |
| 65 | 17 | 23 | 28 | 36 | 39 | 40 | 44 | 43 | 40 | 65 |
| 60 | 15 | 21 | 26 | 34 | 36 | 37 | 41 | 41 | 37 | 60 |
| 55 | 14 | 19 | 23 | 30 | 34 | 34 | 38 | 39 | 34 | 55 |
| 50 | 12 | 18 | 22 | 27 | 30 | 32 | 36 | 36 | 31 | 50 |
| 45 | 11 | 15 | 20 | 24 | 27 | 30 | 33 | 34 | 28 | 45 |
| 40 | 10 | 14 | 18 | 22 | 25 | 27 | 30 | 31 | 26 | 40 |
| 35 | 9 | 12 | 16 | 20 | 23 | 24 | 29 | 29 | 25 | 35 |
| 30 | 7 | 10 | 14 | 18 | 20 | 23 | 26 | 27 | 22 | 30 |
| 25 | 6 | 9 | 12 | 17 | 18 | 20 | 24 | 25 | 21 | 25 |
| 20 | 5 | 7 | 10 | 15 | 16 | 18 | 22 | 23 | 18 | 20 |
| 15 | 3 | 5 | 8 | 12 | 13 | 16 | 19 | 19 | 17 | 15 |
| 10 | 2 | 4 | 6 | 9 | 9 | 13 | 14 | 16 | 12 | 10 |
| 5 | 0 | 0 | 4 | 4 | 6 | 8 | 9 | 12 | 8 | 5 |
| Mean | 15.6 | 21.7 | 26.0 | 33.7 | 37.6 | 38.6 | 41.2 | 41.6 | 37.4 | Mean |
| Std. Dev. | 14.4 | 19.2 | 20.3 | 24.9 | 27.7 | 25.9 | 25.5 | 25.1 | 25.4 | Std. Dev. |

## STANDING LONG JUMP (CM) — BOYS

| Percentiles | Age | | | | | | | | | Percentiles |
|---|---|---|---|---|---|---|---|---|---|---|
| | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | |
| 95 | 147.0 | 154.5 | 165.0 | 174.5 | 180.0 | 193.5 | 209.0 | 217.0 | 229.0 | 95 |
| 90 | 141.5 | 148.5 | 157.5 | 168.0 | 174.5 | 182.5 | 199.5 | 210.0 | 220.5 | 90 |
| 85 | 138.0 | 145.0 | 152.5 | 164.5 | 171.5 | 178.0 | 194.0 | 204.0 | 216.5 | 85 |
| 80 | 135.0 | 141.5 | 149.5 | 161.0 | 168.0 | 173.5 | 188.5 | 198.0 | 210.5 | 80 |
| 75 | 131.0 | 139.0 | 146.0 | 156.5 | 165.0 | 169.0 | 185.5 | 195.0 | 208.0 | 75 |
| 70 | 129.0 | 136.5 | 144.5 | 154.5 | 162.5 | 165.5 | 183.0 | 192.0 | 204.5 | 70 |
| 65 | 126.5 | 134.0 | 142.0 | 152.0 | 160.0 | 163.5 | 180.0 | 190.0 | 201.0 | 65 |
| 60 | 125.0 | 131.0 | 140.0 | 150.0 | 157.0 | 161.0 | 178.0 | 186.5 | 198.0 | 60 |
| 55 | 122.5 | 129.0 | 138.0 | 147.5 | 155.0 | 159.0 | 175.5 | 183.0 | 195.0 | 55 |
| 50 | 120.5 | 127.0 | 136.0 | 146.0 | 151.0 | 156.0 | 172.0 | 180.0 | 191.5 | 50 |
| 45 | 117.5 | 125.0 | 134.5 | 143.0 | 148.5 | 154.0 | 169.0 | 177.0 | 189.0 | 45 |
| 40 | 116.0 | 123.0 | 132.0 | 141.0 | 146.0 | 152.5 | 166.0 | 174.0 | 185.0 | 40 |
| 35 | 112.5 | 120.5 | 130.5 | 139.5 | 144.0 | 149.0 | 163.0 | 172.0 | 182.5 | 35 |
| 30 | 111.5 | 117.5 | 127.0 | 136.5 | 141.5 | 146.5 | 160.5 | 169.0 | 180.0 | 30 |
| 25 | 109.0 | 115.0 | 124.5 | 134.5 | 138.5 | 143.5 | 156.0 | 165.5 | 176.5 | 25 |
| 20 | 105.0 | 111.0 | 120.5 | 132.0 | 135.5 | 141.0 | 152.0 | 161.0 | 173.0 | 20 |
| 15 | 101.0 | 109.0 | 116.5 | 129.5 | 131.5 | 137.0 | 149.0 | 157.5 | 170.0 | 15 |
| 10 | 96.0 | 102.0 | 112.0 | 126.5 | 126.0 | 133.0 | 143.5 | 152.0 | 164.0 | 10 |
| 5 | 90.0 | 95.0 | 106.0 | 114.5 | 117.5 | 122.0 | 136.0 | 145.0 | 154.0 | 5 |
| Mean | 119.5 | 126.3 | 135.1 | 145.5 | 151.0 | 156.3 | 170.0 | 180.0 | 191.1 | Mean |
| Std. Dev. | 17.7 | 18.2 | 19.1 | 18.5 | 19.6 | 22.4 | 26.8 | 23.8 | 26.0 | Std. Dev. |

## STANDING LONG JUMP (CM) — GIRLS

| Percentiles | Age | | | | | | | | | Percentiles |
|---|---|---|---|---|---|---|---|---|---|---|
| | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | |
| 95 | 135.0 | 148.5 | 158.0 | 165.0 | 177.5 | 183.5 | 184.0 | 188.0 | 191.5 | 95 |
| 90 | 129.0 | 140.5 | 150.5 | 159.0 | 170.0 | 176.0 | 176.0 | 182.5 | 183.5 | 90 |
| 85 | 125.0 | 137.5 | 147.5 | 154.0 | 166.5 | 169.0 | 172.5 | 178.5 | 177.5 | 85 |
| 80 | 121.0 | 135.0 | 143.5 | 150.5 | 160.5 | 165.0 | 170.0 | 173.5 | 175.0 | 80 |
| 75 | 119.0 | 132.0 | 140.0 | 147.5 | 156.0 | 161.0 | 166.0 | 171.5 | 171.0 | 75 |
| 70 | 116.0 | 129.0 | 138.5 | 145.5 | 154.0 | 158.5 | 163.5 | 168.0 | 166.0 | 70 |
| 65 | 114.0 | 128.0 | 134.0 | 143.0 | 151.0 | 156.0 | 160.0 | 165.5 | 163.5 | 65 |
| 60 | 110.5 | 125.5 | 132.0 | 141.0 | 148.0 | 153.5 | 157.5 | 162.0 | 161.5 | 60 |
| 55 | 108.5 | 122.0 | 130.0 | 137.5 | 144.0 | 151.0 | 155.5 | 160.0 | 159.5 | 55 |
| 50 | 106.0 | 120.0 | 126.5 | 135.5 | 140.5 | 150.0 | 153.0 | 156.5 | 155.5 | 50 |
| 45 | 104.0 | 117.0 | 125.0 | 134.0 | 139.0 | 147.5 | 150.5 | 153.5 | 152.0 | 45 |
| 40 | 101.5 | 115.0 | 122.5 | 132.0 | 137.0 | 145.5 | 149.0 | 150.0 | 150.0 | 40 |
| 35 | 98.5 | 112.0 | 120.0 | 130.0 | 134.0 | 142.0 | 146.5 | 148.0 | 147.0 | 35 |
| 30 | 96.0 | 110.0 | 117.0 | 127.0 | 132.0 | 140.0 | 143.5 | 146.0 | 143.0 | 30 |
| 25 | 94.0 | 107.0 | 114.5 | 124.0 | 130.0 | 135.5 | 138.5 | 144.0 | 141.5 | 25 |
| 20 | 91.0 | 103.0 | 111.5 | 120.0 | 126.0 | 131.0 | 132.0 | 140.5 | 138.5 | 20 |
| 15 | 89.0 | 101.0 | 109.0 | 116.0 | 122.0 | 126.0 | 126.5 | 137.0 | 132.0 | 15 |
| 10 | 83.5 | 96.0 | 103.0 | 110.0 | 119.0 | 120.5 | 124.0 | 134.0 | 128.5 | 10 |
| 5 | 80.0 | 89.0 | 97.0 | 101.0 | 111.5 | 112.5 | 117.5 | 120.5 | 121.0 | 5 |
| Mean | 105.9 | 119.2 | 127.4 | 135.2 | 142.5 | 148.3 | 152.0 | 155.8 | 153.7 | Mean |
| Std. Dev. | 18.3 | 18.1 | 18.7 | 19.2 | 22.1 | 21.6 | 20.4 | 22.8 | 26.6 | Std. Dev. |

PUSH-UPS — BOYS

| Percentiles | Age | | | | | | | | | Percentiles |
|---|---|---|---|---|---|---|---|---|---|---|
| | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | |
| 95 | 20 | 21 | 20 | 23 | 23 | 23 | 24 | 26 | 27 | 95 |
| 90 | 18 | 20 | 19 | 21 | 21 | 21 | 22 | 24 | 25 | 90 |
| 85 | 17 | 18 | 18 | 20 | 20 | 20 | 20 | 23 | 24 | 85 |
| 80 | 16 | 17 | 17 | 19 | 19 | 19 | 20 | 22 | 23 | 80 |
| 75 | 15 | 16 | 16 | 18 | 18 | 18 | 19 | 21 | 22 | 75 |
| 70 | 15 | 16 | 16 | 17 | 17 | 17 | 18 | 20 | 21 | 70 |
| 65 | 14 | 15 | 15 | 17 | 17 | 16 | 17 | 19 | 20 | 65 |
| 60 | 14 | 15 | 15 | 16 | 16 | 16 | 17 | 19 | 20 | 60 |
| 55 | 13 | 14 | 14 | 15 | 15 | 15 | 16 | 18 | 19 | 55 |
| 50 | 13 | 14 | 14 | 15 | 14 | 14 | 16 | 17 | 18 | 50 |
| 45 | 12 | 13 | 13 | 14 | 14 | 14 | 15 | 16 | 18 | 45 |
| 40 | 12 | 12 | 12 | 14 | 13 | 13 | 15 | 16 | 17 | 40 |
| 35 | 11 | 12 | 12 | 13 | 12 | 13 | 14 | 15 | 17 | 35 |
| 30 | 11 | 11 | 11 | 13 | 12 | 12 | 13 | 15 | 16 | 30 |
| 25 | 10 | 11 | 11 | 12 | 12 | 11 | 13 | 14 | 15 | 25 |
| 20 | 10 | 10 | 10 | 11 | 11 | 11 | 12 | 13 | 14 | 20 |
| 15 | 10 | 10 | 10 | 11 | 9 | 10 | 11 | 13 | 13 | 15 |
| 10 | 8 | 9 | 7 | 9 | 6 | 9 | 10 | 11 | 12 | 10 |
| 5 | 5 | 6 | 3 | 6 | 3 | 4 | 8 | 10 | 10 | 5 |
| Mean | 12.7 | 13.7 | 13.3 | 14.9 | 14.1 | 14.4 | 15.7 | 17.4 | 18.4 | Mean |
| Std. Dev. | 4.2 | 4.7 | 4.8 | 5.0 | 5.6 | 5.3 | 5.1 | 5.1 | 5.5 | Std. Dev. |

PUSH-UPS — GIRLS

| Percentiles | Age | | | | | | | | | Percentiles |
|---|---|---|---|---|---|---|---|---|---|---|
| | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | |
| 95 | 18 | 19 | 18 | 18 | 19 | 19 | 18 | 19 | 18 | 95 |
| 90 | 16 | 17 | 17 | 16 | 17 | 16 | 16 | 17 | 15 | 90 |
| 85 | 15 | 16 | 16 | 15 | 15 | 15 | 15 | 15 | 14 | 85 |
| 80 | 14 | 15 | 15 | 15 | 14 | 14 | 14 | 14 | 13 | 80 |
| 75 | 13 | 15 | 14 | 14 | 14 | 13 | 13 | 13 | 12 | 75 |
| 70 | 13 | 14 | 13 | 14 | 13 | 12 | 12 | 12 | 11 | 70 |
| 65 | 12 | 13 | 13 | 13 | 12 | 12 | 12 | 12 | 11 | 65 |
| 60 | 12 | 13 | 12 | 13 | 12 | 11 | 11 | 11 | 10 | 60 |
| 55 | 12 | 12 | 12 | 12 | 11 | 11 | 11 | 11 | 10 | 55 |
| 50 | 11 | 12 | 11 | 12 | 10 | 10 | 10 | 11 | 7 | 50 |
| 45 | 11 | 11 | 11 | 11 | 10 | 10 | 10 | 10 | 5 | 45 |
| 40 | 10 | 11 | 10 | 11 | 10 | 8 | 8 | 10 | 3 | 40 |
| 35 | 10 | 10 | 10 | 10 | 8 | 6 | 5 | 10 | 1 | 35 |
| 30 | 9 | 10 | 9 | 9 | 6 | 4 | 3 | 8 | 1 | 30 |
| 25 | 7 | 8 | 7 | 7 | 4 | 2 | 1 | 5 | 0 | 25 |
| 20 | 6 | 7 | 4 | 5 | 2 | 1 | 0 | 2 | 0 | 20 |
| 15 | 4 | 5 | 2 | 4 | 1 | 0 | 0 | 1 | 0 | 15 |
| 10 | 2 | 2 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 10 |
| 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 |
| Mean | 10.2 | 11.2 | 10.3 | 10.6 | 9.4 | 9.0 | 8.3 | 9.6 | 7.0 | Mean |
| Std. Dev. | 5.1 | 5.4 | 5.5 | 5.4 | 6.2 | 6.7 | 6.2 | 6.0 | 6.3 | Std. Dev. |

## 50 M RUN (SEC) — BOYS

| Percentiles | Age | | | | | | | | | Percentiles |
|---|---|---|---|---|---|---|---|---|---|---|
| | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | |
| 95 | 9.03 | 8.63 | 8.35 | 8.03 | 7.90 | 7.70 | 7.48 | 7.12 | 7.04 | 95 |
| 90 | 9.30 | 8.86 | 8.50 | 8.18 | 8.02 | 7.92 | 7.60 | 7.31 | 7.18 | 90 |
| 85 | 9.47 | 9.03 | 8.68 | 8.33 | 8.15 | 8.04 | 7.73 | 7.45 | 7.24 | 85 |
| 80 | 9.65 | 9.18 | 8.79 | 8.46 | 8.28 | 8.13 | 7.85 | 7.57 | 7.30 | 80 |
| 75 | 9.76 | 9.30 | 8.92 | 8.57 | 8.36 | 8.23 | 7.91 | 7.62 | 7.37 | 75 |
| 70 | 9.87 | 9.42 | 9.04 | 8.64 | 8.52 | 8.30 | 8.00 | 7.68 | 7.43 | 70 |
| 65 | 9.97 | 9.50 | 9.12 | 8.70 | 8.59 | 8.40 | 8.08 | 7.75 | 7.49 | 65 |
| 60 | 10.04 | 9.58 | 9.20 | 8.79 | 8.66 | 8.49 | 8.14 | 7.85 | 7.56 | 60 |
| 55 | 10.14 | 9.64 | 9.27 | 8.86 | 8.73 | 8.57 | 8.22 | 7.94 | 7.61 | 55 |
| 50 | 10.24 | 9.71 | 9.35 | 8.93 | 8.82 | 8.65 | 8.31 | 8.01 | 7.68 | 50 |
| 45 | 10.40 | 9.81 | 9.45 | 8.97 | 8.91 | 8.71 | 8.40 | 8.07 | 7.78 | 45 |
| 40 | 10.51 | 9.89 | 9.55 | 9.06 | 9.00 | 8.80 | 8.50 | 8.14 | 7.89 | 40 |
| 35 | 10.61 | 9.97 | 9.62 | 9.17 | 9.07 | 8.90 | 8.57 | 8.26 | 7.95 | 35 |
| 30 | 10.71 | 10.10 | 9.71 | 9.27 | 9.19 | 9.01 | 8.67 | 8.40 | 8.06 | 30 |
| 25 | 10.83 | 10.26 | 9.82 | 9.39 | 9.30 | 9.10 | 8.78 | 8.52 | 8.15 | 25 |
| 20 | 10.98 | 10.37 | 9.97 | 9.47 | 9.40 | 9.29 | 8.88 | 8.62 | 8.21 | 20 |
| 15 | 11.17 | 10.64 | 10.10 | 9.70 | 9.57 | 9.46 | 9.04 | 8.75 | 8.38 | 15 |
| 10 | 11.50 | 10.84 | 10.34 | 9.93 | 10.00 | 9.62 | 9.34 | 8.92 | 8.48 | 10 |
| 5 | 11.96 | 11.20 | 10.63 | 10.33 | 10.43 | 10.03 | 9.74 | 9.32 | 8.89 | 5 |
| Mean | 10.03 | 9.58 | 9.29 | 8.98 | 8.87 | 8.68 | 8.28 | 8.05 | 7.66 | Mean |
| Std. Dev. | 1.96 | 1.65 | 1.27 | 0.92 | 1.08 | 1.00 | 1.27 | 0.98 | 1.16 | Std. Dev. |

## 50 M RUN (SEC) — GIRLS

| Percentiles | Age | | | | | | | | | Percentiles |
|---|---|---|---|---|---|---|---|---|---|---|
| | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | |
| 95 | 9.51 | 8.93 | 8.59 | 8.30 | 8.10 | 7.91 | 7.84 | 7.82 | 7.70 | 95 |
| 90 | 9.84 | 9.19 | 8.76 | 8.50 | 8.29 | 8.14 | 8.00 | 7.92 | 7.89 | 90 |
| 85 | 10.01 | 9.33 | 8.94 | 8.64 | 8.44 | 8.25 | 8.10 | 8.06 | 8.02 | 85 |
| 80 | 10.10 | 9.47 | 9.08 | 8.77 | 8.57 | 8.37 | 8.21 | 8.18 | 8.18 | 80 |
| 75 | 10.24 | 9.56 | 9.19 | 8.90 | 8.67 | 8.47 | 8.33 | 8.24 | 8.30 | 75 |
| 70 | 10.33 | 9.67 | 9.28 | 8.97 | 8.80 | 8.58 | 8.43 | 8.31 | 8.40 | 70 |
| 65 | 10.47 | 9.78 | 9.37 | 9.09 | 8.87 | 8.66 | 8.53 | 8.38 | 8.47 | 65 |
| 60 | 10.58 | 9.87 | 9.48 | 9.20 | 8.97 | 8.74 | 8.60 | 8.46 | 8.55 | 60 |
| 55 | 10.68 | 10.00 | 9.57 | 9.29 | 9.07 | 8.82 | 8.72 | 8.57 | 8.64 | 55 |
| 50 | 10.77 | 10.12 | 9.67 | 9.34 | 9.14 | 8.91 | 8.80 | 8.65 | 8.70 | 50 |
| 45 | 10.89 | 10.25 | 9.78 | 9.44 | 9.23 | 9.00 | 8.86 | 8.70 | 8.80 | 45 |
| 40 | 10.96 | 10.38 | 9.91 | 9.53 | 9.32 | 9.10 | 8.96 | 8.82 | 8.89 | 40 |
| 35 | 11.09 | 10.48 | 10.07 | 9.60 | 9.44 | 9.18 | 9.07 | 8.92 | 9.00 | 35 |
| 30 | 11.25 | 10.61 | 10.20 | 9.69 | 9.56 | 9.26 | 9.16 | 8.99 | 9.09 | 30 |
| 25 | 11.44 | 10.71 | 10.32 | 9.87 | 9.67 | 9.34 | 9.30 | 9.10 | 9.17 | 25 |
| 20 | 11.54 | 10.89 | 10.47 | 10.02 | 9.77 | 9.49 | 9.46 | 9.24 | 9.30 | 20 |
| 15 | 11.74 | 11.10 | 10.64 | 10.19 | 9.95 | 9.60 | 9.64 | 9.34 | 9.42 | 15 |
| 10 | 12.01 | 11.41 | 10.84 | 10.40 | 10.16 | 9.92 | 9.86 | 9.54 | 9.61 | 10 |
| 5 | 12.50 | 11.88 | 11.22 | 10.71 | 10.49 | 10.37 | 10.19 | 9.77 | 9.97 | 5 |
| Mean | 10.58 | 9.98 | 9.64 | 9.31 | 9.17 | 8.89 | 8.76 | 8.53 | 8.51 | Mean |
| Std. Dev. | 1.92 | 1.75 | 1.44 | 1.21 | 0.97 | 1.09 | 1.23 | 1.41 | 1.65 | Std. Dev. |

## 1.6 KM RUN (MIN:SEC) — BOYS

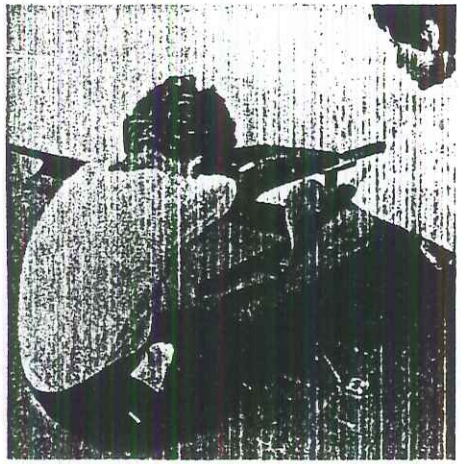
| Percentiles | Age | | | | | | | | | Percentiles |
|---|---|---|---|---|---|---|---|---|---|---|
| | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | |
| 95 | 7:50 | 7:22 | 7:01 | 6:49 | 6:40 | 6:34 | 6:16 | 6:05 | 6:05 | 95 |
| 90 | 8:08 | 7:40 | 7:16 | 7:02 | 6:51 | 6:47 | 6:32 | 6:19 | 6:17 | 90 |
| 85 | 8:22 | 7:49 | 7:26 | 7:12 | 7:00 | 6:58 | 6:43 | 6:28 | 6:22 | 85 |
| 80 | 8:35 | 7:59 | 7:36 | 7:18 | 7:10 | 7:04 | 6:50 | 6:35 | 6:30 | 80 |
| 75 | 8:46 | 8:09 | 7:49 | 7:28 | 7:18 | 7:12 | 6:56 | 6:43 | 6:35 | 75 |
| 70 | 8:59 | 8:19 | 7:57 | 7:34 | 7:24 | 7:18 | 7:02 | 6:49 | 6:41 | 70 |
| 65 | 9:07 | 8:32 | 8:05 | 7:42 | 7:33 | 7:26 | 7:10 | 6:56 | 6:47 | 65 |
| 60 | 9:17 | 8:40 | 8:13 | 7:49 | 7:41 | 7:34 | 7:19 | 7:02 | 6:53 | 60 |
| 55 | 9:27 | 8:47 | 8:21 | 7:55 | 7:49 | 7:43 | 7:25 | 7:12 | 6:59 | 55 |
| 50 | 9:45 | 8:57 | 8:33 | 8:01 | 7:59 | 7:50 | 7:35 | 7:18 | 7:03 | 50 |
| 45 | 9:55 | 9:09 | 8:43 | 8:09 | 8:06 | 7:57 | 7:44 | 7:25 | 7:08 | 45 |
| 40 | 10:06 | 9:20 | 8:55 | 8:18 | 8:14 | 8:14 | 7:54 | 7:33 | 7:16 | 40 |
| 35 | 10:22 | 9:31 | 9:03 | 8:30 | 8:27 | 8:20 | 8:05 | 7:39 | 7.22 | 35 |
| 30 | 10:35 | 9:54 | 9:21 | 8:42 | 8:41 | 8:28 | 8:14 | 7:49 | 7:34 | 30 |
| 25 | 10:49 | 10:08 | 9:35 | 8:53 | 8:52 | 8:40 | 8:25 | 8:01 | 7:49 | 25 |
| 20 | 11:08 | 10:28 | 9:48 | 9:14 | 9:10 | 8:59 | 8:42 | 8:20 | 8:02 | 20 |
| 15 | 11:34 | 10:54 | 10:13 | 9:32 | 9:35 | 9:23 | 9:04 | 8:42 | 8:17 | 15 |
| 10 | 12:08 | 11:35 | 11:00 | 10:04 | 10:12 | 9:59 | 9:34 | 9:11 | 8:41 | 10 |
| 5 | 12:53 | 12:48 | 12:00 | 11:03 | 11:29 | 10:57 | 10:40 | 9:46 | 9:40 | 5 |
| Mean | 9:29 | 9:07 | 8:42 | 8:14 | 8:15 | 8:03 | 7:42 | 7:25 | 7:10 | Mean |
| Std. Dev. | 2:35 | 2:15 | 2:04 | 1:45 | 1:49 | 1:43 | 1:47 | 1:28 | 1:44 | Std. Dev. |

## 1.6 KM RUN (MIN:SEC) — GIRLS

| Percentiles | Age | | | | | | | | | Percentiles |
|---|---|---|---|---|---|---|---|---|---|---|
| | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | |
| 95 | 8:51 | 8:24 | 7:58 | 7:48 | 7:43 | 7:34 | 7:29 | 7:30 | 7:30 | 95 |
| 90 | 9:19 | 8:43 | 8:20 | 8:03 | 7:58 | 7:50 | 7:51 | 7:42 | 7:53 | 90 |
| 85 | 9:33 | 8:56 | 8:37 | 8:25 | 8:11 | 8:05 | 8:05 | 7:56 | 8:08 | 85 |
| 80 | 9:54 | 9:12 | 8:53 | 8:38 | 8:22 | 8:17 | 8:21 | 8:09 | 8:21 | 80 |
| 75 | 10:05 | 9:24 | 9:03 | 8:48 | 8:36 | 8:26 | 8:30 | 8:20 | 8:36 | 75 |
| 70 | 10:19 | 9:33 | 9:15 | 8:57 | 8:46 | 8:32 | 8:38 | 8:36 | 8:50 | 70 |
| 65 | 10:37 | 9:43 | 9:24 | 9:08 | 8:52 | 8:45 | 8:49 | 8:47 | 9:00 | 65 |
| 60 | 10:59 | 9:57 | 9:35 | 9:17 | 9:05 | 8:53 | 9:02 | 8:55 | 9:11 | 60 |
| 55 | 11:09 | 10:07 | 9:45 | 9:29 | 9:21 | 9:06 | 9:14 | 9:06 | 9:24 | 55 |
| 50 | 11:20 | 10:21 | 9:59 | 9:42 | 9:34 | 9:18 | 9:24 | 9:19 | 9:39 | 50 |
| 45 | 11:32 | 10:32 | 10:15 | 9:51 | 9:47 | 9:31 | 9:37 | 9:28 | 9:48 | 45 |
| 40 | 11:44 | 10:46 | 10:26 | 10:04 | 9:59 | 9:45 | 9:47 | 9:37 | 9:59 | 40 |
| 35 | 11:56 | 11:02 | 10:42 | 10:13 | 10:15 | 10:02 | 9:55 | 9:48 | 10:13 | 35 |
| 30 | 12:08 | 11:21 | 10:56 | 10:34 | 10:30 | 10:17 | 10:10 | 10:05 | 10:27 | 30 |
| 25 | 12:26 | 11:35 | 11:14 | 10:51 | 10:52 | 10:34 | 10:25 | 10:17 | 10:43 | 25 |
| 20 | 12:49 | 11:53 | 11:35 | 11:06 | 11:07 | 10:55 | 10:40 | 10:33 | 10:58 | 20 |
| 15 | 13:09 | 12:29 | 11:55 | 11:27 | 11:29 | 11:22 | 11:08 | 11:01 | 11:20 | 15 |
| 10 | 13:42 | 13:01 | 12:20 | 12:02 | 12:11 | 11:48 | 11:31 | 11:32 | 11:47 | 10 |
| 5 | 14:50 | 13:40 | 13:14 | 12:56 | 12:45 | 12:30 | 12:27 | 12:23 | 12:16 | 5 |
| Mean | 11:00 | 10:16 | 9:55 | 9:37 | 9:37 | 9:24 | 9:11 | 8:56 | 9:04 | Mean |
| Std. Dev. | 2:53 | 2:35 | 2:36 | 2:24 | 2:27 | 2:10 | 2:27 | 2:39 | 3:05 | Std. Dev. |

# FITNESS MEASURES

## SIT AND REACH



### Equipment

Sit and reach box. A metric ruler may be needed for a small number of students with excellent flexibility. See diagram in Appendix G for the design and construction of a sit and reach box.

### Preparation

Set up the sit and reach box against a wall, or solid object, so that it is not able to move.

### Dress Requirements

Students are to be bare-footed.

### Test Procedures

Seat the student, bare-footed, with the soles of both feet flat against the front of the box. The legs must be straight and the back of the knees flat on the floor. The student is to place one hand beside the other so that the finger tips are level and reach forward, without jerking, as far as possible and hold for three seconds.

Have the student stretch forward with head down, place your hand on the student's knees to be sure they do not bend. Count three seconds to yourself then read the distance reached at the level of the finger-tips.

The measure of flexibility is read to the nearest complete centimetre reached, always rounding to the lower score. If students reach beyond their toes the score is positive; if they do not reach the level of the toes the score is recorded as negative.

Allow all students two warm-up attempts and then two trials. The score is the better of the two trials.

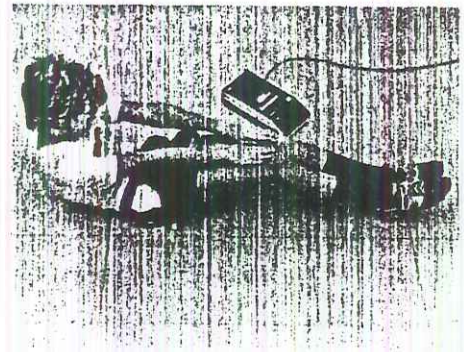
### Points to watch

Make sure there is no jerking in the movement, that the finger-tips remain level, and that the legs remain flat. Should the correct technique not be used, repeat the test.

Take particular care to record whether the score is positive or negative.



## SIT-UPS



### Equipment

Tape recorder, tape of cadence and 140 degree protractor (an elbow of plywood cut to this angle). The cadence required is one sit-up cycle every three seconds, one second to curl-up, one second holding the curl-up position and one second to lower to the floor.

### Preparation

Have a level floor area on which to do this test. Use a gymnasium mat if available or a carpeted area. If neither of the above are available use the bare floor.

### Dress Requirements

Shoes must be on.

### Test Procedures

Have the student lie on the floor with knees bent to 140 degrees and heels on the ground. Use the protractor to check that the correct angle is obtained.

The student is to place the hands, with fingers extended, on the front of the thighs and curl the trunk upward until the finger-tips reach the level of the patella. This position is to be held for one second before returning slowly to the starting position with the back of the head touching the ground. The test continues for five minutes, to a maximum of 100 sit-ups.

The student must keep both heels on the ground at all times and both arms straight throughout the test. A cadence of 20 sit-ups per minute must be maintained. Watch to see that technique is satisfactory. Any lifting of the feet, going beyond the level of the knee with the hands, jerking or failing to keep time will mean the test is stopped. Record the number of correctly executed sit-ups.

### Points to watch

Make sure the angle at the knee does not alter and that the head touches the floor between each sit-up.

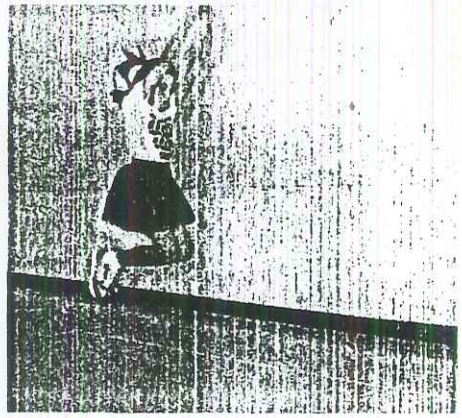
Students should be encouraged to shut their eyes while performing the test so they concentrate on their technique rather than competing with the students on either side of them.



Appendix B

Testing Protocols From The Australian Schools Fitness Test (Pyke, 1986. p.22-28)

# STANDING LONG JUMP



## Equipment

Measuring tape, masking tape or chalk, 3 m non-slip gymnastic mat.

## Preparation

Fix the measuring tape to the floor, or gym mat, using masking tape and mark the starting line with either the tape or chalk. A grassed area can be used if no suitable indoor space is available.

## Dress Requirements

Shoes should be on to prevent jarring on landing.

## Test Procedures

The student stands with the toes behind the line and with the feet slightly apart. A two-foot take-off and landing is to be used. The student should swing the arms and bend the knees to provide drive.

Use masking tape to mark the landing point at the closest part of the heel to the starting line. Place a ruler from the marked landing point at right angles to the measuring tape and read the measurement where the ruler crosses the tape. Record the score in completed centimetres.

Should the student fall back the trial is void and another trial should be given.

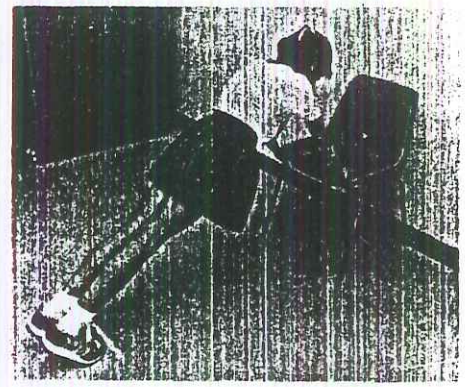
Allow each student two trials with the best to count. With younger children it is useful to provide support on landing to give confidence.

## Points to watch

Ensure one foot does not step at the take-off. If this occurs, allow another trial.



# PUSH-UPS



## Equipment

A standard 46 cm chair, stopwatch, chalk or masking tape.

## Preparation

Place the chair against a wall.

## Dress Requirements

The student's shoes are to be on to allow for the best grip. If shoes slip on the floor surface then bare feet can be used.

## Test Procedures

To mark the position for the feet, the student lies, face up, with the soles of both feet in line with the front of the chair seat. Mark a line on the floor at the level of the elbows.

Have the student stand behind this line and reach forward to place both hands, shoulder width apart, on the front edge of the chair.

Make sure the body and legs are in a straight line with the arms extended and at an angle of approximately 90 degrees to the body.

On the command to start, the student does as many push-ups as possible in a period of 30 seconds.

For a push-up to be counted the students must lower themselves until their chest touches the front edge of the chair and then raise themselves until their arms are straight. It is important that the body is kept in a straight line throughout. Count the number of completed push-ups aloud.

If a push-up is not completed satisfactorily, tell the student why and repeat the previous number until another correctly performed action occurs.

## Points to watch

Make certain that the chest touches the chair and that the arms are returned to the fully extended position for each push-up.

# 50 m RUN

## Equipment

50 m tape, as many stopwatches as timekeepers, finish line, starting pistol or wood blocks for starting, coloured bibs or bands for identification of runners, witch's hats or flags.

## Preparation

Measure a straight, level, 50 m track at right angles to the wind direction. Mark the start and finish with flags or witch's hats. Allow as many lanes as there are timekeepers.

## Dress Requirements

Shoes on.

## Test Procedures

Students run in small groups with as many runners as there are timekeepers and stopwatches available.

It is necessary to give the group a thorough warm-up with stretching for thighs, groin and calves and some light jogging prior to testing.

The students are to start from behind the starting line in a standing position. There will be only one trial, so the students should be instructed to do their best and run as fast as possible until well past the finish line.

Give the command 'READY', wait until they are all steady and signal the start. The time is measured to the nearest 1/100th of a second.

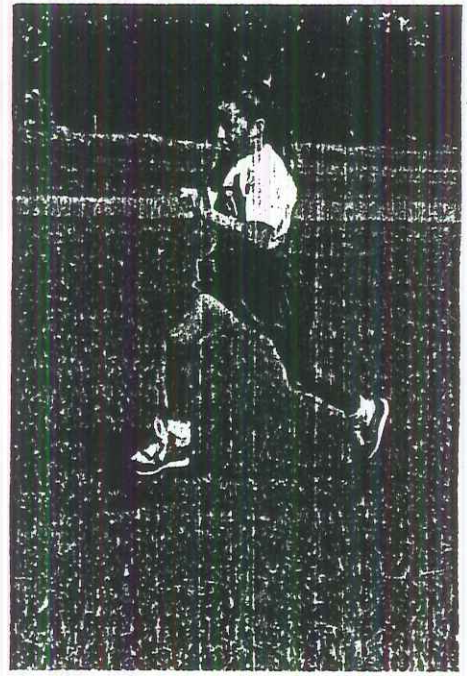


group and the timing using the starting pistol or blocks. A score sheet (see Appendix B) is to be used to check off the number of laps completed by each student. The use of numbered coloured bibs will help in this procedure if the students are not familiar to the timekeepers.

The timekeepers ensure that each student in their group completes the required number of laps, and record their times as they finish. Give the students several minutes of 'cooling down' by having them continue walking and deep breathing.



# 1.6 km RUN



## Equipment

Stopwatch for each timekeeper, line-marker or 20 witch's hats or flags, coloured bibs, starting pistol or blocks.

## Preparation

If the school does not have an accurate 400 m track then mark a level grassed area with a circle of 31.8 m radius. This will give a circle of 200 m circumference needing 8 laps to complete 1.6 km. The easiest method is to fix a tape of the required length with a stake in the centre of the area and walk in a circle marking the circumference with a line-marker. If using witch's hats or flags, they should be placed at frequent intervals to ensure that the students run the full distance. Spraying the correct location of the markers with coloured paint will save remeasurement.

## Dress Requirements

The students should wear shoes.

## Test Procedures

Divide the class to be tested into as many groups as there are timekeepers. It is useful to select students of varying endurance ability in each group so that several students do not finish together. Should this occur, call out the times as they pass the finish and have them return immediately so that their time can be recorded. Each group should commence and finish the run from a different point on the circle.

All students should be told the number of laps to be completed and that the technique best employed for running the distance is to maintain a steady pace for the start and middle of the distance. They are then able to increase speed at the end of the distance if they still feel comfortable and have the endurance available. Walking is permitted should it be required, however they should attempt to run the entire distance.

Have one person in a central position to act as starter for the class. Start the whole

## Appendix C

### Letter Requesting Permission from the Principal to Conduct Research at Hilton Primary School

1 March 1990

Unit 6
72 Waddell Road
Bicton WA 6157

Principal
Hilton Primary School
Rennie Cres. North
Hilton WA 6163

Dear Mr Clifton,

I wish to apply for permission to conduct research within your school. The research involves conducting the Australian Schools Fitness Test on all children aged seven to twelve.

The results of my research will be used to assess the fitness levels of these children and compare the results against Australian norms developed in 1985 by the Australian Council for Health, Physical Education and Recreation. This will enable the development of an appropriate Physical Education Programme within the school as a part of the School Development Plan. All results will remain completely confidential with no names being used in the final report.

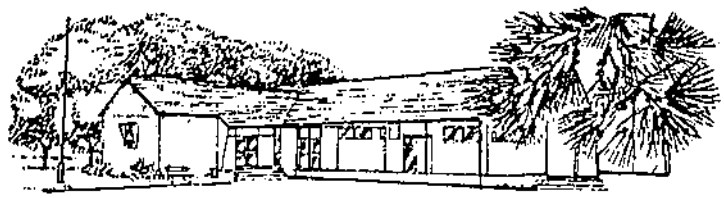
The research is to be conducted as a component of a Bachelor of Education with Honours.

Yours sincerely,

Sue McCarrey.

## Appendix D

## Letter from the Principal Granting Permission to Conduct Research at Hilton Primary School



HILTON
PRIMARY SCHOOL
NORTH RENNIE CRESCENT
HILTON 6163
TELEPHONE: 337 1006

To whom it may concern,

PERMISSION TO CONDUCT RESEARCH AT HILTON PRIMARY

Miss Sue McCarrey has been given permission to conduct research into the physical fitness of children enrolled at Hilton Primary School.

This work will be incorporated into the Mangagement Information System of the School Development Plan so that an evaluation of the effect of the Physical Education programme at Hilton can be made each year.

The work will enable us to establish a baseline of fitness levels for comparison in future years.

Yours faithfully

G.J.Clifton
Principal
2.3.90

## Appendix E

### Letter to Parents Outlining the Research to be Conducted

June 14 1990

Dear Parents,

As part of my Physical Education Programme, I am collecting information on the skill and fitness levels of all children attending Hilton Primary School. As part of this I will be conducting a fitness test to all children aged between 7 and 12 on Wednesday June 27th or Friday June 29th in the event of bad weather.

The fitness test I will be using has been specifically designed by the Australian Council for Health, Physical Education and Recreation for school children of this age. It will not involve blood tests or any other medical procedure. The test involves the following six simple activities:

1. Sit and Reach
2. Safe Sit-ups
3. Standing Long Jump
4. Safe Push-ups
5. 50 metre sprint
6. 1.6 kilometre run/walk (children can walk if they need).

**On the testing day the children will need to:**

* **Wear sport skirt / shorts and shirt. (Tracksuit over the top)**

* **Wear gym shoes, sandshoes or sneakers.**

* **NOT do any exercise on the morning of testing.**

The test results will also be used as part of my research for an Honours Degree. No child's name will be used in my research and all results are totally confidential.

If there is any medical reason why your child should not be involved, please don't hesitate to contact me.

Sue McCarrey
Physical Education Specialist
Hilton Primary School

## Appendix F

### Student Record Form used During Application of The Australian Schools Fitness Test

AUSTRALIAN SCHOOLS FITNESS TEST - STUDENT RECORD FORM

IDENTIFICATION NUMBER - _____

AGE (IN YEARS) - _____

SEX (M / F) - _____

DATE OF BIRTH - _____/_____/_____

| | | |
|---|---|---|
| SIT AND REACH | _____ | cm. |
| SIT-UPS | _____ | (number completed) |
| STANDING LONG JUMP | _____ | cm. |
| PUSH-UPS | _____ | (number completed) |
| 50m RUN | _____ | seconds |
| 1.6km RUN | _____ | minutes:seconds |

# Appendix G

## Overall Data Sheet

## For the Presentation of Data for Statistical Analysis

---

### AUSTRALIAN SCHOOLS FITNESS TEST - OVERALL DATA FORM

CODES: MALE 1
FEMALE 2

| | |
|---|---|
| SIT AND REACH TEST | 1 |
| SIT-UP TEST | 2 |
| STANDING LONG JUMP | 3 |
| PUSH-UP TEST | 4 |
| 50m RUN | 5 |
| 1.6km RUN | 6 |

---

| | VARIABLES | | TESTS | | | | | |
|---|---|---|---|---|---|---|---|---|
| I.D. NUMBER | AGE 7-12 | SEX 1/2 | 1 | 2 | 3 | 4 | 5 | 6 |
| 001 | 9 | 2 | 12 | 49 | 130 | 17 | 9.30 | 9.32 |
| 002 | 9 | 1 | 08 | 36 | 156 | 05 | 6.07 | 9.57 |

Appendix H

Hilton Primary School Physical Education

Performance Indicators

# 4. SUBJECT STUDENT OUTCOMES

## 4.1 PHYSICAL EDUCATION (an area of Health)

Related School Performance Indicators

1. A POSITIVE ATTITUDE TO THEMSELVES, OTHERS AND THE WIDER COMMUNITY.

9. A CONCERN FOR AND AN UNDERSTANDING OF HOW TO ACHIEVE PHYSICAL AND EMOTIONAL HEALTH AND WELL-BEING

The student will:

1. develop physical skills which will enable participation in a wide variety of activities;

2. develop physical fitness and soundly functioning body systems for an active life in his/her environment;

3. develop knowledge and understanding of physical and social skills, physical fitness and scientific principles of movement;

4. develop an understanding of the relationship of exercise to personal well-being;

5. develop social skills which promote acceptable standards of behaviour and positive relationships with others;

6. develop attitudes and appreciations that will encourage participation in and enjoyment of physical activity, fitness, quality performance, a positive self-concept and respect for others.

Appendix I

Hilton Primary School Physical Education

Student Outcomes

# PHYSICAL EDUCATION PERFORMANCE CRITERIA

## Student Outcomes

Developed by : Sue McCarrey (Hilton Primary School)

### *YEARS 1 / 2 / 3*

GENERAL

1. Enjoys all aspects of Physical Education.
2. Participates fully in all areas of Physical Education.
3. Responds promptly to signals and instructions.
4. Works cooperatively in small and large groups.
5. Demonstrates qualities of sportsmanship.
6. Is aware of personal performance.

FITNESS

7. Has developed a sound level of fitness.
8. Displays a positive attitude towards regular physical activity.
9. Understands the importance of physical fitness.

GYMNASTICS

10. Understands and uses free space.
11. Moves in space without colliding.
12. Balances on a variety of body parts.
13. Performs controlled body movements.

DANCE

14. Responds to a variety of rhythmic stimuli.
15. Explores and controls rhythmic movement.
16. Able to build a simple dance sequence.
17. Uses movement in a variety of inventive and expressive ways.

GAMES SKILLS

18. Uses both sides of the body.
19. Is aware of and uses various body parts.
20. Able to throw and catch a bean bag.
21. Able to throw and catch small, medium and large balls.
22. Throws accurately at a target.
23. Can kick a ball.
24. Can hit a ball with the hand.
25. Demonstrates basic athletic skills.

### *YEAR 4 / 5*

GENERAL

1. Enjoys all aspects of Physical Education.
2. Participates fully in all areas of Physical Education.
3. Responds promptly to signals and instructions.
4. Works cooperatively in small and large groups.
5. Demonstrates qualities of sportsmanship.
6. Is aware of personal performance.

FITNESS

7. Has developed a sound level of fitness.
8. Displays a positive attitude towards regular physical activity.
9. Understands the importance of physical fitness.

GYMNASTICS

10. Performs controlled body movements.
11. Balances on a variety of body parts and apparatus.
12. Demonstrates effective use of small equipment and apparatus.

DANCE

13. Displays skills and knowledge of modern, social and cultural dances.
14. Invents dances of their own.
15. Observes and appreciates the dance of others.
16. Uses movement in a variety of inventive and expressive ways.

GAMES SKILLS

17. Uses both sides of the body.
18. Can throw accurately overarm.
19. Can throw accurately underarm.
20. Can throw a chest pass accurately.
21. Catches a ball.
22. Can dribble a ball on both sides of the body.
23. Has eye / foot coordination (kicking).
24. Can hit a ball with a bat / racquet.
25. Demonstrates appropriate athletic skills.

### *YEAR 6 / 7*

GENERAL

1. Enjoys all aspects of Physical Education.
2. Participates fully in all areas of Physical Education.
3. Responds promptly to signals and instructions.
4. Works cooperatively in small and large groups.
5. Demonstrates qualities of sportsmanship.
6. Is aware of personal performance.

FITNESS

7. Has developed a sound level of fitness.
8. Displays a positive attitude towards regular physical activity.
9. Understands the importance of physical fitness.

GYMNASTICS

10. Performs controlled body movements both on and off apparatus.
11. Balances on a variety of body parts and apparatus.
12. Demonstrates effective use of small equipment and apparatus.

DANCE

13. Displays skills and knowledge of modern, social and cultural dances.
14. Invents dances of their own.
15. Observes and appreciates the dance of others.
16. Uses movement in a variety of inventive and expressive ways.
17. Improves the quality and style of their dance performance.

GAMES SKILLS

18. Uses both sides of the body.
19. Catches a ball.
20. Catches with a softball mitt.
21. Throws accurately using a small ball.
22. Throws accurately using a large ball.
23. Demonstrates correct batting techniques.
24. Demonstrates fielding skills.
25. Demonstrates understanding of field places and rules of games.
26. Demonstrates appropriate athletic skills.

# Appendix J

## Extracts from the Hilton Primary School Priority Schools Programme 1991 and 1992

# PROJECT SUBMISSION 1991

GOAL : THE STUDENT WILL DEVELOP SKILLS AND ATTITUDE NECESSARY TO PURSUE AN ACTIVE AND HEALTHY LIFESTYLE

PROJECT TITLE : FITNESS TRACK/PLAYGROUND
SEXUALITY EDUCATION

PROJECT DIRECTORS: SUE MCCARREY
SUE MCCARREY

| OBJECTIVES | SUCCESS INDICATORS<br>MONITORING | OPERATION | SUPPORT | COST |
|---|---|---|---|---|
| 3.1<br><br>The student will develop sound attitudes towards personal nutrition and physical health | INDICATORS<br>. the fitness level of all children<br>. motor coordination of all children<br><br>MONITORING<br>. fitness survey based on 1990 data.<br>. coordination survey. | FITNESS TRACK/PLAYGROUND<br><br>As part of the classroom daily fitness routine, it is necessary to establish a proper daily fitness track.<br><br>Daily fitness using the varied activities of the syllabus has been an on-going priority at Hilton Primary.<br><br>In combining the equipment structure with existing playground facilities, the proposed track will have a joint use. | Purchase of fitness track equipment. | $1,500 |
| 3.1<br><br>The student will develop sound attitudes towards personal nutrition and physical health | INDICATORS<br><br>The extent to which students<br>. have knowledge of the reproductive functions<br>. clarify their values regarding sexual relationships<br><br>MONITORING<br><br>. Teacher observation<br>. Issues raised by chn | SEXUALITY EDUCATION<br><br>The physical education teacher will conduct lessons throughout the school on sexuality education based on syllabus guidelines.<br><br>Staff will be in-serviced on this aspect of the health syllabus so that follow-up can occur across the curriculum.<br><br>Parents will be invited to seminars on sexuality education. | Inservice of staff<br><br>Children's texts<br>Teacher texts<br>Videos<br>Parent inservice | N.F.R.<br><br>$954 |
| 3.1 Nutrition | | Canteen review of nutritious meals | TOTAL THIS PAGE: | $2,454 |

# PROJECT SUBMISSION 1992

**GOAL** The student will develop skills and attitude necessary to pursue an active and healthy life style.

**PROJECT TITLE** Fitness Track Programme. **PROJECT DIRECTOR(S)** Sue McCarrey

| OBJECTIVES<br>What do we hope the students achieve ? | SUCCESS INDICATORS<br>How will we know the extent to which objectives are being achieved ?<br>MONITORING<br>What information shall we collect ? | OPERATION<br>How will we achieve the objective ? | SUPPORT<br>What will we need to make it work ? | $$ |
|---|---|---|---|---|
| 3.1 The student will develop sound attitudes towards personal nutrition and physical health. | Success Indicators.<br>The extend to which students –<br>. fitness levels are raised.,<br>. display improved motor co-ordination,<br>. display a positive attitude to personal fitness.<br><br>Monitoring.<br>. Physical Education Specialist's records.<br>. Class teachers observations of children's attitudes to fitness. | Fitness Track/Playground<br>As part of the classroom daily fitness routine, it is necessary to maintain a proper daily fitness track.<br><br>Daily fitness using the varied activities of the syllabus has been an on-going priority at Hilton Primary. | Maintenance only of fitness track | $100 |

# PSP REVIEW - HILTON PRIMARY SCHOOL - 1992

**PROJECT TITLE:** FITNESS TRACK PROGRAMME **PROJECT DIRECTOR:** SUE MCCARREY

**OBJECTIVE:** THE STUDENT WILL DEVELOP SOUND ATTITUDES TOWARDS PERSONAL NUTRITION AND PHYSICAL HEALTH

| SUCCESS INDICATORS | AREAS OF CONCERN | RECOMMENDATIONS |
|---|---|---|
| What were some indicators of the objectives being achieved? | What are some of the aspects of the project that were a concern? | What are some of your recommendations for the way the projects will operate in the future? |
| A whole school fitness test was conducted in 1990 prior to the commencement of the Fitness Programme. Results were compared against Australian Norms developed in 1985.<br><br>Testing in November of 1991 indicated an increase in the level of children's overall fitness.<br><br>Selective testing will occur again in November 1992.<br><br>Children are displaying a more positive attitude towards regular physical activity.<br><br>Skill assessment indicates an improvement in general and specific motor skill. | Whole school fitness testing is extremely time consuming and takes 3 weeks out of the Physical Education Programme.<br><br>Timetabling of the Fitness Programme was adjusted to remove fitness from the early morning maximum learning time.<br><br>An extremely wet winter. | Fitness track will only need maintenance which could be covered in the School Budget, therefore, no PSP funding is required.<br><br>Fitness Programme will need to continue to maintain children's level of fitness and positive attitudes.<br><br>Fitness testing will be random selective testing rather than whole school testing. |

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