THE EFFECTS OF AN INDIVIDUALIZED SELF-MONITORED EXERCISE PROGRAM ON HEALTH RELATED PHYSICAL FITNESS AMONG FOURTH GRADE STUDENTS

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CHAPTER I

INTRODUCTION

A growing concern of the nation is the physical fitness of its citizens. Evidence linking a sedentary lifestyle to coronary heart disease (CHD), obesity, and other prevalent health problems is rapidly mounting (U.S. Department of Health & Human Services [DHHS], 1992). While adult physical fitness has been a main focus for many decades, more recent concerns have been about the lack of fitness among children (Simons-Morton, Parcel, O'Hara, Blair, & Pate, 1988). A growing body of evidence indicated that American children are not physically fit, which has negative implications for their future good health (Simons-Morton, O'Hara, Simons-Morton, & Parcel, 1987). Several factors may contribute to this phenomena including the following: the lack of positive parental role models; an inappropriate focus in school physical education programs; inadequate time apportioned for physical education classes; and, values and attitudes among children not consistent with the desire to participate in moderate to vigorous physical activity (MVPA).

To reverse these trends, the need for intervention at

an early age is paramount. Previous projects and programs initiated to increase physical fitness among children have achieved some success (Butcher, et al., 1988; Duncan, Boyce, Itami, & Puffenbarger, 1983; Werner & Durham, 1988). However, none have individualized the fitness program to address the specific physiological needs of the individual and interests of the child. Failure to individualize the physical fitness program may discourage the continuation of children in physical activities and inhibit the establishment of more permanent lifestyle behavioral changes which include appropriate physical activity.

Since the landmark Kraus-Weber finding of 1953 which concluded that nearly 60% of American youth failed to meet minimal physical fitness standards compared with a failure rate of 9% of European youth, few changes have been initiated to reverse this status (Buchanan, 1989). Two major government documents issued by the U.S. Surgeon General, Promoting Health/Preventing Disease: Objectives for the Nation (U.S. DHHS, 1980) and Healthy People 2000 (U.S. DHHS, 1992), targeted the development of physical fitness and the promotion of increased exercise in children and youth. The leading medical and professional organizations promoting physical fitness joined in this concern when they declared that American youth are not fit (Simons Raithel, 1988). Three major national studies addressing this issue confirmed that American children are

not physically fit (The National Children and Youth Fitness Study, 1985; The National Children and Youth Fitness Study II, 1987; President's Council on Physical Fitness and Sports School Population Fitness Survey, 1985). Noteworthy was a definite trend in increased body fat among children over the past twenty years (Ross, Pate, Lohman, & Christenson, 1987).

The lack of physical fitness among children is particularly distressing when viewed from the standpoint of its relationship to long-term health. Cardiovascular disease (CVD), cancer, obesity, and diabetes may all be precipitated by a sedentary lifestyle. These diseases are manifested over a lifetime with root causes often initiated in childhood (American College of Sports Medicine [ACSM], 1988; Corbin & Lindsey, 1985; Simons-Morton, B., O'Hara, & Simons-Morton, D., 1986).

Particularly important is the development of health related physical fitness which includes the components of cardiorespiratory endurance, strength, muscular endurance, flexibility, and body composition. The improvement of these aspects has great potential for enhancing individual health and reducing the risk of chronic disease (Corbin & Lindsey, 1985).

The United States DHHS has identified the school program as the primary vehicle by which children can be taught to develop health related physical fitness with the assumption that at least 95% of the nation's youth attend

schools for an extended period of time (Lee, Carter & Greenockle, 1987; Simons-Morton et al., 1987). Further, it would seem apparent the school physical education program should implement appropriate activities for the procurement of health related physical fitness. However, Simons-Morton et al. (1987) found that students within the physical education setting did not engage in MVPA to an extent sufficient to develop fitness. Additionally, time allotted to most physical education programs was inadequate to meet minimal requirements in the prescription of exercise established by the ACSM (1991).

Although parents have a significant impact on children at a young age, fewer than 30% of the parents of first through fourth grade students had been found to be participating in moderate to vigorous exercise to a level that would meet minimum requirements for physical fitness (ACSM, 1991; Buchanan, 1989). Where direct role models for promoting fitness in the home are lacking, the only alternative for many in initiating positive change may be the school program.

Lack of appropriate parental role models and insufficient physical education classes for the general population contributed to poor physical fitness in children. Added complications existed when the needs and interests of individual students were ignored. Even with a heightened awareness and increased participation in physical activity,

a high incidence of drop-out within six months of initiating activity has been reported (Rutherford, Corbin & Chase, 1992). Therefore, for children it is essential that appropriate activity for the development of health related fitness be matched with individual interests. Numerous sources highlighted the need for children to engage in enjoyable MVPA (ACSM, 1988). Several studies attempted to raise the level of appropriate physical activity in children (Duncan et al., 1983; Parcel, Simons-Morton, O'Hara, Baranowski, & Wilson, 1989), but none addressed the issue of individual needs and interests.

In view of these findings, it is obvious that the need is substantial for improved physical fitness among America's youth. Specifically, health related physical fitness or those aspects of fitness that pertain to daily life should be developed (Corbin & Lindsey, 1988). While other programs have attempted to increase the level of physical fitness among children (Butcher et al.,1988; Duncan, et al., 1983; Parcel, et al., 1989), no provisions were made to incorporate the child's individual interest. This shortcoming warrants study of an individualized program which addresses the unique physiological needs of the person, and that could be conducted outside of the limited school physical education class program. Such a program could serve as an alternative means for the procurement and retainment of physical fitness for elementary aged students

as a supplement to the instructional school program. The rationale of this study was to provide the means for accessing students to such a viable alternative.

Statement of the Problem

The purpose of this study was to determine the effects of an eight week individualized self-monitored exercise program on selected physiological measurements of fourth grade students. The specific parameters investigated include cardiorespiratory endurance, muscular strength and endurance, flexibility, and body composition.

Hypotheses

This study dealt specifically with the following hypotheses, and significance was accepted at the 0.05 level of confidence:

1. There will be no significant difference in the gain score measurements of cardiorespiratory endurance at the end of eight weeks for fourth grade subjects completing the experimental treatment and those who are in the control group.

2. There will be no significant difference in the gain score measurements of muscular endurance and strength at the end of eight weeks for fourth grade subjects completing the experimental treatment and those who are in the control group.

3. There will be no significant difference in the gain score measurements of flexibility at the end of eight weeks for fourth grade subjects completing the experimental treatment and those who are in the control group.

4. There will be no significant difference in the gain score measurements of percentage of body fat at the end of eight weeks for fourth grade subjects completing the experimental treatment and those who are in the control group.

Limitations

This study was subject to the following limitations:

1. No attempt was made to control the dietary influences on the measured physiological variables.

2. No attempt was made to control the strong peer influence among the 9 to 11 year-old fourth grade subjects of the study that might affect compliance or non-compliance to the treatment phase of the program.

3. No attempt was made to monitor the physical activity of the control group.

Delimitations

The delimitations of this study were:

1. The subjects were delimited to 53 male and 54 female fourth grade respondents between the ages of 9 to 11 who volunteered to participate in the study and who received

parent/guardian approval.

2. The physiological measurements evaluated were delimited to cardiorespiratory endurance, muscular strength and endurance, flexibility, and percentage body fat.

3. Only healthy, non-impaired respondents were used as subjects.

4. Compliance of the treatment program was based on student self report.

Assumptions

This study was based on the following assumptions:

1. It was assumed the self reported record keeping of the participants' exercise was accurate.

2. It was assumed the experimental subjects reached the desired level of intensity during the aerobic phase of the exercise program.

3. It was assumed any changes in the participants' diets were negligible.

Definition of Terms

The following conceptual definitions were used in this study:

Aerobic Exercise. Work which requires the heart to beat more rapidly, causing more oxygen to travel through the body and which must be accomplished in the presence of oxygen.

Body composition. The relative percentage of fat to lean tissue of which the body is composed.

Cardiorespiratory Endurance. The ability of the heart, blood vessels, blood, and respiratory system to supply fuel, especially oxygen, to the muscles during sustained exercise.

Cardiovascular Disease. Diseases which affect the heart and vascular passageways such as stroke and hypertension.

Coronary Heart Disease. Diseases affecting the heart which include hypertension (high blood pressure), atherosclerosis, arteriosclerosis, coronary occlusion, angina pectoris, and congestive heart failure.

Exercise. A subset of physical activity that is planned, structured, repetitive, and has as a final or an intermediate objective the improvement or maintenance of physical fitness.

Flexibility. The functional range of motion about a joint. It is affected by muscle length, joint structure, and other factors.

Health Related Physical Fitness. Those components of physical fitness which have a direct relationship to good health and a lessened risk of hypokinetic disease including: cardiorespiratory endurance, body composition, flexibility, muscular endurance, and strength.

Moderate to Vigorous Physical Activity. Aerobic exercise of at least 10 to 20 minutes that is continuous or

with occasional breaks in intensity.

Muscular Endurance. The ability of the muscle(s) to repeatedly contract at some sub-maximal level.

Muscular Strength. The ability of the muscle(s) to exert a force during a single, maximal contraction.

Physical Activity. Any bodily movement produced by skeletal muscles that results in energy expenditure that can be measured in kilocalories. Physical activity in daily life can be categorized into occupational, sports, conditioning, household, or other activities.

Physical Education. That aspect of the curriculum which helps each individual reach his/her fullest intellectual, physical, and social potential through the medium of physical activities.

Risk Factor. Any of the elements that increase the risk of hypokinetic diseases or conditions.

CHAPTER II

REVIEW OF THE LITERATURE

The design of a individualized self-monitored exercise program for children which will enhance health related physical fitness involves many interrelated factors. Previous research focused on the health related physical fitness aspects of adults; however, an increasing number of studies now involve children. To address the specific issues of this study, the review of the literature will include the following nine categories: 1) physical fitness status of children; 2) relationship of physical activity with health and health related physical fitness; 3) physical activity patterns among children; 4) assessment of health related physical fitness; 5) exercise physiology of children; 6) training effects of exercise on children; 7) existing exercise programs for children; 8) self-monitoring of physical activity; and 9) psychological factors affecting children's participation in physical activity.

Physical Fitness Status of Children

A growing body of information proclaims American youth are not physically fit (Kuntzleman & Reiff, 1992; Reiff et

al., 1985; Ross & Gilbert, 1985; Ross & Pate, 1987; Simons-Morton et al., 1987; Simons-Morton et al., 1988; Updyke & Willett, 1989). Studies with a national scope concerning fitness among children began in the 1950's and have continued into the 1990's. A historical review of youth fitness in America revealed distress about the level of fitness since the colonial period. However, it was not until 1953 that the landmark Kraus-Weber test brought national attention to the status of youth physical fitness. The results revealed that 57.9% of American children failed the tests compared with only an 8.7% failure rate for Austrian, Italian, and Swiss children (AAHPER, 1958; Reiff, et al., 1986). The startling test results prompted the American Association for Health, Physical Education, and Recreation (AAHPER) to conduct the first Youth Fitness Test (YFT) on a national basis in 1958. The 1958 AAHPER YFT items focused on motor performance such as the standing broad jump, shuttle run, 50-yard dash, softball throw for distance, and the 600-yard run. It also included health related tests for strength utilizing pull-ups for boys, modified pull-ups for girls, and sit-ups for both genders (Simons-Morton et al., 1988; Reiff, 1986). In 1965 and again in 1975 the President's Council on Physical Fitness and Sports (PCPFS) joined with the American Alliance for Health, Physical Education, Recreation, and Dance (AAHPERD) to conduct a revised AAHPERD YFT using a national

convenience sample. The results disclosed that the fitness status of children has remained low (Duncan et al., 1983; Reiff, et al., 1986).

Philosophical evolvement of health and physical education professions toward a health related physical fitness emphasis gave impetus to the AAHPERD Health Related Physical Fitness Test (HRPFT) which was released in 1980 (Ross & Gilbert, 1985). This test was developed in cooperation with the PCPFS and adopted by the federal government for students seeking to meet the "President's Challenge". The results of the 1985 AAHPERD HRPFT in 1985 by the PCPFS and AAHPERD found an undesirable level of physical fitness among children (U.S. DHHS, 1986).

To date the most comprehensive studies concerning the physical fitness status of children on the national level are the National Children and Youth Fitness Study (NCYFS) of 1984 and NCYFS II, which followed in 1986. These studies were conducted under the auspices of the Public Health Service, using a national probability sample of children in grades 5-12 and 1-4 respectively, to determine physical activity patterns and fitness status among children of ages 10-17 and 6-9 (Ross & Gilbert, 1985).

Contrary to other studies, the NCYFS reported that as boys reach the older teens some components of their health related physical fitness improved as evidenced by their ability to complete more sit-ups and chin-ups, stretch

farther, and have less body fat than when they were younger. Boys' performance on the one-mile walk/run indicated a decline at age 17. The NCYFS showed that girls' abdominal strength and flexibility improved with age while upper body strength remained consistently low throughout the age span from 10-17. Performance in the one-mile walk/run for girls peaks around age 14, then declines, and eventually levels off in the older teens. Body fat in girls increases until age 15 after which time the increase slows (Ross & Gilbert, 1985).

NCYFS II developed performance norms highly accurate at each fifth percentile for the health related physical fitness tests items for ages 6-9. Due to test protocol, procedures, sample selection, and other factors, only percent body fat could be compared with previous studies. The results showed a significant increase in body fat over the last twenty or more years (Ross, Pate, Delpy, Gold & Svilar, 1987).

Both the NCYFS and the NCYFS II developed national, population-based norms by age and sex for each aspect of health related physical fitness. These norms are not criterion-referenced standards which would indicate an acceptable level of functional capacity, and which also reflects a minimized risk for developing diseases associated with low physical fitness. However, the norms do represent a description of the current fitness status of the

population, provide the basis for tracking change over time, and are useful in comparing subgroups or individuals with the population at large (Ross, Pate, Delpy, Gold, & Svilar, 1987). The researchers' only conclusion was that American youth today have increased in fatness when compared with youth of previous generations.

A publication by the Department of Health and Human Services on behalf of the PCPFS, [1990] in regard to the fitness status of American youth, stated the following:

- Youth fitness in the U.S. has not improved in the last decade and in some cases has declined.
- Approximately 50% of girls ages 6-17 and 30% of boys ages 6-12 cannot run a mile in less than 10 minutes.
- 55% of girls ages 6-17 and 25% of boys ages 6-12 cannot do one pull-up.
- American children have become fatter since the 1960s.
- 40% of children ages 5-8 already show at least one heart disease risk factor (i.e. obesity, physical inactivity, elevated cholesterol, high blood pressure).
- Only 36% of America's school children in grades 1-12 are enrolled in daily physical education (U.S. DHHS, [1990], p. 4).

Simons-Morton et al. (1988) employed an operational

definition of physical fitness and methods of assessment when addressing the level of physical fitness among American children. These authors supported the position of a health related focus toward fitness as opposed to the more traditional motor performance interpretation. In an extensive review of previous research, Simons-Morton et al. (1988) reported that children's cardiorespiratory fitness over the last 40 years included Vo_{2max} values between 45 and 60 $ml \cdot min^{-1} \cdot kg^{-1}$. These values were significantly higher than those for most adults, yet data were lacking that allowed the description of how these were distributed within the general population or as cross-generational comparisons for youth fitness. Further, definitive conclusions cannot be reached on how health fitness of American children has changed over preceding decades. Contrary to these findings, other studies concluded that children are not receiving appropriate activity in physical education classes which promote development of cardiorespiratory fitness. Additionally, there was evidence that children are spending more time in sedentary activities and have become fatter than counterparts of twenty or more years ago (Groves, 1988b; Raithel, 1988; Simons-Morton et al., 1988).

The 1985 PCPFS National School Population Fitness Survey [NSPFS] (Reiff et al. 1986) tested a national probability sample of 18,857 public school children, ages 6-17. Participants were randomly administered six tests from

a battery of nine tests to determine physical fitness level. The tests emphasized health related physical fitness, but also included some skill related fitness components. Comparisons were made with many of the AAHPERD YFT items of the 1958, 1965, and 1975 national surveys. The following conclusions were made: 1) The physical performance of children and youth in 1985 remained at the low level exhibited by counterparts tested in 1975. 2) Although mean performance scores remained essentially the same from 1975 to 1985, a larger percentage of both boys and girls scored lower than the 50th and the 25th percentiles on the test items in 1985 than in 1975. Particularly noteworthy was the low level of performance by large numbers of boys and girls on cardiorespiratory endurance tests. 3) With the exception of trunk flexibility, girls declined or did not continue to improve in their performance after age 14. 4) Boys' performance in trunk flexibility was at a level of increased risk for the development of back problems. 5) Upper arm and shoulder muscle girdle strength and endurance for both boys and girls remained a significant weakness (Reiff et al., 1986).

In another national study, sponsored by Chrysler and the Amateur Athletic Union (AAU), Updyke and Willett (1989) collected data from over four million school children, ages 6 to 17, in over 10,000 public and private volunteer schools annually for the 10 year period between 1980 and 1989. The

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tests included a series of distance runs, sprints, long jumps, high jumps, sit-ups, push-ups and pull-ups. Although the basic standards were designed to be attainable by the average healthy participant in each age and sex group, only 43% of the respondents were able to achieve the minimal level during 1980-1981 (Updyke, 1982). An annual decline of both boys and girls in aerobic fitness level, as measured by age appropriate distance runs, occurred from 1980 to 1989. This represented a total decrease of approximately 10% (Updyke & Willett, 1989). These findings supported the results from the three AAHPERD Youth Fitness Tests that the majority of children are not physically fit (Reiff et al., 1986).

Challenging this viewpoint of declining physical fitness among children and youth is the more recent work of Corbin and Pangrazi (1992). Using criterion-referenced health standards from FITNESSGRAM (Institute for Aerobics Research, 1987) and AAHPERD Physical Best (AAHPERD, 1988), a re-examination of the 1985 NSPFS data found little evidence that children and youth are less fit than they were in previous decades. Even though a higher percentage of children and youth were judged to have achieved a passing score in cardiovascular fitness using criterion-referenced standards, Corbin and Pangrazi concluded there are still many children whose level of fitness in this area was too low.

The analyses by Corbin and Pangrazi (1992) of the 1985 PCPFS data did not include skinfolds for the determination of body composition. It has been proven by others that this variable has increased in children and youth over the last twenty years (Ross, Pate, Lohman, & Christenson, 1987). Vogel (1991) and Giel (1988) stated 15% to 25% of today's children are obese or at least 30% overweight. Kuntzleman and Reiff (1992) reported that statistics from 1976 to 1980 indicated a 54% increase in the prevalence of obesity (triceps skinfolds at the 85%) among children 6-11 years-old and a 98% increase in the prevalence of superobesity (triceps skinfolds at the 95%). For the same age group, Simmons Raithel (1988) reported 54% and 94% increases in obesity and superobesity respectively, from 1963 to 1980.

With the decline in the physical fitness of children and youth, there is evidence that girls are even less fit than boys (Simmons Raithel, 1987). The national studies on physical fitness that addressed the gender issue (NCYFS, NCYFS II, and 1985 National School Population Fitness Survey) all found that girls performed more poorly at all ages, 6-17, except for flexibility (Ross & Gilbert, 1985; Ross & Pate, 1987; Reiff et al., 1986). Further, when Looney and Plowman (1990) analyzed the NCYFS and NCYFS II data base using FITNESSGRAM criterion-referenced standards (CRS) for health related physical fitness, there was a discrepancy in the passing rate between boys and girls of

75% and 50% respectively for four of the five components. While inherent biological differences among the sexes may not make it fair to compare, a finding from the PCPFS survey showed the performance of girls generally declined between 1975 and 1985, while the performance of boys generally stayed the same. This would indeed suggest that girls may be less fit than boys (Simmons Raithel, 1987).

Relationship of Physical Activity to Health and Health Related Fitness

The relationship found between regular participation in MVPA and positive health outcomes, especially cardiovascular disease (CVD) risk reduction, was substantial (Simons-Morton et al., 1988). It is now known that the roots of degenerative diseases, such as atherosclerosis, begin in childhood (Powell, Thompson, Caspersen, & Kendrick, 1987; Ross & Pate, 1987). Some studies claimed 40% of today's children already showed evidence of early signs of CHD (Vogel, 1991). Others (Reiff et al., 1986) maintained that 50% of those in grades K-3 demonstrated symptoms of risk factors for CHD.

However, participation in a regular exercise regimen was one of the best ways of lowering risk and reducing the incidence of such diseases for both children and adults (Powell et al., 1987; Ross & Pate, 1987; Simons-Morton et al., 1987). The 1992 government report, Healthy People

2000: National Health Promotions and Disease Prevention Objectives, stated, "Regular physical activity can help to prevent and manage coronary heart disease, hypertension, noninsulin-dependent diabetes mellitus, osteoporosis, obesity, and mental health problems (e.g., depression, anxiety)...lower rates of colon cancer and stroke and may be linked to reduced back injury" (U.S. DHHS, 1992, p. 94).

According to Sallis (1987), without intervention CHD risk factors prevail over time and can result in CHD. A review of studies by Sallis (1987) documented the tracking, or the tendency for children to maintain their ranking of a CHD risk variable over time. This included the CHD risk factors of high levels of blood pressure, serum cholesterol, lipoprotein, and obesity found present in children. Other studies suggested that physical activity in children is inversely associated with other CHD risk factors such as blood pressure, serum lipoprotein (except high density lipoprotein [HDL]), and obesity (Montoye, 1985; Simons-Morton et al., 1987; Simons-Morton et al., 1990). In addition to supporting these findings, Kuntzleman and Reiff (1992) found significant differences with the improvement of HDL/total cholesterol ratio, triglyceride levels, skinfolds, and both systolic and diastolic blood pressures when the fitness levels of children improved.

Recent evidence of the well documented link between appropriate exercise and positive health suggested a dose-

response relationship between the amount of physical activity and CHD risk reduction (Simons-Morton et al., 1988; Tell & Vellar, 1988; Paffenbarger & Hyde, 1984; and Powell et al., 1987). Particularly meaningful is the increasing evidence that suggests light to moderate physical activity can have significant health benefits, including a decreased risk of CHD. To the inactive individual, an intensity of exercise set below that which is necessary to attain cardiorespiratory fitness is more readily adopted and maintained than vigorous physical activity (U.S. DHHS, 1992). To elaborate on the more specific findings of the dose-response relationship between the amount of physical activity and CHD is a review of the work of Tell and Vellar (1988).

Tell and Vellar (1988) studied the aerobic fitness level, resting pulse rate, self-reported physical activity, and prevalence of CVD risk factors in a population-based study of 785 youth ages 10 to 14 in Oslo, Norway. They found that for both genders, fitness level was significantly and inversely related to body weight, body mass index [weight in kilos/(height in meters)^2], triceps skinfolds thickness, systolic and diastolic blood pressure, and pulse rate, and positively related to high-density lipoprotein/total cholesterol ratio and physical activity. Other findings showed that the fitness level was positively related to high-density lipoprotein cholesterol and

negatively related to triglycerides in females; it was also negatively related to height, total cholesterol, and hematocrit in males. Students in the lowest quartiles of Vo_{2max} had significantly higher body mass index and triceps skinfolds thickness, as well as significantly higher blood pressure and pulse rate. In contrast, higher levels of Vo_{2max} in females were associated with a more favorable lipid profile. A gender-specific multiple regression analysis found triceps skinfolds thickness to be the strongest predictor of Vo_{2max}, followed by pulse rate. In conclusion, the study provided evidence that frequent participation in vigorous physical activity enhances cardiovascular fitness, and may be of benefit in the reduction of future CVD risk.

The symbiotic relationship between increased physical activity and health also appeared to exist with physical activity and physical fitness. NCYFS II results indicated that children who performed better on the mile walk/run participated more frequently in community-based activities, watched less television, were rated by their parents and teachers as more physically active, and received their physical education instruction from a specialist. Children whose body composition is leaner also participated in more community-based physical activities, watched less television, and were rated by teachers and parents as more physically active. Of particular importance was the finding that the parents of leaner children were more active and

exercised more frequently with their children (Pate & Ross, 1987).

The recurrent finding of increased fatness among children enumerated in the studies previously discussed was particularly alarming. Body fat among children is an important indicator of a child's health related physical fitness (Ross, Pate, Lohman, & Christenson, 1987). With an estimated 15% to 25% of school children in the United States obese, Giel stated, "...childhood obesity is, at minimum, a major public health problem" (Giel, 1988, pg. 145). Further documentation found the prevalence of obesity and superobesity (triceps skinfolds at the 85th and 95th percentile respectively) increased between 17% and 306% over the last two decades, depending on the age, sex, and race studied (Groves, 1988b). Moreover, Dr. Jules Hirsch, chairman for the National Institute of Health panel on "The Search for Health", said that obesity is a bona fide disease that kills (NIH Report, 1985; Groves, 1988b). The American College of Sports Medicine [ACSM] (1988) stated that obesity is an independent risk factor for the development of CVD, the number one cause of death in the United States (ACSM, 1988; U.S. DHHS, 1992). Simons-Morton et al. (1988) contend that obesity in children is the result of too little activity rather than too much food intake. William H. Dietz, MD, PhD, and author of a 1985 study examining the dose-response relationship of television viewing with

obesity concluded that each hourly increment of television viewing by adolescents was associated with a 2% increase in the prevalence of obesity. The prospective data collected showed that television viewing in preobese children was the most important predictive factor of determining who will become obese. Further, obese children are more likely to become obese adolescents and later obese adults, who suffer various life-threatening diseases including CHD, stroke, atherosclerosis, and diabetes (Groves, 1988b).

This trend in increased fatness as well as the high incidence of CHD risk factors among children illustrates the severity of the problem of too little appropriate physical activity. While the necessity for change from inactivity to increased activity exists, the means by which this task may be induced are quite complex.

Activity Patterns Among Children

The consensus of the literature was that most children did not engage in enough appropriate physical activity (Kuntzleman & Reiff, 1992; Looney & Plowman, 1990; U.S. DHHS, 1992; Simons-Morton et al., 1987; Simons-Morton et al., 1990; Vogel, 1991). Results from the NCYFS II strongly suggested that "physical education programs, out-of-school activity habits, and parental activity habits have a significant impact on cardiorespiratory endurance and body composition" (Pate & Ross, 1987, p. 46). Therefore, an

examination of these physical activity patterns in settings where children are most likely to engage in physical activity were reviewed. These settings included at school, out-of-school unstructured play, activity with family, or through a community recreation opportunity. In addition, the impact of parental or other social influences were included as well as the likeliness of children to change their existing activity pattern.

School Settings

The U.S. Department of Health and Human Services has identified the school program as the primary vehicle by which children can be taught how to develop health-related physical fitness (U.S. DHHS, 1980). As one of its objectives the 1992 government report, Healthy People 2000, sought an increase (to at least 50%) in the proportion of children and adolescents in grades 1-12 who would participate in daily school physical education. This was down-scaled from the 1980 objective (U.S. DHHS) for greater than 60% of the children and adolescents ages 10 to 17 to participate in daily school physical education programs. Also, the 1992 report sought to increase to at least 50% the proportion of class time spent in physical activity, preferably engaging in lifetime physical activities (U.S. DHHS, 1992).

In a close examination of school physical education

programs, NCYFS found 80.3% of students in grades 5-12 enrolled in physical education. Of this age group the highest percentage of participation in physical education occurred in grades 5 and 6, then declined with each successive grade. The average frequency of physical education class meetings was 3.6 times per week, with a range of one to five meetings per week. The duration of class length, after subtracting time spent in changing clothes and showering, ranged from 20 minutes to over an hour with an average length of 47 minutes. Generally, grades 5 and 6 reported the least amount of activity time (Ross, Dotson, Gilbert, & Katz, 1985). A key 1990 government objective (U.S. DHHS, 1980) stated the school-based program should expand activities beyond competitive sports. However, NCYFS found the direct opposite where, in their opinion, the focus of the physical education class activities was competitive sports. Further, the portion of the program dedicated to life-time activities, those which may be readily carried into adulthood, was only 47.6% (Ross, Dotson, Gilbert & Katz, 1985; Ross & Gilbert, 1985).

In a similar study of physical education programs in grades 1-4, the NCYFS II found the following: Enrollment in physical education classes overall was 97%. The average frequency for physical education class meetings was 3.1 times per week for an average of 33.4 minutes duration. Of the students in grades 1-4 enrolled in physical education,

83.1% received instruction with a specialist at least one day per week. As many as one-third of these teachers did not hold a valid certification and the standards met by the other two-thirds was unknown. The majority of primary aged students take physical education outside on the school grounds (52.4%). It would appear that some schools tend not to invest in a specialist or a gymnasium. Of significance was the sharp transition toward competitive team sports by grades 3 and 4. This trend opposes the recommendation by the government in Objectives for the Nation (1980) that aims for school based programs which embrace physical activities beyond competitive sports (Ross, Pate, Corbin, Delpy & Gold, 1987).

Parcel et al. (1987) directly observed 409 children in grades 3-5 from four elementary schools during physical education class and recess to determine the content of physical education classes, and the amount of MVPA children obtained during the two settings. The findings showed children spent a greater percentage of the available time moving at a higher exertion level during recess (72.8%) than during physical education (50.2%). Further analysis of class content in physical education revealed only 6.1% of the time was spent in aerobic-type fitness activities. This amounts to less than two minutes for the average 33 minute class. Parcel et al. contend it may not be sufficient to increase the number of children who participate in physical

education classes on a frequent basis without also concentrating on the extent and quality of MVPA during physical education.

Settings Outside of Physical Education

There is limited information regarding the physical activity of children in settings other than physical education. However, it appears the majority of the time children spend in physical pursuits occurs outside of school physical education programs (NCYFS, 1985; Simons-Morton et al., 1990). The most comprehensive data available comes from the NCYFS (1985) and the NCYFS II (1987).

By means of a self report survey (Ross, Dotson, Gilbert, & Katz, 1985a), children declared that over 80% of the time in which they are active occurs outside of physical education class. This translates to an average 760 minutes of activity outside of school weekly versus 141 minutes weekly in physical education for the 5th-12th grade student. Boys demonstrated 10% greater amount of time spent in physical activity than girls. Weekly physical activity declined without regard for gender after early adolescence and was lowest among students in grades 10-12. Of significance was the vast fluctuation of activity levels in association with the seasons. The summer rate for participation was 42% higher than the annual average for boys and 41% higher for girls. The rate of participation

for both genders dropped dramatically in the fall to the low in winter of only 47% of the summer level or 69% of the annual average.

The authors of NCYFS (Ross, Dotson, Gilbert & Katz, 1985d; Ross, Dotson, Gilbert & Katz, 1985a) concluded that students in 5th and 6th grades spend much less time in physical eduction than those in 7th-12th grades. Further, the physical activity of the younger students in the community and around the neighborhood fluctuated much more than older students. Youth also varied greatly in their dependency on community organizations, such as religious groups, private organizations, parks and recreation, and scouts, for their physical activity. While the majority of youth depend on these organizations for the pursuit of physical activity, it was significant to note that 18% do not participate in physical activity through any community organization (Ross, Dotson, Gilbert & Katz, 1985a). What was undetermined is whether this group, representing nearly one-fifth of the population for grades 5-12, had only physical education classes to challenge them physically. Given the focus and infrequent meeting of a large majority of physical education programs, it may be that a large segment of youth are already excluding physical activity from their lifestyle.

With younger children in grades 1-4, it was a more difficult task to survey the time spent in physical

activity. The reason, in part, is that children are not as aware of time, nor do they have as accurate an assessment of time. To ascertain the physical activity of this age group, parents were administered a survey regarding the types of activity and settings in which their child engaged in activity as well as their own parental exercise patterns. Among the more pertinent findings were: 1) parents rated their sons as being slightly more active than their same sex and age peers, but rated their daughters as average in their level of activity when compared with other girls of the same age; 2) on school days 72.3% of children in grades 1-4 watched from 0-2 hours of television, 27% watched 3-5 hours, and 0.7% viewed 6 or more hours per day. On weekends these values changed to 28.3%, 61%, and 10.8%, respectively. 3) Nearly two-thirds of first through fourth grade students were involved in public park and recreation department programs. Other community organizations that attracted this age group to participate in physical activity were: sports leagues and teams, (boys, 42.4% and girls, 20.4%); religious groups, (boys, 23.0% and girls, 25.5%); YMCA'S and YWCA'S, (boys, 14.5% and girls 13.4%); clubs and spas, (boys, 15.3% and girls, 22.9%); and Scouts, (boys, 11.7% and girls 17.7%) (Ross, Pate, Caspersen, Damberg & Svilar, 1987).

Simons-Morton et al. (1987) reviewed studies of children in which either percent participation in activity or minutes at certain heart rate ranges were reported or

could be calculated. Although the studies varied widely in purpose, methodology, and definition of MVPA, a cautious conclusion was that evidence did not support the hypothesis that the generally high level of children's fitness is due to frequent participation in MVPA. Cureton (1987) offered support for this conclusion in his review of a longitudinal study by Mirwald and Bailey of 3 to 12 year-old boys.

In a more recent study of the frequency of third and fourth grade children's participation in MVPA, some of the findings Simons-Morton et al. (1990) concluded were: 1) Greater numbers of moderate to vigorous physical activity longer than 10 minutes (LMVPAs) were reported before and after school than during school by boys, 1.6 times, and girls, 1.4 times. 2) Over a three-day period 35.6% of boys and girls reported fewer than one LMVPA daily, and 12.3% of boys and 13.3% of girls reported none. These findings were concluded despite participation in a daily 35-minute physical education program and 10-minute recess. A conclusion for this study indicated that many children do not obtain adequate amounts of physical activity.

Influence of Parents and Others

According to Sage (1986), the family is the first and perhaps the most important social environment for the child. Parents influence their children through their attitudes, self-participation, and encouragement of the child's

involvement in sport. Because parents exert such a tremendous influence on the attitudes of their offspring, it is necessary to review parental participation in physical activity.

A literature review by Sage (1986) found a positive relationship between parental encouragement with actual participation and sport involvement for either gender. In support of this conclusion were the findings by Dennison, Straus, Mellits, and Charney (1988). The study examined physically active and inactive adults and found currently active adults who were active as children had greater parental encouragement to exercise.

Sage reported on a survey of American families in 1983 by Miller Lite claiming that 40% of parents reported frequently engaging in physical activity with their children. This is in contrast to a more recent survey by NCYFS II stating that less than 30% of parents of first through fourth grade students are involved in appropriate physical activity during the week. This finding occurred even though parents of this age group are presumably younger and more active than adults generally (Ross, Pate, Caspersen, Damberg, & Svilar, 1987). Another finding by Caspersen et al. (1986) estimated that only 7.8% of adults engage in MVPA for 20 continuous minutes or more at least 3 days per week. Stephens, Jacobs, and White (1985) stated that only 20% of adults exercise at an intensity and

frequency appropriate for cardiovascular benefit while 40% are completely sedentary. NCYFS II found approximately 50% of parents of first through fourth grade students say they never obtain vigorous exercise (Ross, Pate, Caspersen, Damberg, & Svilar, 1987). Even among the low percentage of parents who were active, the statistical data from the NCYFS II showed that parents do not spend much time exercising with their children. This sends a strong message to the child about the parental value associated with exercise, and could contribute not only to the child's immediate physical activity level but their long-term adherence to exercise as well (Ross, Pate, Caspersen, Damberg, & Svilar, 1987).

According to Sage (1986), as the child matures and moves into adolescence peers have a more direct influence on the behavior of the individual's participation in physical activity. There is increasing evidence that the social influences on children's participation in sports, and to a lesser extent in exercise, plays a significant role. Lee, Carter, and Greenockle (1987) discussed the important influence of teachers and parents as good role models. Further, these adults should strive to instill more positive attitudes toward exercise and fitness in children at an early age.

Godin and Shephard (1984) found parents and teachers were unable to exert control over children's behavior in exercise. Students in grades 7-9 were surveyed regarding

their perceptions of the beliefs held by parents, teachers, and peers toward exercise. The impact these beliefs had on the subjects' motivation to comply with exercise was examined. Although students believed parents and especially teachers, and to a lesser extent peers, thought they should exercise, the findings suggested that students perceived a personal control of their behavior. Thus, they did not necessarily exercise just to comply.

Finally, of importance is the considerable difficulty reported in changing exercise habits. Many studies confirmed the resistance of children to structured programs of vigorous physical activity (Cureton, 1987; Greene & Adeyanju, 1991; Simons-Morton et al., 1987). Cureton (1987) reported that lower-intensity "lifestyle" exercise, with a variety of exercises performed at various times during the day, was more effective than "programmed" aerobic exercise with equal energy expenditure in one continuous high-intensity session for long-term weight loss. Simons-Morton, et al. (1987) and the ACSM (1988) further stated that high-intensity exercise may negatively affect adherence to exercise programs in children. Therefore, it is important that exercise and physical activity programs for children be highly enjoyable.

Assessment of Health Related Physical Fitness

There are many available means to assess the

physiological parameters evaluated in this study. However, because the study was to be conducted in a school setting and the adoption of its concept was aimed at the physical education practitioner, only field tests that could be duplicated with minimal training, expense, and time were considered. Several choices of tests for each of the health related physical fitness aspects of the study were presented in the literature.

AAHPERD has been a leader in the testing of physical fitness for children over the past four decades. Its most recent program, Physical Best (1989), replaced all of the fitness programs previously endorsed by AAHPERD including the AAHPERD Youth Fitness Test, the AAHPERD Health Related Physical Fitness Test, and the President's Council on Physical Fitness and Sport test. The tests utilized in Physical Best with its respective health related area of priority are as follows: one-mile run/walk for cardiovascular endurance; sum of triceps and calf skinfolds or triceps and subscapular for body composition; modified sit-ups for abdominal muscular strength and endurance, and pull-ups for upper body strength and endurance; and sit and reach for flexibility. When circumstances dictated, substitute tests were allowed such as the one-half mile run/walk for kindergarten through third grade or the 9-minute run/walk (AAHPERD, 1989). The American Academy of Pediatrics (AAP) endorsed Physical Best test battery as "the

best mass testing system available for children" (AAP, 1991, p. 127).

A survey by the ACSM (1991) listed the following physical fitness tests as currently being promoted on a national basis for children: for cardiorespiratory endurance the mile run/walk for time, one-half mile run/walk (ages 6 to 7), and steady state jog; for body composition the sum of skinfolds thicknesses and Body Mass Index; for muscular strength/endurance pull-ups, flexed arm hang, modified pull-up, bent knee sit-ups or curl-ups and isometric or modified push-ups; and for flexibility the sit and reach test and v-sit reach.

Pate (1991) discussed some recently developed cardiorespiratory endurance field tests. A steady-state 20-minute run was employed by the Fit Youth Today program. Another test utilized incremental increases in pace with a 20-meter shuttle run until the child could no longer maintain the required rate.

In a review of literature, Simons-Morton et al. (1987) reported the distance run tests used in the AAHPERD HRPFT of 1980, the NCYFS in 1984, and the PCPFS Survey of 1985 correlate only modestly with aerobic power (Vo_{2max}). deVries (1985) agreed that distance run tests, an indirect measure of maximal oxygen uptake, are inappropriate measurements since Vo_{2max} is largely determined by hereditary factors and therefore cannot be used as a measure of training status.

Instead, deVries advocated the best reflection of training status was the use of the percentage of Vo_{2max} and maximal heart rate that can be maintained without greatly exceeding resting blood lactate values or anaerobic threshold (AT). However, this would require extensive laboratory testing, thus making it impractical for the mass, field situation involved in the current study. In seeking an alternative method, there does not seem to be a more appropriate measurement for the indirect assessment of physical working capacity than long distance runs.

In Europe, school-aged children are presently being measured by the Eurofit test for physical fitness, a battery of tests developed by the Council of Europe. After defining physical fitness with a holistic view of health related and performance related fitness, components for cardiorespiratory endurance, muscle strength, muscle endurance, flexibility, and body adiposity are included. The specific tests employed for this respective purpose in the health related area are: the endurance shuttle run, physical work capacity, hand grip, sit-ups, sit and reach, and skinfolds measurements. The shuttle run is a 20 meter maximal, progressive, multi-stage test that utilizes an audible signal for pacing. The validity for this test ranges from 0.67-0.91 compared with other running tests with a validity of 0.22-0.82 (Georgiades & Klissouras, 1989).

The validity and reliability for the most commonly used

field tests for health related physical fitness has been reported by Pate (1991). Validity coefficients for distance runs, such as the mile run/walk or 1.5 mile run for time and the 9 or 12-minute run for distance, ranged from 0.2-0.9. Higher validity was observed for older children rather than for younger children. Reliability for these tests ranged from 0.6-0.92 with most in excess of 0.75. However, scant knowledge exists of the reliability of distance run tests in children younger than age 10. Little is known about the validity of sit-up or curl-up tests when compared with laboratory measures for abdominal strength and endurance, but both tests are moderately reliable, with test-retest coefficients ranging from 0.6-0.8. Pull-up tests generally have reliability coefficients exceeding 0.8, although the validity of this test has rarely been assessed. However, one study of children ages 9-10 reported validity of a modified pull-up test as 0.72 which was better than the validity of the standard pull-up (0.51) or flexed arm hang (0.48). The validity of sit and reach tests has not been adequately determined; however, one study reported a closer association with hamstring flexibility (0.60-0.73) than with lumbar flexibility (0.27-0.30). In comparison, the reliability for sit and reach tests usually exceeds 0.9. The validity between the sum of two skinfolds thicknesses (triceps and subscapular or triceps and calf) and body density was approximately 0.9 in children. Inter-tester

reliability when measuring children ranged from 0.89-0.98.

Safrit and Wood (1987) studied the reliability of the AAHPERD health related physical fitness test battery, which consisted of the 9-minute run, the sum of the triceps and subscapular skinfolds measures, the sit and reach, and the number of sit-ups in one minute. The tests were found to have a high multivariate reliability for boys and girls in grades 6-8 and acceptably high univariate reliabilities for the same groups, with the exception of the distance run test. Lack of motivation was listed as a primary reason for the 9-minute run findings.

The reliability reported for the President's Council on Physical Fitness and Sports (PCPFS) National 1985 Fitness Survey (Reiff et al., 1986) was as follows: pull-ups, 0.82-0.89; flexed-arm hang, 0.74; curl-ups (bent knee sit-ups), 0.68-0.94; shuttle run, 0.68-0.75; standing long jump, 0.83-0.98; 50-yard dash, 0.83-0.94; one-mile run/walk, 0.65-0.92; V-sit, 0.70-0.94; and the two-mile walk did not have available data in the literature.

The reliability and validity of the skinfolds assessments was further supported by Lohman (1987). According to Lohman, skinfolds assessments for children are superior to the underwater weighing standard of adults. Children have a higher water and lower bone mineral content, thus body density using the hydrostatic method overestimates percent fat in children. Lohman further stated that either

the combined sums of the triceps and subscapular or the triceps and calf skinfolds were equally successful in estimating percent fat in children. However, caution should be used when applying the reference charts to the low end of the scale. Lohman placed a 3% error utilizing the caliper method providing all standards are met, and a larger percent error when they are not, or with children who have a unique distribution of fat. Pate (1991) supported Lohman's use of skinfolds measurements as an accurate estimation of the percentage of body fat in children. According to Pate, the sum of two skinfolds thicknesses correlates with body density at 0.9 in children. Pate further placed inter-tester reliability coefficients of children at 0.89-0.98 and the error of estimation at approximately 3.5%.

A more recent method predicted the sum of skinfolds in children using a multiple regression equation which is composed of age, gender, height (inches), weight (pounds) and waist circumference (inches). The equation was developed utilizing the NCYFS data base of children ages 10-18. While it has been found to be useful in identifying children and youth with mild obesity or greater, it was inadequate for predicting the sum of skinfolds below the 50th percentile (Luna, Lee, Nieman, & Hopp, 1991). Thus, at present skinfolds measurements remain the method of choice for estimating percent body fat in children and youth (Lohman, 1988; Luna et al., 1991).

Exercise Physiology of Children

Commonly considered as the "gold standard", the Resource Manual for Guidelines for Exercise Testing and Prescription, published by the American College of Sports Medicine (1988), cited the major physiological differences between children and adults as well as the implications these differences have for exercise prescription. These functional differences are categorized into metabolic, cardiovascular, pulmonary and thermoregulatory mechanisms. Overall, these differences do not make children any less suitable than adults for prolonged and continuous activities.

Metabolic Characteristics

The ACSM (1988) reported that children, when compared with adults, exhibited the following metabolic characteristics during exercise: lower absolute Vo_{2max} but similar Vo_{2max} when expressed relative to body size ($ml \cdot kg^{-1} \cdot min^{-1}$); similar submaximal oxygen demand for cycling, but a higher metabolic cost for walking and running; lower concentration and rate of utilization of muscle glycogen, limited glycolysis due to low levels of phosphofructokinase (PFK); lower maximal blood lactate levels which limit a child's tolerance for sustained, high intensity exercise; and a shorter half-time of oxygen which allowed children to reach steady state faster.

A literature review by Simons-Morton et al. (1988), presented conflicting opinions with the ACSM's explanation of metabolic characteristics of children. Support was found for the findings of similar Vo_{2max} in children and adults when expressed as a relative value, and for lower blood lactic acid concentration levels, even though children will not perform as well as adults in endurance events. In contrast, Simons-Morton et al. (1988) stated that children are hindered in activities such as cycling where energy demand is independent of body size, but not as limited in weight-bearing activities such as walking or running, where the energy demand is related to body weight. Pate and Durstein (1986) as well as Shephard, Allen, and Bar-O (1983), agreed with the ACSM assessment of the metabolic functioning of children. Watson (1992) concurred with the ACSM in describing the similarity of relative Vo_{2max}, but advocated its expression as a proportion to body segment length as a more valid comparison between children and adults.

Cardiovascular Characteristics

When comparing the cardiovascular response to exercise of children and adults, the ACSM (1988) found the following characteristics to be common among children: a lower absolute maximal cardiac output (Q); a somewhat lower Q at a given Vo_2; a maximal stroke volume and stroke volume at a

given Vo_{2max} that is lower; a higher heart rate at any metabolic load including maximum power output; a lower oxygen carrying capacity; somewhat higher oxygen (O_2) in arterial and venous blood; blood flow to active muscle that is higher; and lower maximal and submaximal systolic and diastolic blood pressures (ACSM, 1988). Simons-Morton et al., (1988) agreed that when children are compared with adults there is a lower stroke volume, lower cardiac output, higher arteriovenous oxygen difference, smaller maximal cardiac output, and higher maximal heart rate. Bar-Or (1983) further supported the lower stroke volume of children during submaximal exercise when compared with adults.

Pulmonary Characteristics

The pulmonary response of children engaged in exercise when contrasted with adults showed the following characteristics according to the ACSM (1988): a smaller absolute maximal minute ventilation (V_{Emax} expressed as $L \cdot min^{-1}$); a relative V_{Emax} ($ml \cdot kg^{-1} \cdot min^{-1}$) equal to adolescents and young adults; a higher $V_{Esubmax}$ ventilatory equivalent at any given Vo_2; a respiratory frequency (f) and tidal volume (T_v) that is more rapid and more shallow; and a lower rating of perceived exertion (RPE) which indicated the strenuousness of the exercise was deemed to be easier by children at a given intensity level. The findings of a lower T_v and higher f

during exercise among children than adults is supported by Simons-Morton et al. (1988).

Thermoregulation

The ACSM (1988) and others, (Watson, 1992; AAP, 1991) reported that children have approximately 36% greater surface area per unit mass than adults. This, combined with a lower rate of sweat production and a higher rate of heat production during exercise, creates greater thermoregulatory stress in children than adults (ACSM, 1988; Simons-Morton et al., 1988). Further, a greater core temperature was required to initiate a sweating response (ACSM, 1988). Acclimatization to heat for children is slower physiologically but faster subjectively, and the body cools faster in water (ACSM, 1988). The AAP (1991) further cautioned against overheating of children when overdressed in cold environments during vigorous exercise, such as cross-country skiing or ice hockey. Conversely, hypothermia may occur during prolonged physical activity of mild intensity, as in hiking, or more likely will develop when the child exercises in cold water.

Exercise Prescription

The implications of the physiologic characteristics of children for exercise prescription relate primarily to the thermoregulation of body temperature. The ACSM (1988) and

the AAP (1991) cautioned that children need to be closely monitored when exercising in climatic extremes. Children are inefficient in gross motor tasks which results in a higher metabolic cost. This higher metabolic cost, combined with a poor sweating capacity, a large surface-to-mass ratio, and an immature cardiovascular system, causes children to have a shorter tolerance for exercising in hot climates, and creates a greater susceptibility to heat stress. Further, children do not psychologically perceive this stress during the early stages of acclimatization and therefore should be closely observed. Fluid intake prior to and during exercise, especially if prolonged in nature, is of utmost importance, and light-weight, absorbent clothing was advised (ACSM, 1988; AAP, 1991).

The exercise prescription for children in terms of frequency, duration, and intensity followed the same guidelines as that which is recommended for adults (ACSM, 1988). There is, however, a difference of opinion as to how each of the variables are prescribed.

The ACSM (1991) advocated an intensity level of 40-85% of functional capacity dictated by the current exercise habits of the individual, a frequency of several daily short term sessions for low functioning persons (1-3 METS) or 3 to 5 weekly sessions (5 or more METS), and a duration of 15 to 60 minutes with the average being 20 to 30 minutes. For the sedentary, bouts of less than 10 minutes may be optimal for

initial conditioning.

The position statement of the American Heart Association on exercise prescribes 3 days per week, or every other day, as the frequency rate for children at 60% of their functional capacity for at least 30 minutes (Simons-Morton et al., 1988). Pate and Blair (1978) recommended that children exercise 4 days per week at 70% of functional capacity for 20 to 30 minutes (Simons-Morton et al., 1988). Rowland (1981) advocated 3 days of exercise per week at a vigorous level for 30 minutes to suffice for children's cardiorespiratory fitness (Simons-Morton et al., 1988). Daily exercise at a moderate to vigorous intensity level for 30 minutes per day in one or more sessions was the recommendation for children according to Haskell (1985) (Simons-Morton et al., 1988). Georgiades and Klissouras (1989) advocated year-round participation in appropriate physical activity in one or more moderate-to-vigorous activities which required an expenditure of 7 kcal/min or a target heart rate of 160 beats per minute at least three times per week for 20 minutes or longer.

The AAP (1991) guidelines for developing physical fitness through exercise included the following: optimum frequency should be 3 to 5 exercise bouts per week; intensity level should be 70-85% of Vo_{2max} or a heart rate of 150 or more beats/minute, although less intense exercise may suffice, especially in subjects with low fitness levels;

duration should be at least 15 minutes for each exercise bout, and the 3 to 5 weekly sessions must last 6 weeks or longer to increase fitness.

A suggested use of the national norms developed for health related physical fitness from the NCYFS projects was to prescribe exercise and activity (Pate, Ross, Dotson, & Gilbert, 1985; Ross, Dotson, Gilbert, & Katz, 1985b; Ross, Pate, Delpy, et al., 1987). While positive scientific verification for the prescription of exercise for children based on adult guidelines is still lacking, no apparent detriments seem to exist either. There is however, a caution advisory against overtraining because children may be more anatomically susceptible to overuse injuries due to the presence of growth tissue (ACSM, 1988).

In regard to training controversy exists as to whether the use of adult guidelines for children will increase their level of maximal oxygen intake beyond that which is acquired by growth. The ACSM advised a prescription that will keep children active, with less concern for activities that increase Vo_{2max}. Zwiren (1988) also reported that children spontaneously prefer short-term intermittent activities with a high recreational component and variety (ACSM, 1988).

While there appears to be an agreement in the literature concerning the issue of adult guidelines of exercise for children, it is important to state that there is no conclusive, verifiable proof that adult standards are

the best course to follow. Rather, there is a lack of information to refute such a practice. Additionally, there are no scientific physiologic factors that have been identified to indicate children are less suitable than adults for prolonged and continuous activities (ACSM, 1988).

Pending further investigation, the type of activity pursued to reap the most benefits becomes the more relevant question at hand. Both from a physiological and psychological viewpoint, the ACSM (1988) recommends enjoyable, intermittent activity. Conversely, Simons-Morton et al. (1987) cited that endurance training was more effective than intermittent. Further, several studies advocated intense endurance training to yield greater results (Simons-Morton et al., 1987). Although it did not yield significant positive results, Stewart and Gutin (1976) and Becker and Vaccaro (1983) utilized strenuous continuous activity. In light of these findings, intermittent activities make more sense from a psychological and physiological view since the child can reach metabolic steady-state faster, and recover faster due to the lower oxygen deficit contracted (ACSM, 1988).

Training Effects of Exercise on Children

The majority of the research to date concerning the training effects of exercise was related to the adult response. A cursory review of the cardiorespiratory

adaptations to endurance training yielded these results. At maximal exercise oxygen consumption, stroke volume, cardiac output, and tissue oxygen extraction increased significantly resulting in improved performance. The blood flow to the active muscles increased as blood was shunted from the uninvolved splanchnic tissues. No change was noted in heart rate, contractility of the heart muscle, or improved oxygen transport due to ventilation at maximal exercise. During rest there were no notable changes resulting from endurance training in the following physiological functions: oxygen consumption, cardiac output, contractility of the heart, muscle or splanchnic blood flow, oxygen extraction, or ventilation. However, there was a decrease in heart rate and an increase in stroke volume (ACSM, 1988; AAP, 1991).

Pate and Durstein (1986) summarized the cardiorespiratory adaptations to endurance training in four areas as follows: 1) Heart--decreased heart rate during rest and submaximal exercise; increased stroke volume during rest, submaximal exercise and maximal exercise; and increased maximal cardiac output. 2) Vascular System--decreased blood pressure during submaximal exercise and decreased total peripheral resistance during exercise. 3) Blood--Increased total blood volume, red cell mass, and total hemoglobin. 4) Pulmonary System--decreased ventilation during submaximal exercise but increased ventilation at maximal exertion.

The studies conducted specifically with children, in regard to the effects of endurance training of maximal aerobic power, have shown conflicting results. Several studies reported an increase in Vo_{2max} as a result of training intervention (Bar-Or, 1989; Pate & Durstein; 1986) while others observed no change (Daniels, Oldridge, Nagle & White, 1978; Stewart & Gutin, 1976; Becker & Vaccaro, 1983). In comparing these studies, the initial fitness level of the subjects and the length and severity of the training program seemed to discriminate between the contrasting results. The available evidence suggested that for significant increases in maximal aerobic power to occur, subjects must be relatively unfit initially and/or exposed to training regimens that are heavy and prolonged in nature (Pate & Durstein; 1986).

With the training-induced increases in maximal aerobic power, children exhibited many of the same physiological adaptations seen in adults including increased heart volume, stroke volume, maximal cardiac output, blood volume and total hemoglobin. These changes were most commonly found to occur among postpubertal youth. In contrast with adults, the arteriovenous oxygen difference has not been observed to change in children as a result of training (Pate & Durstein; 1986).

Skeletal adaptation to endurance training was found to be dependent upon the frequency, duration, and intensity of

the type of contractions involved in the training. The muscular adaptation response to exercise is an enhanced ability to contract the tissues in the same manner in which they were trained (ACSM, 1988).

As a result of strength training, such as weight lifting, the following muscle properties remained unchanged: fiber composition; fatty acid and myosin ATPase enzymatic activity; substrate storage of ATP/CP and glycogen; myoglobin content; mitochondrial number; and capillary density. Fiber area was somewhat increased with strength training as was glycolytic and Krebs cycle enzyme activity. The latter two may remain unchanged or an increase in the Krebs cycle enzymatic activity may occur (ACSM, 1988).

In contrast, sprint training is believed to produce the following: change in fiber composition from type I (slow to contract but fatigue resistant) to type IIc (intermediate contractile and metabolic characteristics); small to moderate increases in the enzyme activities of the Krebs cycle, fatty acids, glycolytic, and myosin ATPase. Substrate storage of ATP/CP and glycogen either increased or remained unchanged, and the myoglobin content and mitochondrial number increased. Capillary density is believed not to change (ACSM, 1988).

Endurance training responses showed the most marked changes in muscle properties, generally in a positive direction. There was a large increase in the Krebs cycle

enzymes, a moderate increase in the fatty acids, a small increase in myosin ATPase and either a small increase, decrease, or constant level of glycolytic enzyme activity. It is believed there are also increases in fiber composition, ATP/CP and glycogen substrate storage, myoglobin content, mitochondrial number, and capillary density. Fiber area does not change (ACSM, 1988). In specific reference to the skeletal muscle adaptations in children induced by endurance training, the oxidative enzyme activities and muscle glycogen stores have been reported to increase. This follows the same pattern as in adults (Pate & Durstein, 1986).

With so much emphasis on the impact of sedentary and underfit boys and girls resulting from a lack of exercise, it would be negligent to omit the other end of the spectrum, those who train strenuously. The American Medical Association (Cowart, 1989) reported there is a small but growing subgroup of young people who engage in too much exercise which results in overuse injuries (Cowart, 1989). Clain and Hershman (1989) reported some of the more common overuse injuries among children as stress fractures and Little League elbow. The ACSM (1988) stated that children may be anatomically more susceptible to overuse injuries than adults because of the presence of growth tissue. Those at risk included individuals who exhibit any of the following characteristics: 1) abrupt changes in the

intensity, duration, or frequency of training (intensity should not exceed more than a 10% weekly increase); 2) musculotendinous imbalance in strength and flexibility; 3) anatomic malalignment of the lower extremities; and 4) improper footwear and inappropriate running surfaces. Clain and Hershman (1989) reported the overuse injuries found among children resemble those in adults, with one important difference. The involvement of the growth tissue in children presents serious implications for a favorable outcome. With early intervention potential long-term complications in the young can be prevented.

Exercise Programs for Children

Various programs to promote positive and appropriate physical activity among children have been reported utilizing a variety of strategies. Programs targeted toward the community, families, and schools have achieved differing rates of success.

Community-based Programs

The concept of adopting an intervention program to increase appropriate physical activity aimed at an entire community appears to be very attractive. The actual process for the realization of such a sizeable endeavor has both benefits and problems. With community participation there is the potential to make policies, plans, and programs more

responsive to the people served (Checkoway, 1989). Many sources to circulate information or to provide opportunities for education, such as the media, health agencies, and businesses, can be employed. However, one of the major difficulties in community-based approaches for health promotion is developing direct points of contact with the target population for comprehensive management of the complex problem of modifying behavior (Simons-Morton et al., 1986).

A review of the literature produced limited programs with the purpose of developing appropriate physical activity within the general population. Simons-Morton, O'Hara, & Simons-Morton, (1986) reported on a three-year campaign which encouraged increased participation in unstructured physical activity in five different communities utilizing various intervention strategies. However, the primary goal of the study was to promote changes in dietary behavior. Therefore, no assessment of changes in exercise behavior was conducted.

Family-based Programs of Exercise

A summary of the literature by Simons-Morton et al. (1986) concerning family-based programs to promote changes in diet and exercise habits, revealed the family-based approach was no more effective or was ineffective in eliciting change when compared with the individual-based

approach. There were some possible exceptions in regard to weight control with exercise.

School-based Programs

There have been a number of investigators who have attempted to increase the physical fitness and/or physical activity of school-aged children within the structure of the school. "Heart Smart" (Butcher et al., 1988) and "Go For Health" (Simons-Morton, O'Hara, Baranowski, & Wilson, 1989) are examples of comprehensive programs that strove to positively impact dietary and exercise habits and attitudes. Other researchers used physical education classes as the primary vehicle for the implementation of the program, while still others have used supplemental programs conducted by the classroom teacher but directed by the physical educator.

"Heart Smart: A School Health Program Meeting the 1990 Objectives for the Nation" (Butcher, et al, 1988) was a cognitive behavioral intervention program which included a fitness component as part of the overall program design to reduce CHD risk factors. Students in grades K-6 were instructed in ways to promote the development of desirable attitudes toward lifetime physical fitness and how to become more responsible for their own fitness. Students were exposed to a variety of physical activities which then were included in a personal fitness program.

A comprehensive program with an overall goal of

creating healthful eating and physical activity practices was administered to third and fourth grade subjects as part of the "Go For Health" project (Simons-Morton et al., 1989). Objectives that related specifically to developing physical activity as part of the physical education program included increasing the amount of time students engaged in MVPA to at least 50% and increasing the proportion of class content devoted to general and cardiovascular fitness. Within the classroom component, objectives directed toward enhancing physical activity encompassed ones which would develop students' knowledge and skills, self-efficacy, and a positive attitude. Of all the study findings, those for the cognitive measures of physical activity were the most inconsistent. With the exception of one school, third graders showed no improvement in behavioral capability or self-efficacy while fourth grade students increased both behavior capability and self-efficacy (Simons-Morton, O'Hara, Baranowski, & Wilson, 1989).

Steinhardt and Stueck (1986) proposed a curriculum model for physical education classes based on personal fitness. Previously none existed. The model incorporated three main areas of interaction: physical fitness components, health related objectives, and individual characteristics. The physical fitness components included: cardiovascular endurance, muscular endurance, strength, flexibility, body composition, and performance skills. The

health related objectives were comprised of weight control, stress management, coronary heart disease risk reduction, and protection from musculoskeletal disorders. Individual characteristics to be considered when participating in physical activity are: perceived benefits including psychological, physical and social; perceived barriers; individual meanings and values; individual's intentions; self-efficacy; and self-regulatory skills. The key to implementing this model, according to the authors, was for teachers to respond to the needs and characteristics of individual students. Its adoption would ensure that each student would:

> be able to appraise his/her current level of physical fitness, participate in a fitness program designed at the optimum frequency, intensity, and duration for developing physical fitness, and understand the health-related outcomes to be gained from being a physically fit person (Steinhardt & Stueck, 1989, p.28).

Kopperud (1986) implemented an elementary physical education program with a physical fitness emphasis. It consisted of five components with equal importance in achieving established goals. 1) The Physical Education Class Activities Program included activities which were part of six categories: rhythmic; apparatus, stunts, and tumbling; cooperative games and relays; manipulative skills;

sports-recreational skills; and movement. The regular physical education classes met two times per week for 30 minutes each for grades 1-5, and one time per week for 15 minutes for kindergarten. 2) The AAHPERD HRPFT was given to students in grades 1-5 at the beginning and end of the year. 3) Each student participated in the Indian Trails Individualized Physical Fitness Program for 15 minutes two times each week under the direction of the classroom teacher. Professionally developed health related and skills fitness areas were emphasized at six different stations. 4) Teaching Lifetime Fitness-Elementary Series (Laurie & Corbin) containing concepts of the importance of physical fitness and how to develop and maintain physical fitness was taught by the physical educator. 5) A take-home exercise program consisting of four exercises for each month from November through March was performed by the student with the aid of the parents or guardians. Kopperud concluded that with effective integration, prepackaged fitness programs have potential as a valuable component of the curriculum. The implementation of these five components resulted in the culmination of a comprehensive elementary physical education program.

Two different studies successfully elevated the health related physical fitness of elementary students as a result of supplemental programs during scheduled recess under the direction of the classroom teacher (Duncan et al., 1983;

Werner & Durham, 1988). A fifth grade experimental class had daily, structured physical fitness activities for nine months. The change in their pre and post fitness scores on the AAHPERD YFT showed significant improvements in hamstring flexibility, pull-ups, sit-ups and the mile run. Subjects were tested again after the three month summer vacation, and although scores had declined the experimental group was found to have retained significant differences in sit-ups and the mile run (Duncan et al., 1983). Werner and Durham (1988) examined the effects of a nine week study where experimental groups in grades 4-6 received supplemental 20 minute lessons, three times per week. Pretests and posttests were administered in the mile run for time, sit-ups in one minute, sit and reach, and triceps and abdominal skinfolds measurements. Treatment effects in favor of the experimental groups in all of the health related fitness areas were found.

Self Report Measures of Physical Activity

Self report measures of physical activity are widely used by epidemiologist and behavioral scientists to investigate such areas as the relationship of physical activity with CVD, determination of alternative methods for increasing physical activity, or to identify and explain those who exercise and those who do not exercise (Baranowski, 1988). An examination of the advantages as

well as the validity and reliability of self report measures among children of physical activity was pertinent to this study.

Several advantages exist for the use of self report data collection. A variety of variables may be obtained from one source when self report is used that may not be available from other sources. For example, self report could be utilized to assess the duration, intensity, and frequency of activity over time. Not only is self report tremendously versatile, but it is relatively quick, inexpensive, and unobtrusive. For these reasons, self report has become the method of choice by epidemiologist and health educators (Baranowski, 1988).

There are limits to the validity and reliability of self report measures, but as Baranowski (1988) explained, there are limits to any measure of physical activity. Based on a review of nine prominent studies using self report of physical activity, some of the conclusions Baranowski drew included the following: 1) When the same instrument is applied to the same group of people to determine the pattern of habitual activity, there is a reasonably high reliability coefficient. 2) The same instrument when applied to the same group of people to determine the recall of specific events which do not overlap in time (usually a short time frame) have modest correlation with one another. 3) The correlation of self report instruments with external

criteria are modest to nonexistent.

Error has been documented in all self report measures of physical activity. Therefore, it is prudent to probe the major sources of these errors: the accuracy of the definition of the desired variables, and human cognitive processes.

The effective physiological stimulus to prevent cardiovascular disease is not clear. Until an accurate definition of the kind and quantity of physical activity necessary to prevent CVD is determined, it is not possible to absolutely approximate behavior to produce the effective physiological stimulus or assess such behavior with self report instruments (Baranowski, 1988).

In regard to the cognitive process, means by which skills for accurate recall may be enhanced and errors in memory reduced must be examined. Respondents are not likely to be able to distinguish between 20 minutes or 30 minutes of physical activity or bouts of uninterrupted aerobic activity unless a watch is used. Therefore, it is advisable to use a watch for record keeping purposes. One of the most common errors in memory recall is memory decay. Otherwise stated, memory becomes less accurate over time (Baranowski, 1988). When children were asked to self report their physical activity for the same day or previous day, they did so with reasonable accuracy (Baranowski et al., 1984; Baranowski, 1988; Parcel, Simons-Morton, O'Hara, Baranowski,

& Wilson, 1989; Sallis, Buono, Roby, Carlson, & Nelson, 1990; Wallace, McKenzie, & Nader, 1985). The same day self reported physical activities of third and fourth grade students agreed with trained observers 86.3% of the time (Parcel et al., 1989). Further support for the accuracy of same day self report among children came from Wallace et al. (1985). Overweight boys (ages 11-13, n=11) were surreptitiously observed at a fitness camp by their counselor. When subjects recalled events by mode, the authors reported an accuracy of 75% for intensity level, 46% for mode of activity, and 98% for the day. After four days, some of the children were unable to remember any details of their previous activity.

Self report was further validated with the Caltrac accelerometer, an electronic device that assesses the quantity and intensity of movement in the vertical plane. Boys and girls (n=35) ranging in age from 8 to 13 years were field tested for two days, and a subset (n=15) were further analyzed under laboratory conditions. Very high inter-instrument reliability of the Caltrac accelerometer was found in both field and laboratory studies. More important to this study, the data tended to corroborate children's short-term activity recall with quantitative measurements. Specifically, the accuracy of children's recall of physical activity was significantly correlated with Caltrac activity counts on both days of the field study portion, but only

showed significant correlation with activity heart rate on day 2 of the study. The net caloric costs of three different treadmill speeds (3, 4, and 5 mph) of 10 minute durations were analyzed and compared with physical activity recall. The results indicated a close agreement of kilocalories (kcal) from the accelerometer and activity recall on day 1, but suggested that activity recall kcal was actually underestimated on day 2 (Sallis et al., 1990).

In a study to design a self report form that would maximize the child's accuracy in reporting aerobic activity, Baranowski et al. (1984) tested six forms with children in grades 3-6. The self reported behavior on the forms was then validated by trained observers over a two day period. The self report forms were brief, using simple words and sentences. Time was varied by reporting for the whole day or for the segmented day (i.e., before school, during school, after school, and after supper for school days; or morning, afternoon, and evening for non-school days). To determine a way to minimize the problem of children being unaware of the duration of time, three forms were developed that varied the response for time. One format required the exact number of minutes engaged in aerobic activity. The other formats had two options (none or less than 20 minutes, more than 20 minutes) or three options (no activity, less than 20 minutes, 20 minutes or more). The exact-minutes format produced the lowest percent agreement when combined

with the day as a whole reporting scheme, but the highest percent agreement resulted when combined with the trichotomous response format (Baranowski et al., 1984).

Psychological Factors of Children in Physical Activity

Thus far, the focus of the attainment and maintenance of physical fitness has been on the physiological product. Scant attention has been directed toward the impact of psychological factors on exercise adherence, but it is precisely those elements that will ultimately lead to the adoption or abandonment of exercise as a lifestyle behavior (Fox, 1988). Self-esteem, attitudes, self-confidence, and motivation all play a role in the decision making process of whether to include exercise in the daily routine. In consideration of the fact that the drop-out rate of sedentary individuals who initiate a regular exercise program is 50% within the first 3 to 6 months, measures must be taken to minimize this occurrence (ACSM, 1988; Rutherford, Corbin, & Chase, 1992; Custer & Doty, 1992). For the purposes of this study, the components of motivation to exercise will be closely examined. These components include types of intrinsic and extrinsic motivation factors, and an analysis of their use.

Extrinsic Awards for Physical Activity

The use of awards has been a common practice in

conjunction with fitness testing among children (AAHPERD, 1989; Institute for Aerobics Research, 1988; U.S. DHHS, 1990). An examination of the award schemes in place at the national level with the impact they have on motivating children to exercise follows.

The "President's Challenge" has been part of the PCPFS testing program since 1966. Based on normative percentiles, most recently from the PCPFS National 1985 School Population Survey (Reiff, 1986), students were required to score at or above the 85th% on all five tests items to qualify for the Presidential Physical Fitness Award. In 1987 the National Physical Fitness Award was initiated into the plan with the 50th% as its standard (U.S. DHHS, 1990). According to the PCPFS (1987), motivation via these award incentives was a "central focus of PPFA (Presidential Physical Fitness Award Program)" (U.S. DHHS, 1987, p. 16).

Physical Best recognizes different aspects of the process of attaining fitness through physical, cognitive, and affective behaviors. The Fitness Goals Award may be earned by students who reach pre-established goals that have been designed with the help of the teacher. For example, the overfat student may walk for a specified duration and frequency in addition to writing a paper on caloric balance and control of body composition. The Fitness Activity Award acknowledges students' involvement and participation in physical activities that should develop and maintain health

related fitness outside of the physical education setting. The Health Fitness Award is earned by students who meet the criterion reference standards for all five health fitness components. The intent of the program was to motivate students by letting them experience success through reasonably attainable goals. Participation in physical activity is regarded as a legitimate goal in itself, according to AAHPERD (1989).

The Institute for Aerobics Research, with the sponsorship of Campbell Soup Co., introduced FITNESSGRAM in 1987. The system was developed by former AAHPERD experts who resigned over a disagreement with the PCPFS and which subsequently caused the split between the PCPFS and AAHPERD (Corbin, Whitehead, & Lovejoy, 1988). As stated in the FITNESSGRAM User's Manual, "The principal goal of the awards is to encourage regular physical activity which can be performed for a lifetime" (Institute for Aerobics Research, 1988, p.4-1). Four awards were proposed as a means for the realization of this goal. A six week conditioning program including activities for warm-up, strength development, aerobic activity, and cool-down is completed by students a minimum of three days a week to fulfill the "Get Fit" Award criterion. The FITNESSGRAM Honor Award is reserved for special recognition of students who have accomplished a difficult fitness goal, whether it may be for those with special talents or those who have overcome adversity, in

their quest for physical fitness. The "I'm Fit" Award may be earned by students who have achieved the criterion standard for four of the five FITNESSGRAM health related physical fitness tests. They must also have earned the "Get Fit" Award and/or "Fit for Life" Award. The "Fit for Life" Award recognizes any individual (child or adult) who has garnered enough points from physical exercise through a self-administered exercise program. Certificates are available as rewards for districts who elect not to utilize the aforementioned incentives (Institute for Aerobics Research, 1988).

Intrinsic Awards for Physical Activity

There is an overwhelming consensus that for exercise behavior to be adopted as a matter of choice, the motivation to participate in physical activity must come from within the individual (AAHPERD, 1989; ACSM, 1988; K. Fox, 1991; K. R. Fox, 1988; Rutherford et al., 1992). This intrinsic motivation, as it is called, has been operationally defined as "the amount of time individuals voluntarily spend at an activity during their free time" (Rutherford et al., 1992, p. 19). Intrinsic motivation is enhanced when one feels competent about their performance in an activity. People who feel competent subsequently find exercise to be enjoyable, interesting, and important. They do not feel that exercise creates pressure or tenseness nor does it

require great effort (Rutherford et al., 1992). These perceptions of physical competence are further associated with one's choice and degree of involvement in activity and sport (K. Fox, 1991).

Enhancing Motivation Toward Exercise in Children

According to the ACSM (1988) self-motivation is a learned behavior. It is defined as "the ability to find rewards for behavior independent of external rewards available for that behavior" (ACSM, 1988, p. 336). A tenet of cognitive evaluation theory stated,

> individuals are intrinsically motivated to seek self-determined, optimal challenges as a means of learning and achieving competence--which is a pleasurable outcome in itself, leading in turn to further quests for challenge and self-determination. However, if an attempt to achieve competence is perceived as being externally initiated or controlled, or if the outcome leads to perceptions of incompetence, then intrinsic motivation will be undermined and the previously motivated behavior will decline or cease (Corbin, et al., 1988, p. 205).

Otherwise stated, one who is motivated toward physical activity is more likely to participate in exercise than one who is not motivated. Further, intrinsic motivation is associated with longer term adherence to exercise than is

extrinsic motivation (Corbin et al., 1988). The application of this concept to children and exercise takes on many forms.

First, there is the question of whether extrinsic awards should be used at all. While the creators of these awards purport that they are motivational, recent criticism of this practice has been levied. Many find the PCPFS award system to be particularly objectionable. The long standing President's Award, which until 1987 was the only award offered by the PCPFS, is achieved by less than 1% of youth. Even the 50th% National Award is earned by less than 15% of the population. Because these awards are given for achievement of the product (fitness) rather than the process (exercise), intrinsic motivation would be reduced (Corbin et al., 1988). This impact is further confounded when consideration is given to the fact that children's fitness is dominated by genetic and maturational factors rather than activity patterns (K. Fox, 1991). According to cognitive evaluation theory these awards would reduce feelings of internal control and physical competency for the vast majority (Corbin et al., 1988).

In contrast, process awards, such as those given by FITNESSGRAM and Physical Best, would be supported by cognitive evaluation theory as promoting intrinsic motivation. It is reasoned that these awards offer success to all who are willing to work for it in addition to

providing information that relates to feelings of physical competence on a regular basis (Corbin et al., 1988).

While in theory there is considerable merit to this plan, at least one study refutes its premise. Whitehead and Corbin (1991) hypothesized that participation in the FITNESSGRAM program would produce more positive intrinsic motivation toward exercise and feelings of physical self-worth than would participation in the President's Challenge. However, they found no differences in outcomes for the two fitness batteries. Although the analysis of gender differences was not a main purpose of the study, it is worthy to note that males scored significantly higher than females on feelings of competence, confidence, and other self-evaluative aspects of physical performance (Whitehead & Corbin, 1991). Other critics point out the difficulty in monitoring exercise behavior. These antagonists argue extrinsically motivated children may make false claims or repeat the same exercises over and over which may actually reduce interest in regular exercise (Corbin et al., 1988).

Based on the best theoretical evidence available, if awards are to be used process awards are recommended in favor of performance awards (Corbin et al., 1988). Beginners especially can benefit from external rewards early in the developmental process to help encourage and motivate them to exercise (ACSM, 1988). If performance awards are used, then criterion referenced awards are acceptable, but

not awards based strictly on normative performance (Corbin et al., 1988).

Further scrutiny of the issue of criterion reference standards, such as awards, found a striking difference between the two sets of standards for FITNESSGRAM and Physical Best. The AAHPERD standards were markedly higher for the mile run/walk than FITNESSGRAM standards. When these differences were examined by Cureton and Warren (1990) using an existing data set, a higher percentage of subjects were classified correctly when using FITNESSGRAM standards than with Physical Best standards, 85% versus 61%. Cureton and Warren further stated that even if youth were physically active almost half of the population might not be able to achieve the AAHPERD criterion levels of Vo_{2max}.

A novel type of award allows the participant to select their own. Rewards that are relevant to the individual will be more motivating. Another less traditional type of award that must not be overlooked is social support. This form of reward stemming from an instructor, exercise partner, or family member who encourages participation in exercise can have a powerful effect. Praise is a critical component of social support and should be immediate and specific to be the most effective. Contracts indicating the intention to exercise are an example of a formalized use of social support (ACSM, 1988).

A second question, and perhaps a more important one

than whether awards should be utilized or not, is that of how to enhance intrinsic motivation. Agreement within the literature states that permanent adherence to exercise is grounded in intrinsic motivation (ACSM, 1988; K. Fox, 1991; K. R. Fox, 1988; Meredith, 1988; Rutherford et al., 1992). There are also numerous suggestions of ways to develop intrinsic motivation. Some of these recommendations are included below.

1) Make exercise fun. Children especially are affected by immediate outcomes and will not voluntarily engage in activities they do not find enjoyable (ACSM, 1988; ACSM, 1991; K. Fox, 1991; Meredith, 1988).

2) Minimize any negative factors that may decrease the likelihood of exercise involvement. Extrinsic pressures, such as grades based on fitness tests results or unattainable standards of performance, will only serve to make children withdraw from activity (Fox, 1991; ACSM, 1988; Corbin et al., 1988).

3) Provide the right kind of success. If children are continually forced to compete in activities which reward performance, such as scoring the greater number of goals or running the fastest, those who cannot compete may develop low expectations of success. They may subsequently project these feelings of failure to all physical activity and become sedentary rather than risk further failure. Instead, the focus should be on lifetime physical participation.

Emphasis on participation and not performance is critical (ACSM, 1988; K. Fox, 1991; Rowland, 1986; Rutherford et al., 1992).

4) Set appropriate goals for physical activity and modify them as necessary. Goals will vary among participants so a higher degree of satisfaction and adherence will occur if goals can be tailored to the individual. For an individual to strive to achieve a goal, they must first validate its premise as being within the realm of their capacity. Appropriate expectations should be structured in the early phases of the program (ACSM, 1988; Corbin et al., 1988; K. Fox, 1991; Rowland, 1986).

5) Provide relevant feedback in a timely manner. Information conveying "success" is especially important and particularly for beginners. Helping beginners to focus on feelings of competence first will lead to enjoyment, interest, and reduced tension (ACSM, 1988; Rowland, 1986; Rutherford et al., 1992).

Summary

The low level of children's health related physical fitness is alarming and widespread. There is particular concern regarding the diminished capacity in cardiorespiratory fitness and the increased percentage of body fat. Also of significance is the discrepancy between the levels of boys' fitness and the even lower levels of

girls' fitness.

An estimated 40% of today's children exhibit early symptoms of CVD (Vogel, 1991), and without intervention these conditions could manifest into CVD. The particularly well-documented trend in increased fatness in children has specific health implications. Obesity has been classified as a disease in itself as well as a risk factor for other diseases such as CHD. However, a dose-response relationship between the amount of appropriate physical activity and the reduction of CVD risk factors appears to exist. There also seems to be a relationship between increased physical activity and higher levels of physical fitness among children.

To fully comprehend children's exercise habits as a first step in an intervention plan, it is important to ascertain where children are most likely to exercise. The majority of children spend the greater portion of their physical activity in settings other than school physical education classes, but a large portion, nearly one-fifth, may not exercise at all. This leaves the school program as the only exposure to exercise for these children. When the school program was examined, it is significant to note the focus and content emphasized competitive team sports with little aerobic activity. It is difficult to change the behavior pattern of exercise in children. Further, it does not appear that parents as a whole are effective role models

of an active lifestyle, nor do they motivate their children to exercise.

There are many field tests that are appropriate to assess children's health related physical fitness. At the time of this writing, AAHPERD's Physical Best test battery is the method of choice. It offers acceptable limits of reliability and validity in addition to ease of administration.

The recommended prescription of exercise for children follows the same guidelines for adult standards even though a physiological difference exists between children and adults. There is also a dissimilarity of the opinions of experts as to how each of the variables (frequency, duration, and intensity) should be prescribed.

There is not a great deal of specific information in regard to the training effects exercise has on children. The mechanisms are assumed to resemble those of adults. Of the empirical data that is available, conflicting results have been reported. For children who train strenuously caution should be used to avoid overuse injuries.

Various exercise programs utilizing a variety of strategies have been implemented in an effort to promote positive and appropriate physical activity among children. Programs aimed at the community, family, and school have achieved differing rates of success.

Self report of exercise behavior has been widely used

in research. With children, self report was found to be most accurate when recalled on the same day utilizing a form which requested the exact number of minutes engaged in activity during segments of the day. Reliability and validity of self report is acceptable when consideration is given to minimizing error.

The psychological factors of children related to exercise will determine whether children will adhere to physical activity of their own volition. Motivation is a key element in this process. The use of various incentive awards that may foster extrinsic motivation but might also diminish intrinsic motivation is questionable. Intrinsic motivation is vital to voluntary exercise adherence, and there are several ways in which it may be cultivated.

CHAPTER III

METHODS AND PROCEDURES

The purpose of this study was to determine the effects of an eight week individualized self-monitored exercise program on selected health related physiological measurements of fourth grade students. The specific parameters investigated include cardiorespiratory endurance, muscular strength and endurance, flexibility, and body composition.

Prior to initiating this study, the consent of the Superintendent of the Selinsgrove Area School District located in central Pennsylvania was granted (Appendix A). Approval from Oklahoma State University's Institutional Review Board was also obtained (Appendix B). All of the following procedures were conducted in accordance with the guidelines for ethical treatment of human subjects. Subsequent meetings with the investigator, Director of Elementary Education, the elementary physical educators in the district, and the classroom teachers confirmed the role that each would play for the selection of the subjects and the collection of data.

Selection of Subjects

The subjects were 75 volunteers from the fourth grade physical education classes in a central Pennsylvania school district. The participants in this study represented five different schools and were selected from seven different classes. The subjects ranged in age from 9-11 years. Only those who had no contraindications to exercise as indicated by the parent/guardian on the informed consent were eligible for the study (Appendix C).

The students were initially approached by the investigator during a regularly scheduled physical education class of 35 minutes duration. Following a fast-paced cardiorespiratory game, which the investigator had previously found to be highly enjoyable with other similar aged students, the class was led in a discussion about physical fitness. The purpose and description of the study were explained at an age appropriate level, including the expectations for the respondents and how they were to be assigned to the groups. Appendix D outlines the material presented to the students. The verbal solicitation of the students was followed by a student carried letter and consent form to the parents on the same day (Appendixes C and E). Both student and parent/guardian were asked to sign the informed consent form.

One hundred sixty fourth grade students were invited to participate in the study. Respondents totaled 107 or 66.9%

of the initial group. Subjects were randomly divided into control and experimental groups. Initially, the control group numbered 54 and the experimental group 53 with these numbers eventually reduced to 46 and 44, respectively. The primary reason subjects were dropped from the study was due to absenteeism for pre- or post-test of the one-mile run/walk (10 students). Concerted effort was made to make-up missed tests to avoid dropping subjects from the study due to incomplete data. Other reasons for dismissing subjects included the following: student request, (4); moved, (2); injury unrelated to the study, (2); and inability to complete the tests, (1). Subjects non-compliance to the treatment further reduced the number of subjects analyzed in the experimental group from 44 to 29, 20, 23, and 29 for the respective variables of cardiorespiratory endurance, muscular strength/endurance, flexibility, and body fat percentage. The number of subjects analyzed for the control group for the respective variables was 46, 44, 45, and 46. One control subject moved before all the post-test data could be collected and another was unable to finish the sit-up posttest.

Subjects assigned to the treatment group were asked to complete a survey during their regular classroom time indicating their preference, accessibility, and ability to engage in selected aerobic exercises (Appendix F). After an explanation and examples of each item had been given as well

as an opportunity for students to ask questions, students completed the survey in a step by step manner under the guidance of the investigator.

Selection of Assessment Instruments

A literature review indicated that the AAHPERD Physical Best (1989) battery of health related physical fitness tests had acceptable levels of reliability and validity (Pate, 1991), and had been endorsed by the AAP (1991) as the method of choice for testing. For these reasons, as well as its development by leading professional experts in the field of health and physical education, and the investigator's own administrative experience with the battery, the test items for the study were selected from the Physical Best battery.

To reduce time requirements and maintain simplicity for the administration of both the data collection phase of the study and student participation in the exercise program, only one assessment for muscular strength and endurance was made. Bent-knee sit-ups when combined with the sit and reach met the need for abdominal strength and flexibility of the lower back and hamstrings as a means to minimize one's risk of lower back injury. Additionally, sit-ups were deemed the most practical for students to execute on their own for the treatment phase of the study. Therefore, sit-ups were selected as the method of assessment of muscular strength and endurance for the study.

For the purposes of this study, the protocol selected among the Physical Best (AAHPERD, 1989) options for estimating percent body fat was the sum of the triceps and subscapular. It was the experience of the investigator that it was easier to obtain the subscapular skinfolds for the following reasons: 1) Seasonal conditions dictated that subjects would wear long pants. The current trend in pants was a tightly fitted ankle which would have necessitated lowering the pants to obtain the skinfolds. Despite precautions taken to isolate the subject, complete privacy was not ensured. Therefore, this method was unacceptable. 2) The problems encountered in other studies of acquiring an unincumbered evaluation of the subscapular for female subjects was not likely to be encountered with the age of these subjects. 3) Further rationale for this choice is offered by Lohman (1987) who found no difference in estimating percent fat in children when the sums of the triceps and subscapular or the triceps and calf skinfolds were used.

Test Procedure

The two physical education class sessions prior to the start of the treatment served as the time period for collection of the pretest data. Since classes met only every third school day, the time frame for gathering the data was from 9 to 10 days prior to the explanation and

implementation of the treatment for the experimental subjects.

All subjects participating in the study were administered four pretests: one mile run/walk, maximum number of sit-ups in one minute, sit and reach, and sum of triceps and subscapular skinfolds. Subsequently, identical posttests in the two physical education class periods following the eight weeks of the program were administered. In some instances it was necessary to retain a few students past the scheduled 35 minute class session to obtain all data. Students who were absent for test dates were measured by the investigator following their return to school when the tests could be administered prior to the execution of the treatment phase of the study or within one week following the completion of the treatment phase. Due to time constraints, unless a student could perform the one mile run/walk with another class, no further attempt was made to make-up that analysis. The researcher administered all the tests with the assistance of the physical educator in charge of the class being tested. Subjects were assessed in mass for the mile run/walk and sit-ups and individually for the sit and reach and skinfolds evaluations.

The following physiological measurements, as a part of the Physical Best (1989) program from the American Alliance of Health, Physical Education, Recreation, and Dance (AAHPERD) were utilized in the study.

Cardiorespiratory Endurance

The one mile run/walk for time was used to estimate maximal oxygen uptake for each subject. The test was conducted on an outdoor course designated by traffic cones and consisted of 440 yard laps. Prior to the testing date subjects were requested via a written reminder to wear appropriate footwear and comfortable clothing.

Following a period of warm-up and instruction of the test which had been explained to the students previously, the entire class at the request of the physical education instructor in charge (approximately 25 students), whether involved in the study or not, ran in mass. The physical education instructor verbally assigned a number in rank order to each student as the mile was completed, and recorded the names of each student next to the order in which they finished the run. The investigator recorded the finish times in minutes and seconds corresponding to the order in which subjects crossed the finish line. Then students compared their finish place with the physical education teacher to eliminate any confusion among those who crossed the finish line at approximately the same time.

Muscular Strength and Endurance

The bent-knee sit-up test was preceded by an explanation including what constituted a correct effort. The acceptable technique was demonstrated to the subjects in

the following manner. A supine starting position on mats with knees bent, feet on the floor, and heels 12-18" from the buttocks was assumed. The subject's arms were crossed and held against the chest with the hands on opposite shoulders and the chin tucked to the chest. A partner held the ankles and counted each effort when the subject curled up and touched the thighs with the elbows while the arms were still in contact with the chest and returned the midback to the down position. The students collectively evaluated aloud as the investigator performed correct and various types of incorrect examples. Subjects then tested in mass, one-half of the class at a time for one minute each. Upon completion, the investigator recorded the number of sit-ups performed by each subject as judged by the student partner.

Flexibility

An explanation and demonstration of the sit and reach test was presented to the entire class by the investigator. For testing, each subject was in the seated position with the legs and arms fully extended and the hands overlapping, palms facing downward. Shoes had been removed and the heels were placed approximately shoulder width apart against a specially constructed apparatus box built according to Physical Best specifications (AAHPERD, 1989). Subjects were permitted three fair trials before the most distant

point of the fourth reach was recorded to the nearest centimeter. To constitute a fair trial subjects held the reach for a minimum of one second, maintained locked knees, and kept one hand evenly on top of the other. To assure conformity to these standards the investigator placed one hand on the participant's knees.

Initially four subjects were allowed to warm-up with slow, steady stretches. Thereafter, the investigator tested each subject individually while the physical education instructor conducted lessons with the bulk of the class. Upon completion of the analysis, the subject rejoined the class after notifying the next person being tested to warm-up.

Estimation of Body Composition

The stage area of the multi-purpose room offered privacy for administration of body fat assessment by the investigator while the physical educator conducted class with the remaining students. To speed the evaluation process, two students of the same sex waited off-stage while one was tested. Upon completion of the test, the individual joining the class would be told who to send back to the stage area.

Each subject's body fat percentage was estimated with the sum of the triceps and subscapular skinfolds measurements. Each site was measured by the investigator

with a Lange skinfolds caliper at least two times. If a discrepancy was found, a third measurement was taken to insure accuracy. The right side of the body was used for the procedure barring the presence of any scars, injuries, etc., in which case the left side would have been used. The specific location and measurement of each site was as follows:

Triceps. A vertical fold was raised midway between the right olecranon process of the humerus and acromion process of the scapula on the posterior of the triceps brachium. The subject was positioned with the arm relaxed, palm facing the right leg.

Subscapular. A diagonal fold, inclined approximately 45 degrees from horizontal, in the natural cleavage of the skin was picked up at the inferior angle of the scapula. The subject was standing comfortably erect with the arms relaxed at the sides of the body.

Exercise Program

The individualized self-monitored exercise program consisted of cardiorespiratory, muscular strength and endurance, and flexibility components for the experimental subjects. Control subjects were instructed to go about their usual daily exercise routine.

Cardiorespiratory Endurance

The cardiorespiratory endurance phase of the program was prescribed by the investigator in relation to the intensity, duration, and frequency by which it should be carried out as described below. The duration of the activity served as the modifier for the gradual progression of the program. Duration was individualized for experimental subjects to assist with the difficult task of program adherence for those trying to change their behavior. Exercise modality, such as running or bicycling, was also individualized to enhance the enjoyment of the participant and adherence to the program. An important factor of the modality selection was the input from the subject's interests. Also, subjects could participate with others if they desired to do so.

Intensity. Experimental subjects were instructed to exercise at a level of intensity which required them to breathe hard and still be able to speak out loud for the duration of the exercise. The investigator detailed a full explanation of the application of this concept complete with a physical demonstration as to what constitutes too little an effort or too great an intensity so that participants could see and hear how the breathing should be. This included strict instructions that emphasized students should exercise no harder than their ability to vocalize permitted.

However, subjects were cautioned to keep their breathing elevated throughout the duration of the exercise. This meant they could slow down as often as necessary when breathing became too labored to articulate sound, but should not stop for extended periods of time.

Duration. As a result of the pretest performance on the mile run/walk, subjects were categorized into quartiles according to the NCYFS or NCYFS II normative scores associated with the age of the child at the time of the test (Ross, Dotson, Gilbert, & Katz, 1985; Ross, Pate, Delpy, Gold & Svilar, 1987). For example, the raw score of the subject's time for the mile run/walk determined the participant's placement within the four quartiles. Synthesizing the recommendations from the literature review for exercise prescription of children with regard to physiological and psychological components, the investigator developed the progression for exercise duration as outlined in Table I.

Subjects were directed to keep track of the time spent in the aerobic activity and report the number of minutes engaged in exercise on the form named by the investigator as the Progress Report for Finding Fitness (Appendix G). Whether subject's elevated breathing to an acceptable level throughout the exercise bout was indicated by a yes or no response below the time recorded for the activity (Appendix G). Earlier, if participants had responded negatively on

TABLE I

PROGRESSION OF DURATION OF AEROBIC EXERCISE ACCORDING TO QUARTILE SCORE ON ONE MILE RUN/WALK PRETEST

Quartile	Week 1	2	3	4	5	6	7	8
0%-25%	6:00	7:00	8:00	9:00	10:30	12:00	13:30	15:00
26%-50%	8:00	9:30	11:00	12:30	14:00	16:00	18:00	20:00
51%-75%	10:00	12:00	14:00	16:00	18:00	20:00	22:00	25:00
76%-100%	12:00	14:30	17:00	19:30	22:00	24:30	27:00	30:00

Time is in minutes and seconds.

the Physical Activity Survey (Appendix F) to possessing an appropriate watch that could be used while exercising, the investigator loaned the child a watch.

Frequency. Experimental subjects were instructed to complete the cardiorespiratory phase of their program a minimum of three times per week for the eight weeks of the study. Subjects were permitted to repeat the program up to a maximum of five times per week if they so chose. The physiological ramifications for overloading beyond five workouts per week were discussed with the participants.

Modality. The type of cardiorespiratory exercise the participant was to engage in was listed on the Individual Exercise Program for Finding Fitness (Appendix H). The investigator determined a variety of choices, such as bicycling, jumping rope, or running, for the individual

dependent upon their response to the Physical Activity Survey (Appendix F). Subjects were advised they could alternate the mode of cardiorespiratory exercise if they chose to do so. If all of the choices became monotonous to the individual, the subject was asked to call or see the investigator about changing the exercise mode.

Flexibility

To lengthen the muscle tissue of the lumbar area of the back and the hamstrings as a means for reducing injury to the lower back, the same sit and reach exercise used for testing was utilized, but without the apparatus box. Subjects were reminded to begin in a seated position with legs extended, to keep both hands together and reach as far forward as possible with slow, sustained effort. Should the point of discomfort be reached, the subject should relax before pain was evident. Subjects were advised to complete one set of the sit and reach exercise for the specified number and length of time prescribed prior to engaging in the aerobic phase of the program, and the second set after all other exercise had been completed. The sit and reach exercise should be performed from three to five times per week as directed for compliance.

The specific progression for duration and number of repetitions was derived by the investigator. It was based on the recommendations of Corbin and Lindsey (1985) with

consideration of the age and capabilities of the fourth grade child. The information is shown in Table II.

If the participant completed the stretches as specified, they placed a check mark on the progress report under the appropriate day of the week for flexibility. The report was left blank if they did not comply (Appendix G).

TABLE II

DURATION, REPETITIONS, AND SETS FOR THE SIT AND REACH FLEXIBILITY EXERCISE

	Week							
	1	2	3	4	5	6	7	8
Number of repetitions	5	5	5	5	5	5	5	5
Time held in seconds	10	15	20	25	30	35	40	45
Total number of sets	2	2	2	2	2	2	2	2

Muscular Strength and Endurance

To condition the abdomen for muscular strength and endurance as a means of minimizing low back injury, sit-ups were used. Experimental subjects were directed to complete as many sit-ups as possible within one minute. They were instructed to use the same format as when tested with sit-ups but without anyone holding the ankles. The investigator

suggested the subjects be timed by an observer as a motivational tool, but could monitor their own duration if no one was available. Subjects were challenged to try to complete the number of sit-ups accomplished during the pretest and to add one or two to that number each exercise session. To assure compliance with the exercise program, participants were directed to complete the sit-ups phase of the program three days but no more than five days per week.

Subjects reported the number of sit-ups performed in one minute for each day completed on the Progress Report for Finding Fitness. On days where no sit-ups were executed, the form was left blank (Appendix H).

Body Composition

Although body composition is an essential health related physical fitness component, it was beyond the scope of this study to administer a specific intervention in the treatment of the subject to manipulate this variable. The present study was interested only in how appropriate activity might impact percent body fat.

Instructions to Experimental Subjects

The program developed for student's called the Individual Exercise Program for Finding Fitness, was explained in detail to the treatment subjects by the investigator (Appendix H). Every phase of the program, as

specified in Appendix H, was elaborated. Each subject had their own personalized program to look at during the consultation and was encouraged to ask questions. Further, the investigator asked different students to demonstrate the procedure for the sit and reach and sit-ups exercises. Aided by the researcher, the subjects critiqued the execution of their peers' performance. Then the subjects performed the exercises in mass until the investigator was satisfied that each participant was adept in using proper technique.

The investigator enumerated each of the Tips for Finding Fitness (Appendix I) which accompanied the Individualized Exercise Program (Appendix H) in detail. Subjects were given the opportunity to ask questions. Additionally, they were encouraged to go over these forms with their parents.

Finally, students were quizzed as to the particulars of the program implementation. For example, "How many seconds should the sit and reach be held during week 4?", and "What do you put in the box for sit-ups on week 2?".

Reporting Procedures

Experimental participants reported weekly to the investigator via the Progress Report for Finding Fitness (Appendix G). The forms were dropped off in the regular classroom where the subject was responsible for picking up

the form for the following week. To minimize any confusion, each weekly progress report had at the top of the page, the date of the week it covered and when it was to be returned to school.

Parents initialed the reports as a means of involving them with their child in the study. It was hoped that this would generate discussion and support between parent and child that would motivate the child to adhere to the exercise program.

In the communication to the participants, the focus was on accurate record keeping. With the manner of presentation, subjects were made to feel that what they reported was valuable in regard to the outcome of the study as opposed to feeling pressured to report compliance, whether they did or did not.

Extrinsic Awards

Those returning their Progress Report for Finding Fitness (Appendix G) were awarded a star by their name on a chart displayed in the regular classroom. The two-fold purpose was: (1) to encourage participants to return their forms, and (2) to help maintain continued interest for the study. An added incentive, in the form of the promise of an extra, unnamed extrinsic reward for returning all of the forms during the eight weeks, was given to all subjects without regard to compliance or non-compliance. This offer

was made during the first week of study. Control subjects were included in the award scheme if they stayed in the study. Upon completion of the collection of data, all subjects were given certificates of participation and a frozen yogurt treat from a local business. Those experimental subjects who returned all their weekly reports and those control subjects who remained in the study were also rewarded with a camera from a local business. These awards were accompanied by a letter acknowledging the supplier and suggestions for continued physical activity (Appendix J).

Criterion for Program Compliance

Each segment of the exercise program was judged separately to determine compliance with the independent variables of the study. The Progress Reports for Finding Fitness were the basis for the investigator's decision concerning compliance. Each phase of the program had to be carried out a minimum of three times per week for six of the eight weeks to be deemed compliant. Further, the following restrictions had to be met for the cardiorespiratory aspect of the program: 1) the number of minutes engaged in the activity had to meet the minimum requirement stated on the individualized exercise program for the week involved; and, 2) the subject had to report "yes" for sustained, elevated breathing.

Follow-Up Procedures

All subjects were provided with their confidential pre- and posttests scores along with the age appropriate AAHPERD standards. A letter of explanation to be reviewed with the parent(s)/guardian(s) accompanied the confidential results (Appendix K). The certificates of participation and a letter accompanying the other extrinsic rewards were also sent with all the subjects.

Analysis of Data

Prior to the analysis of the data, each subject's gain score was determined by subtracting the raw pretest score from the raw posttest score for the one mile run/walk, sit-ups, and sit and reach. The sum of the triceps and subscapular skinfolds were first converted into the percent body fat before gain scores were determined for that variable.

The gain scores for the variables of cardiorespiratory endurance, muscular strength/endurance, and flexibility were then statistically subjected to separate 1 x 8 analysis of variance (ANOVA) for each phase of the program. The four sub-groups or quartiles for the experimental and the four quartile sub-groups for the control comprised the eight cells for each ANOVA. The gain scores for body fat percentage were not subdivided into quartiles. Percent body fat was statistically investigated by a *t*-test. All

dependent measures were tested at the .05 level of significance. Meaningful findings were subsequently submitted to Duncan's post hoc analysis.

CHAPTER IV

RESULTS AND DISCUSSION

The purpose of this study was to determine the effects of an eight week individualized self-monitored exercise program on health related physical fitness among fourth grade students. Seventy-five subjects, sub-divided into an experimental and a control group, assisted in this effort. The treatment participants self-monitored an individualized exercise program consisting of cardiorespiratory endurance, muscular strength/endurance, and flexibility components. These physiological parameters were assessed along with the percent of body fat.

A total of 75 subjects were analyzed in the areas of cardiorespiratory endurance, muscular strength and endurance, flexibility, and percentage of body fat. The specific number of students analyzed for each component was 75, 64, 68, and 75, respectively. The discrepancy in these figures is explained primarily by the rate of compliance to the treatment by the 44 experimental subjects of the experimental group. The number of participants remaining in the experimental group for each of the variables was: cardiorespiratory endurance, 29; muscular

strength/endurance, 20; and flexibility, 23. Statistical analysis for body fat was determined by using the same subjects that complied with the cardiorespiratory endurance phase of the treatment. Therefore, 29 subjects were evaluated for body composition in the experimental group. The number of subjects analyzed in the control group also fluctuated. One control subject moved prior to the collection of all posttest data, and another was unable to complete the sit-up posttest. The number of subjects evaluated in the control group was: cardiorespiratory endurance, 46; muscular strength/endurance, 44; flexibility, 45; and percent body fat, 46.

Descriptive Data

The subjects ranged in age from 9-11 years. Participants included fifty 10 years old; twenty 9 years old and five 11 years old. The distribution by gender in the control and experimental groups was females, 25 and 12, respectively, and males, 21 and 17, respectively. The means and standard deviations for cardiorespiratory endurance, muscular strength and endurance, and flexibility are shown in Table III.

In regard to percent body fat, the experimental group displayed a mean gain score of -0.70 and standard deviation of 2.14 after the 8 week study. These values were -.14 and 1.91, respectively for the control group.

TABLE III

MEANS AND STANDARD DEVIATIONS FOR CARDIORESPIRATORY ENDURANCE, MUSCULAR STRENGTH AND ENDURANCE, AND FLEXIBILITY

Quartile Groups	Variable					
	Cardiorespiratory Endurance (time in sec.)		Muscular Strength and Endurance (number per min.)		Flexibility (centimeters)	
	Expt.	Control	Expt.	Control	Expt.	Control
0-25%	-130.4 (86.7) n=14	-35.9 (122.2) n=18	10.0 (7.1) n=2	5.5 (5.2) n=9	1.5 (3.5) n=9	1.0 (2.6) n=14
26%-50%	-61.4 (48.7) n=5	-12.2 (98.2) n=9	2.5 (7.3) n=6	4.6 (7.2) n=11	-2.5 (1.9) n=4	1.6 (3.2) n=13
51%-75%	-3.4 (48.3) n=5	19.1 (103.5) n=10	2.4 (5.0) n=7	3.0 (4.2) n=15	1.0 (1.7) n=3	1.1 (2.3) n=11
76%-100%	-28.2 (28.0) n=5	0.0 (64.4) n=9	2.8 (6.1) n=5	-1.3 (5.0) n=9	-1.1 (3.7) n=7	1.0 (2.4) n=7

Results

Significance of participation in the individualized self-monitored exercise program of the selected physiological measurements was determined by using three separate measures of analysis of variance (ANOVA) of the gain scores for cardiorespiratory endurance, muscular strength and endurance, and flexibility. The initial assignment to a cell within the 1 x 8 ANOVA was dependent

upon the pretest performance scores of the variable. The subsequent data that emerged as the gain scores for the two groups (control and experimental) of four sub-divisions each (quartiles of 0-25%, 26%-50%, 51%-75%, and 76%-100%) were analyzed in an 1 x 8 ANOVA. Percent body fat was evaluated by the comparison of control and experimental gain scores with a *t*-test. The results of these procedures are found in Tables IV-VI.

TABLE IV

ANALYSIS OF VARIANCE: COMPARISON OF CARDIORESPIRATORY ENDURANCE BETWEEN EXPERIMENTAL AND CONTROL GROUPS

Source	Sums of Squares	Degrees of Freedom	Mean Square	F
Between Groups	178554.5	7	25507.78	2.91*
Within Groups	586789.3	67	8758.05	
Total	765343.8	74		

* Significance $P<0.05$.

The results of the this study showed that after an individualized self-monitored exercise program of 8 weeks duration, the only significant improvement of the selected physiological components assessed was in cardiorespiratory

TABLE V

ANALYSIS OF VARIANCE: COMPARISON OF MUSCULAR STRENGTH/ENDURANCE BETWEEN EXPERIMENTAL AND CONTROL GROUPS

Source	Sums of Squares	Degrees of Freedom	Mean Square	F
Between Groups	252.10	7	36.01	1.01
Within Groups	1994.34	56	35.61	
Total	2246.44	63		

TABLE VI

ANALYSIS OF VARIANCE: COMPARISON OF FLEXIBILITY BETWEEN EXPERIMENTAL AND CONTROL GROUPS

Source	Sum of Squares	Degrees of Freedom	Mean Square	F
Between Groups	83.74	7	11.96	1.42
Within Groups	504.42	60	8.41	
Total	588.16	67		

endurance, F=2.91, $P<0.05$ (Table V). Further investigation of this variable using Duncan's post hoc analysis, revealed the subjects in the lowest experimental quartile (0-25%) had

significantly greater improvement when compared with participants in the three upper control quartiles (26%-50%, 51%-75%, 76%-100%), and the third quartile (51%-75%) of the experimental group.

The stated hypotheses of the study and the application of the statistical analysis to each of them yields the following outcomes:

1. There will be no significant differences in the gain score measurements of cardiorespiratory endurance at the end of eight weeks for fourth grade subjects completing the experimental treatment and those who are in the control group. The study outcomes rejected this hypothesis based on the significant findings of the experiment at the .05 level of confidence.

2. There will be no significant differences in the gain score measurements of muscular endurance and strength at the end of eight weeks for fourth grade subjects completing the experimental treatment and those who are in the control group. The investigation findings failed to reject this hypothesis.

3. There will be no significant differences in the gain score measurements of flexibility at the end of eight weeks for fourth grade subjects completing the experimental treatment and those who are in the control group. As a result of no significant findings, this hypothesis failed to be rejected.

4. There will be no significant differences in the gain score measurements of percentage of body fat at the end of eight weeks for fourth grade subjects completing the experimental treatment and those who are in the control group. A *t*-test of gain scores for percent body fat showed no significant differences. Therefore, the hypothesis failed to be rejected.

Discussion

It was postulated in this study that an individualized self-monitored exercise program of health related physical fitness for fourth grade students could improve the components of health related physical fitness (cardiorespiratory endurance, muscular strength/endurance, flexibility, and body composition). In regard to the most critical component of health related physical fitness, cardiorespiratory endurance, the intervention was positive.

The experimental subjects who adhered to the program and who were in the lowest quartile showed the greatest gain score in cardiorespiratory endurance when compared to those in the upper three quartiles of the control group. An examination of the means in Table III showed the only group that did not improve in their raw score was the 51%-75% control quartile. One might speculate that, in the spring, all the subjects became more active. However, the attention to relevant activity for the experimental condition caused

improvement with each of the quartiles when compared with the respective control counterpart. Further, as already stated, this improvement was significant for the previously lowest fit quartile in the experimental group. This finding is consistent with the literature which indicated the most notable gains are among those initiating an exercise program, and the smallest quantitative gains are among those who are already highly fit.

What was surprising to find was the magnitude of the cardiorespiratory improvement among the 0-25% experimental quartile given the treatment conditions. To accommodate the psychological and physiological suggestions of the literature germane to exercise adherence, the duration of the exercise bout for the treatment of the low fit groups was noticeably below the duration standards recommended for the improvement of physical fitness. However, as other research has suggested, lower levels of activity may be beneficial to increase health benefits. In this case, it appears to also be advantageous in improving cardiorespiratory fitness. It was not surprising that the gains in the highly fit groups were small since, according to the literature, it is difficult to show substantial improvement at that level.

Changes in muscular strength/endurance and flexibility did not exhibit any significant findings nor were any trends established. There are four probable explanations for these

outcomes. First of all, self report is a potential source of error as defined in the literature. To reduce the error the following precautions were taken. 1) Careful attention was given to the explanation of the procedures of the program and the design of the self report forms. 2) Conformity to the most successful self report forms (Baranowski et al., 1984) using exact minutes and a segmented day format was potentially improved upon in the present study. Subjects not only reported the exact minutes, but were asked to complete the form immediately following the workout. This procedure further capitalized on the more accurate short term memory recall. 3) Further, the use of a watch was adhered to in the program implementation to minimize cognitive error in recording. Even with all these precautions, those who employ self report admit to certain limitations of validity and reliability. In this study, the fourth grade student may have recounted their exercise incorrectly, either inadvertently or purposefully.

Second, the treatment may have been ineffective. There was no variety in the treatment plan for the required sit-ups and sit and reach exercises. Although it was not documented by a quantitative method, there were some unfavorable student comments concerning dislike for these exercises. The lower rate of student compliance would tend to confirm in a quantitative manner the suspicion that

subjects did not comply because of their dissatisfaction with the exercises. Further, the literature strongly favors enjoyable activity as a means of establishing intrinsic motivation and adherence to exercise. The subjective student reaction regarding sit-ups could be interpreted to suggest that students who did comply to the treatment were not fully motivated to perform. This may be especially true since subjects were asked to perform at a high intensity level.

A third interpretation of the results may stem from the data collection of the pretests and posttests. The literature reported the reliability of sit-ups as a measure of abdominal endurance/strength ranged from 0.6-0.8. The reliability of the sit and reach was high, usually in excess of 0.9, and inter-tester reliability when measuring children was 0.89-0.98 (Pate, 1991). However, a feasible argument that with children assessing the sit-ups to determine the number counted toward the total an error could have been made. Also, due to time constraints, it was necessary for the physical educator to assist the investigator with the sit and reach tests. Although the instructor was trained to conduct these evaluations, the fact that different individuals administered them introduced an element of variance.

Finally, a combination of all these factors may have caused interactions which affected the outcomes.

The final variable that did not change meaningfully as a result of participation in the individualized self-monitored exercise program was the percentage of body fat. One possible explanation for no significant results for decreased body fat could be insufficient time. Such a conclusion would be consistent with the literature. It was noteworthy that body fat decreased more in the experimental group than it did in the control group. This leads one to speculate whether this trend would become significant with longer treatment.

Finally, some of the results could be attributed to the limited number of subjects. A design utilizing a cluster sample might possibly help control any contamination in the variables due to internal validity factors such as values, history, and attitudes of the subjects.

Summary

Expansive previous research has demonstrated that American children lack desirable levels of health related physical fitness components. The need for relevant exercise is linked to a beneficial health and physical fitness status. Unless there is appropriate intervention for those exhibiting risk for CVD, the symptoms could manifest into CVD.

Earlier research indicated children engaged in physical activity primarily outside of school. A significant number

of children, nearly one-fifth, reported no physical activity other than what they received in the school program. Further, the focus and extent of MVPA in the physical education program was insufficient for physical fitness needs. Prior research was inadequate in assessing whether activity of children outside physical education is relevant to health and physical fitness needs.

The time criterion necessary for the improvement of health related physical fitness was beyond most school physical education programs. However, the critical role played by the educational system serves as the basis for the cognitive, affective, and psychomotor development necessary for the self actualization of implementing lifetime physical activity. Therefore, an alternative mean for children to attain appropriate exercise was required. The implementation of a program such as the one suggested in this study may foster the inclusion of physical activity by choice. Such a practice could enhance the physical education program and serve as a solution to the dilemma now faced by the physical education practitioner.

CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

The need for relevant physical activity among children to improve the low levels of physical fitness that currently exist has been well established. Research has further documented the school physical education program as the foundation for initiating appropriate change in the exercise habits of young people. However, the frustration of too little time within the framework of the school program to satisfy the physiological conditions for the improvement of health related physical fitness poses a complex dilemma. In an effort to extend the physical education program beyond the confinements of the school, the present study was conducted.

The purpose of this study was to determine the effects of an eight week individualized self-monitored exercise program on health related physical fitness among fourth grade students. Seventy-five subjects, sub-divided into an experimental and a control group, assisted in this effort. The treatment participants self-monitored an individualized exercise program consisting of cardiorespiratory endurance, muscular strength/endurance, and flexibility components.

These physiological parameters were assessed along with the percent of body fat.

The results of this study showed a significant difference in cardiorespiratory endurance, or estimated Vo_{2max}, at the end of the eight week individualized self-monitored exercise program. Specifically, those in the lowest quartile of the experimental group exhibited the most meaningful improvement when compared with those in the upper three quartiles of the control group and the next to highest treatment quartile. No significant differences were found in abdominal muscular strength/endurance, lumbar/hamstring flexibility, or body fat percentage.

Conclusions

The results of the study are the justification for the following conclusions. The first resolve is the fourth grade students of the study were capable of monitoring and complying with an individualized self-monitored exercise program of eight weeks duration. Physical educators should take advantage of this additional opportunity for improving health related physical fitness. Secondly, appropriate cardiorespiratory activity produced a training effect after eight weeks within the study sample. Finally, the present study did not elicit significant changes in muscular strength/endurance, flexibility, or body composition. Changes in the current format would be required to invoke

significant differences in these areas.

Recommendations

The following recommendations for future research related to individualized self-monitored exercise programs for elementary students are:

1. An investigation of extended length (16 weeks, 24 weeks, 32 weeks) examining the same physiological variables as this study. With any future study, and particularly a longer one, it is recommended that there should be provisions for variation of all the activities of the exercise program. For example, sit-ups could be conducted in a modified fashion which may include reverse sit-ups, crunches, and/or curls, and performed in a manner in which the speed of execution is either increased or slowed. A more playful approach to developing the components of muscular strength/endurance and flexibility could be employed, examples include using rhythmic aerobic activities for calisthenics or resistive stretches using an elastic band. A study of longer duration may also focus on different muscle groups for the enhancement of muscular strength/endurance and flexibility.

2. An analysis of other elementary age groups using the same principles of this study.

3. An investigation following the guidelines of this study but restricted to indoor activities that the child

could engage in at home during the winter months.

4. A study coupling the individualized self-monitored exercise program with an educational program on nutrition for subjects who are targeted as over fat.

5. An examination of subjects targeted at risk for CVD which utilizes the same physiological variables as those in this study in addition to the variables of diastolic and systolic blood pressure, and blood lipid profiles.

6. An investigation of the effects of an individualized self-monitored exercise program on girls versus boys using the same variables as this study.

7. A study focusing on the rate of adherence of boys versus girls to an individualized self-monitored exercise program and the ramifications of the findings.

8. An inquiry of the differences in the health related components used in this study contrasting a control group to those within a treatment group who complied and those who did not.

9. An investigation using the variables of this study in a manner which would allow for the analysis of exercise of the control group.

10. A study design utilizing cluster sampling for the previously mentioned research projects.

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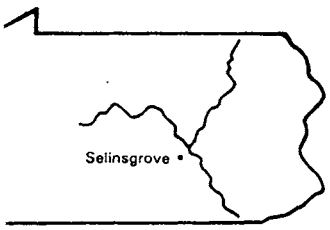
APPENDIX A

SUPERINTENDENT APPROVAL



SELINSGROVE AREA SCHOOL DISTRIC

401 NORTH EIGHTEENTH STREET, SELINSGROVE, PA. 17870-1198 PHONE: 717-374-1144

RL G. ROHRBACH, D. Ed.
perintendent

February 4, 1991

Mrs. Mavis Zeigler
25 Meadowbrook Drive
Selinsgrove, PA 17870

Dear Mrs. Zeigler,

I have reviewed your request for permission to conduct research in the Selinsgrove Area School District in regard to your Doctoral program for Oklahoma State University. It is my understanding that you will utilize fourth grade students to study the effects of individualized exercise based upon prescriptions as a result of diagnosis of the child's health and related fitness.

Approval is given for you to conduct this study. Individual releases must be obtained from the parents of each child. I would suggest that you make contact with Mrs. Maureen Wagner, Acting Director of Elementary Education at 374-1140, to further discuss your project.

I wish you well.

Sincerely yours,

Karl G. Rohrbach, D.Ed.
Superintendent

KGR/cab/mzeigler

CC: Mrs. Maureen Wagner

APPENDIX B

INSTITUTIONAL REVIEW BOARD FOR HUMAN SUBJECTS APPROVAL

IRB APPROVALS

April 10 - May 22, 1991

EXPEDITED PROPOSALS

AS-91-026 The Effects of Cigarette Smoking on Performance
Principal Investigator: F. Collins/K. Skaar
Reviewers: K. Kocan/H. Sare

AS-91-038 The Relationship Between Smoking, Eating, and Emotion
Principal Investigator: F. Collins/S. Corzatt
Reviewers: B. Stoecker/M. Tilley

ED-91-027 The Effects of a Self-Monitored Exercise Program on Health-Related Physical Fitness Among Fourth Grade Students
Principal Investigator: B. Edgley/M. Ziegler
Reviewers: K. Kocan/J. McCullers

HE-91-019 Nutritional Status and Parasitic Infections of Homeless Children
Principal Investigator: J. Wolgemuth
Reviewers: B. Bryson/S. Edwards

APPENDIX C

INFORMED CONSENT FORM

Individual's Consent for Participation
in a Research Project

I, _____, on behalf of my child,_____, voluntarily agree to allow him/her to participate in this study entitled "The Effects of An Individualized Self-Monitored Exercise Program on Health Related Physical Fitness Among Fourth Grade Students" conducted by Mavis Ziegler.

The purpose of this study is to enhance health related physical fitness (cardiorespiratory endurance, muscular strength and endurance and body composition) by increasing appropriate activities outside of physical education classes.

I and my child understand that he/she will be assigned to one of two groups which are the control group and the treatment group (individualized exercise program, IEP), and that the group assignments are at random, by chance. All participants will be given pretests and posttests consisting of the one mile run/walk, sit-ups in one minute, sit and reach, and skinfolds measurements from the triceps (back of arm) and subscapular (shoulder blade). Those assigned to the treatment group, will be given an IEP to be performed a minimum of three times per week for eight weeks. I and my child understand that the activities in the IEP have been based on the participant's fitness tests (outlined above) and personal interests as indicated on a survey.

All participants in this study can expect to increase their knowledge of physical fitness and how to improve it. Further, those in the treatment group may also realize the following benefits: an increase in cardiorespiratory endurance, muscular strength and endurance, and flexibility, and a decrease in percentage of body fat.

I realize that, if the exercise guidelines that will be provided are adhered to, the potential risks of injury should not be any greater than when one normally engages in physical activities. I agree to assume the risk for and to properly instruct my child in safe conduct while bicycling, swimming, walking, or undertaking other activities that may lead to great harm such as being hit by a car, drowning, falling, etc.

By signing this consent form, I and my child acknowledge that participation in this study is voluntary. We also acknowledge that we have not waived any of our legal rights or released Oklahoma State University (institution from

which investigator will receive degree) from liability for negligence.

I and my child understand that participation is voluntary, that there is no penalty for refusal to participate, and that I or my child are free to withdraw consent and participation in this project at any time without penalty after notifying the project director.

If I have any questions or need to report an adverse effect about the research procedures, I will contact the principal investigator, Mavis Ziegler, by calling the number made available to me. I may also contact Terry Maciula, University Research Services, 001 Life Sciences East, Oklahoma State University, Stillwater, OK 74078: (405) 744-5700.

I have indicated below the nature and extent of any diseases or conditions that may adversely affect my child while exercising such as cardiovascular disease, arrhythmia, chest pain, shortness of breath, hypertension, respiratory disease, severe anemia, diabetes, asthma, marked obesity, physical or orthopedic disabilities, or other. I understand that when warranted, this may be reason for my child to be exempted from the study.

_____

_____

_____

_____

_____

Please check one.
_____ I will allow my child to participate in this study.
_____ I will not allow my child to participate in this study.

I have read and fully understand this consent form. I sign it freely and voluntarily.

_____	_____
Date	Signature of Research Subject (Student)
_____	_____
Date	Signature of Parent/Guardian Telephone Number
_____	_____
Date	Signature of Principal Investigator

APPENDIX D

OUTLINE OF VERBAL SOLICITATION TO SUBJECTS

VERBAL REQUEST TO FOURTH GRADE STUDENTS

FOR PARTICIPATION IN STUDY

I. What is Physical Fitness?

A. Health Related
1. Cardiorespiratory Endurance (Heart/lung)
2. Muscular Strength and Endurance
3. Flexibility
4. Body Composition

B. Skill Related

II. What can good physical fitness do for you?

A. You can get more fun out of what you are doing because you won't tire so easily.

B. You will be more alert so schoolwork and playing should go more smoothly.

C. You are helping yourself toward a better and fuller life. Being physically fit can make you look better, feel better, and help you to grow up to be the kind of person you want to be.

D. If you are interested in sports, becoming physically fit is a must.

III. The purpose of this study is to help you to work (play) toward better health related physical fitness and for physical education teachers to find a helpful way for you to do that.

A. By signing up you will be randomly assigned to a control group or treatment group.

B. Emphasize the importance of the two different groups and what it means to be a part of each group.

1. Control group--Basic group (like the foundation of the house) for all the results to be compared to. You will do whatever exercise you normally do or whatever you feel like doing.

2. Treatment group--Will be given an exercise program to follow each week for eight weeks. It can be part of play time and should take from 15 to 40 minutes, 3 to 5 times each week. There is

a short form you must fill out and turn in each week.

C. You may exercise with your friends, your favorite music or even your mom or dad. An important part of this program is to make certain that your exercise is enjoyable. That is why a survey will be used to find out your interests so your individual program can be geared to you.

D. Whether you are in the control or treatment group, you can expect to learn more about physical fitness.

E. If you sign up to participate and change your mind, you may drop out later. You won't get into any trouble if you decide to drop out.

F. To be part of the study you must have your parent or guardian sign the consent form and return it by March 18.

APPENDIX E

WRITTEN SOLICITATION TO PARENT(S)/GUARDIAN(S) AND SUBJECTS FOR PARTICIPATION

March 13, 1991

Dear Parent(s)/Guardian(s) and Fourth Grade Students,

As a doctoral candidate in education with an emphasis in exercise physiology, one of my long term professional and personal goals is to help young people achieve physical fitness. People with abundant physical vitality have been shown to be generally healthy, mentally alert and socially well-adjusted. Conversely, inactivity may lead to heart disease, back pain, obesity, ulcers, diabetes and depression among other things. Relevant physical activity during a child's growing years, can help to prevent or correct such problems.

The Selinsgrove Area School District has granted me permission to conduct a study with fourth grade students which will promote increased physical activity and enhance health related physical fitness (heart/lung endurance, muscular strength and endurance, flexibility and body composition). The important considerations of the study are as follows:

- Students would be assessed for health related fitness during physical education class. The items being used are the one mile run/walk for heart/lung endurance, sit-ups for abdominal strength and endurance, sit and reach for flexibility and skinfolds measurements to determine percent body fat. Except for the skinfolds, these tests are already a part of the curriculum.
- An individualized exercise prescription (IEP) would be developed on the basis of student's interests and the outcomes of the fitness tests for those students randomly assigned to the experimental group. Students placed in the control group would not be given an IEP.
- Experimental subjects should allow from 15 to 30 or more minutes, three times per week either at school or home for eight weeks to complete the IEP. The participation can be a part of normal play time.
- There should not be any undue discomfort or risk for the participant as long as the guidelines of the IEP are followed.

The emphasis of this study is to promote physical activity outside of physical education classes and to enhance health related physical fitness at the same time. The idea of individualizing the program is to make the exercise fun and to meet the needs of each participant. The concepts learned by the student participating in this study can be invaluable in their pursuit of a healthy lifestyle over the years.

You may indicate your willingness to participate by completing the informed consent attached on the next page and returning it to the school by March 19. Your confidential results will be made available to you at the end of the study. Thank you for your assistance and happy exercising!

Sincerely,

Mavis Ziegler,
Physical Education Specialist

APPENDIX F

SURVEY OF INTEREST

PHYSICAL ACTIVITY SURVEY

Name	Birthday (Mo.,Day,Yr.)	Telephone #

Classroom Teacher	School	Boy or Girl (circle one)

1. Do you have a watch that is digital or has a secondhand that you could use while you exercise?

(Circle) Yes or No

2. Put a check by any exercise you would like to do but **ONLY** if **ALL** of these describe you:

A. You know how.
B. You have the equipment.
C. You have the place to do it.
D. You <u>like</u> the exercise.

<u>Heart/lung Endurance Exercises</u>

_____ Bicycling
_____ Jumping Rope
_____ Race Walking (fast pace)
_____ Roller Skating
_____ Running/Jogging
_____ Swimming
_____ Other--Please Specify. It should be a type of exercise that will get you breathing hard for 10-20 minutes.

_____

_____

_____

APPENDIX G

PROGRESS REPORT FOR FINDING FITNESS

PROGRESS REPORT FOR FINDING FITNESS

For Week 1--April 7-13. **Return to school Mon., April 15.**

First and Last Name	Classroom Teacher	Parent/Guardian Initials

1. **Flexibility**--Put a check mark under each day you did the sit and reach stretches for flexibility. If you did not do all the stretches leave the space blank.

2. **Heart/lung Exercise**--Put the number of minutes you ran, walked, bicycled, etc. in the correct box. You should be breathing hard the entire time but still be able to talk out loud. Put a yes or no to show in the correct box if you did this.

3. **Muscle Strength and Endurance**--Put the number of sit-ups you did in one minute. Remember, your knees should be bent and your arms folded across your chest. Push yourself on this one!

	Sun	Mon	Tue	Wed	Thur	Fri	Sat
Flexibility Sit and Reach							
Heart/lung Exercise Run, Bike, etc. (number of min.)							
Breathe hard the entire time? (yes or no)							
Muscle Strength and Endurance Number of Sit-ups							

APPENDIX H

INDIVIDUALIZED EXERCISE PROGRAM

FOR FINDING FITNESS

INDIVIDUAL EXERCISE PROGRAM
FOR FINDING FITNESS

For_____ School _____

Classroom Teacher _____ Room Number_____

How to do your program.

1. Start with the sit and reach for a warm-up. Slowly stretch 5 times without bouncing. Stretch for as many seconds as shown for each week. You may count for this, one, two, etc.

2. Do one of the heart/lung exercises for the time shown each week. Do not count when you slow down and then walk as part of the exercise time. This means that if you are supposed to bike for 15 minutes, you ride without stopping. Push yourself so you are breathing hard and try to break into a sweat. However, you should still be able to talk out loud. You may do a different exercise on different days. Also, you may exercise longer if you want to and it is still comfortable for you. This means you can still talk out loud.

3. Do as many sit-ups as you can do in one minute. Remember, your knees should be bent and your arms folded across your chest.

4. Finish with another 5 sit and reach stretches. Hold them as long as you did to warm up.

5. Do your program at least three times each week but no more than five. Any more than that could be too much.

6. If you need to lower body fat, besides exercising, try to eat fewer foods high in fat and sugar. Examples are: French fries, other fried foods, butter, soda drinks, candies, cookies, etc.

FINDING FITNESS

EXERCISE PROGRAM

Week	1	2	3	4	5	6	7	8
Flexibility Sit and Reach Number of times Seconds Held	5+5 10	5+5 15	5+5 20	5+5 25	5+5 30	5+5 35	5+5 40	5+5 45
Heart/lung Exercise Bicycle, Jump Rope, Race Walk, Run, Swim, Minutes: Seconds								
Sit-ups As many as you can in 1 minute								

Other Heart/Lung Exercise you can do:

_____

_____

_____

APPENDIX I

GUIDELINES FOR FINDING FITNESS

EXERCISE GUIDELINES

Congratulations! You have taken an important step in becoming physically fit, getting started. So that your exercise program is fun and safe, please keep these important steps in mind.

1. WARM-UP your muscles. Do this by starting your activity slowly. Stretch slowly, hold for 10 or more seconds, and do not bounce. If you don't warm-up you could get hurt.

2. To improve you need to OVERLOAD. That is you need to do more than you have been doing. Your Exercise Program for Finding Fitness will tell you what you should do. Remember, if you go beyond this, it may be too much and you could hurt yourself.

3. You must overload for a SPECIFIC fitness area and body part. Stretching exercises will not build heart and lung fitness, neither will exercising the legs build up the arms. Your Exercise Program for Finding Fitness will help you get better in all the health related areas of physical fitness (heart and lung endurance, strength and muscle endurance, flexibility, and body composition).

4. PROGRESSION, or getting better one step at a time, is important. Please be patient and follow your program. You didn't start out reading with books so don't plan to be physically fit by the end of the week.

5. ALWAYS COOL DOWN AFTER EXERCISING!!! Do this by slowing down gradually and then walking. Your breathing should be back to normal before you stop to stand, sit, or lie down. It is helpful to repeat your stretches to keep from getting sore muscles.

6. If it hurts, you are doing something wrong. Some discomfort is allowed but not pain. The "no pain, no gain" way of thinking is not only ridiculous, but can be dangerous. Be sure you follow these guidelines. If it still hurts try to go easier. You can always give me a call if you continue to have problems.

7. Have fun with your exercise! You might want to exercise to music or with a friend or family member.

8. Record your exercise on a calendar to keep track of your progress. PLEASE, don't forget to bring the weekly progress report to school. Turn it in and put a star by your name!

APPENDIX J

EXPLANATION OF REWARDS TO STUDENTS

June 10, 1991

Dear Fourth Grade Student and Parent(s)/Guardian(s),

You have been so terrific that I wanted to do something extra to thank you. Also, I hope you will continue being active and eating right. Because I didn't have the funds to do something myself, I spent a lot of time asking businesses in the community to donate something to help out.

McDonald's has donated a frozen yogurt treat for everyone in the study to enjoy. Remember, it's OK to eat desserts sometimes. When you do, make wise choices. For example, frozen yogurt is healthier than ice cream because it has less fat.

The cameras are from Boscov's and are for those who returned all of their forms. See what different kinds of physical activities you can do when using it. Here are some suggestions:

*Take a nature hike and take pictures of the wildlife.
*Have a friend or family member take your picture while you are bicycling, running, swimming, doing chin-ups or push-ups, etc.
*Hold a neighborhood track meet with your friends and take pictures of the different events.
*Work out an active routine to music and take pictures.
*Come up with your own idea for a workout.

Boscov's has also given two jump ropes for each school in the name of the Fitness Finder's Research Study which can be used by all.

Have a great summer and remember to keep active. Exercise does make a better you!

Sincerely,

Mavis Ziegler,
Physical Education Specialist

APPENDIX K

RESULTS OF FITNESS TESTS

June 10, 1991

Dear Fourth Grade Student and Parent(s)/Guardian(s),

Thank you once again for your participation in the fitness study. You are to be congratulated for your efforts.

Included are the results from the pre and post health related physical fitness tests. Also shown is the American Alliance of Health, Physical Education and Recreation (AAHPERD) standard according to age for the tests. I would expect that those who were in the treatment group and who followed their exercise program as specified may have modest improvements in heart/lung endurance and somewhat greater gains in strength, muscular endurance, and flexibility. If exercise was drastically increased then a decrease in body fat may have resulted as well, although it would not be expected. Hot and/or humid weather adversely affects all the tests, especially the one-mile walk/run. The degree of motivation and attitude will also be factors. Eight weeks is a minimal amount of time to show improvement in any of these categories, especially body composition. Twelve weeks or longer with an appropriate exercise program should yield the results you want, so stick with it!

My hope is that you will continue to exercise. Heart/lung (cardiorespiratory) endurance is the most important of all the areas so you should especially "play" at that. Try to increase your heart rate so that you are breathing hard but are still able to talk out loud conversationally while you exercise. Maintain that for at least 15 to 60 minutes, three times per week. Some excellent types of exercise would be swimming, bicycling, race walking or jogging. Try to avoid the hottest part of the day and drink plenty of water, etc. Never wear plastic jogging suits, etc.

Fitness Test	Pre-Score	Post-score	AAHPERD Standard
1-mile run/walk (Heart/lung endurance)	_____	_____	11 min.--girls 10 min.--9 yr. boys 9:30 min.-10 yr.boys 9:00 min.-11 yr.boys
Sit-ups in one minute (Strength and muscle endurance)	_____	_____	28--9 year girls 30-10 girls & 9 boys 33--11 year girls 34--10 year boys 36--11 year boys

Sit-and-reach (Flexibility)	_____	_____	25 cm--girls and boys
Sum of Skinfolds (Body composition)	_____	_____	16 to 36 mm--girls 12 to 25 mm--boys

Again, thank you and I wish you the best. If you have any questions I may be reached at the number provided to you before June 13 or after July 5. Happy exercising! **You are terrific!**

Sincerely,

Mavis Ziegler,
Physical Education Specialist

VITA

Mavis Fairbanks Ziegler

Candidate for the Degree of

Doctor of Education

Thesis: THE EFFECTS OF AN INDIVIDUALIZED SELF-MONITORED EXERCISE PROGRAM ON HEALTH RELATED PHYSICAL FITNESS AMONG FOURTH GRADE STUDENTS

Major Field: Higher Education/Exercise Physiology

Biographical:

Personal Data: Born in Manhattan, Kansas, October 26, 1952, the daughter of Gustave and Helen Fairbanks.

Education: Graduated from Manhattan High School, Manhattan, Kansas, in May, 1970; received Bachelor of Science Degree in Physical Education and Science from Kansas State University at Manhattan, in December, 1973; received Masters of Science in Recreation from Kansas State University, Manhattan, Kansas, in May, 1977; completed requirements for the Doctor of Education degree at Oklahoma State University, Stillwater, Oklahoma, in December, 1993.

Professional Experience: Adjunct Assistant Professor, Departments of Biology and Athletics, Susquehanna University, Selinsgrove, Pennsylvania, 1985 to 1993; Assistant Professor, Department of Health, Physical Education and Recreation, Phillips University, Enid, Oklahoma, 1980 to 1985; Instructor of Health, Physical Education and Recreation and Women's Basketball and Tennis Coach, University of Science and Arts of Oklahoma, Chickasha, Oklahoma, 1979 to 1980; Elementary Physical Education Instructor, Hutchinson, Kansas, 1977 to 1979; Graduate Teaching Assistant, Department of Health, Physical Education and Recreation, Kansas State University, Manhattan, Kansas, 1976 to 1977; and Physical Education Teacher and Assistant Girls' Basketball and Track Coach, Center for Exceptional Students and Alamogordo High School, Alamogordo, New Mexico, 1974 to 1975.

OKLAHOMA STATE UNIVERSITY
INSTITUTIONAL REVIEW BOARD
FOR HUMAN SUBJECTS RESEARCH

Proposal Title: The Effects of a Self-Monitored Exercise Program on Health-Related Physical Fitness Among Fourth Grade Students

Principal Investigator: Betty Edgley/Mavis Fairbanks Ziegler

Date: March 14, 1991 IRB # ED-91-027

This application has been reviewed by the IRB and

Processed as: Exempt [ ] Expedite [x] Full Board Review [ ]

Renewal or Continuation [ ]

Approval Status Recommended by Reviewer(s):

Approved [ ] Deferred for Revision [ ]

Approved with Provision [x] Disapproved [ ]

Approval status subject to review by full Institutional Review Board at next meeting, 2nd and 4th Thursday of each month.

Comments, Modifications/Conditions for Approval or Reason for Deferral or Disapproval:

The following changes must be made for full approval of this application.

1. Reference the IRB application form, page 2, item 2: The children should not be approached by the investigator prior to gaining permission to do so from school authorities.

Signature: _____ Date: April 1, 1991

Chair of Institutional Review Board