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# A Comparison of the Effects of Two Exercise Programs on Children's Self-Concept, Locus of Control, and Mood

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# A Comparison of the Effects of Two Exercise Programs on Children's Self-Concept, Locus of Control, and Mood

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## Abstract

The effects of two physical fitness programs on children's self-concept, locus of control and mood were investigated in this study. It was expected that children who participated in a vigorous running program would demonstrate reduced depression and anxiety but a more internal locus of control and an increase in self-concept than children in a routine exercise group.

Participants in the Running Group were three fifth grade classes of a public elementary school in Richmond, Virginia ($N$ = 60). Participants in the Routine Exercise Group were three fifth grade classes from a comparable public elementary school in the same district ($N$ = 75). Children in both groups completed the Children's Depression Inventory (CDI), trait measure of the State-Trait Anxiety Inventory for Children (STAIC-T), Children's Nowicki-Strickland Internal-External Control Scale (CNS-IE), and Piers-Harris Self-Concept Scale prior to treatment. Nine-minute timed runs, skinfold measurement, and a test of the number of sit-ups completed during a 60-second time period were also administered. Children in both groups received daily 10-20 minute exercise periods for five weeks, supervised and monitored by their classroom teachers. Children in the Routine Exercise Group received a variety of fitness activities. Children in the Running Group received a running program a maximum of three days a week and a variety of fitness activities on the remaining days. At the end of five weeks, both groups were re-assessed on the same measures.

Overall, statistical analyses suggest that differential treatment effects were non-significant. The influence of both exercise programs taken as a whole on physical and psychological measures was assessed due to the project's inability to substantiate the original hypotheses. The calculation of repeated measures analysis of variance revealed statistically significant differences on all physical and psychological measures, but no significant clinical effects. A correlation matrix was then computed. High pre- and post-scores on the timed run test were significantly correlated with low depression and anxiety scores and with a more internal locus of control.

These findings suggested possible weaknesses in the study including strong demand characteristics, weak intervention, and/or inadequate psychological measures. Implications and recommendations for future studies were outlined.

# Review of the Literature

## Interest in Physical Exercise

Better to hunt in the field for health unbought
Than fee the Doctor for a nauseous draught.
The wise for cure on exercise depend.

Dryden, circa 1675

Physical exercise has become increasingly popular in recent years. Accompanying this rise in popularity came studies of the psychological benefits of physical fitness emerging from a variety of settings. Physical educators, exercise physiologists, psychologists, rehabilitation counselors, psychiatrists and other physicians have demonstrated the psychological rewards of regular exercise.

The running movement, in particular, has drawn an enthusiastic band of supporters. With the increase in the number of runners in the United States from 6,000,000 to 20,000,000 between 1976 and 1979 and an estimated 40,000,000 runners in 1980 (Fixx, 1980), came the press' propaganidization of jogging's physical and psychological benefits (Folkins & Sime, 1981). Numerous studies later emerged in an attempt to demonstrate the purported positive relationship between the improved physical fitness resulting from a regular running program and mental health variables. A variety of explanations have been offered to account for these psychological changes and will now be discussed.

## Theoretical Perspectives

The psychological changes and particularly the alleviation of depression occurring in runners have been attributed to a variety of causal factors. Physiological changes are often accredited with producing psychological changes (Cooper, 1977; Dulberg & Bennett, 1980; Ismail & Young, 1977). The effects of tricyclic antidepressants, for example, appear to be amplified by running (Kostrubala, 1976). These amplified effects have been viewed as evidence that long-distance running influences the central nervous system at the cellular level (Morgan, 1979). Some attribute the antidepressant effect of running to increases in norepinephrine (Greist, Klein, Eischens, & Faris, 1978).

The "runner's high", or a feeling of intense well-being, reported by some runners has also been investigated as evidence of physiological and psychological changes produced by running. This experience generally occurs after a run of 25 or 30 minutes and is often described as feelings of euphoria, renewed energy and an ability to think more clearly (Fixx, 1978; Morgan, 1979; Sachs & Pargman, 1978; Wagemaker & Goldstein, 1980). EEG changes have been demonstrated after 25 to 35 minutes of running (Wagemaker & Goldstein, 1980). These changes indicated that subjects who had been fatigued and unable to shift from right-sided image thinking to left-sided verbal thinking before running were able to switch from image to verbal thinking after running, thereby eliminating right-left confusion and improving the ability to think more clearly. This reversal of right-left confusion may be responsible for the runner's high (Wagemaker & Goldstein, 1980).

Various psychological factors have been accredited with the therapeutic effects of running. Running may give the individual a

sense of mastery. According to this view, when a person sees himself or herself as becoming more and more able to perform meaningful tasks and gaining direction and control of his or her body, the individual gains a new self-respect (Dulberg & Bennett, 1980). This sense of control may be a key element in helping the individual learn that he or she is an adequate and capable person (Greist, Klein, Eischens, Faris, Gurman, & Morgan, 1979; Hilyer & Mitchell, 1979). Learning patience, learning that the runner has the capacity for change, generalization, distraction from symptoms of depression, positive "addiction", symptom relief, consciousness alteration, and biochemical changes are other factors cited as contributing to the beneficial effect of running (Greist et al., 1979).

Need for an Integrated Theoretical Model

Research in this area is desperately in need of an integrated theoretical model that can pull together the various claims of cause and effect. Lazarus' model (1975) of a cognitively oriented theory of adaption and emotion may apply to research on physical fitness training and mental health as well as it does to biofeedback research (Folkins & Sime, 1981). A "metatheoretical" model of psychological activity, such as is outlined by Lazarus for biofeedback, may prove helpful in lifting the physical fitness research out of the confusion created by "atheoretical, mechanistic" approaches (Folkins & Sime, 1981, p. 375).

No one theory is universally accepted to explain the body and mind interaction demonstrated in the physical fitness literature. The lack of theoretical concensus may be at least partially attributable to poorly designed experiments. Folkins and Sime (1981), in their excellent review article summarizing the effects of physical fitness

training on mental health, evaluate the relevant literature on the basis of Campbell and Stanley's criteria (1963) for experimental designs. Aspects of the Campbell and Stanley model for evaluation of experimental research will be referred to throughout this paper as a means of understanding the implications of the studies presented.

## Physiological Changes Associated with Running

Physiological changes resulting from a strenuous running program have been well documented. Changes associated with vigorous exercise, and specifically running, include greater mechanical efficiency as measured in terms of lower oxygen consumption for a given amount of work, higher cardiac output with less increase in pulse rate and blood pressure during submaximal exercise, and quicker recovery in pulse rate and blood pressure after submaximal exercise (Broucha, 1974). Physiological changes in runners demonstrated by Ismail and Young (1977) include improvement in myocardial vascularization, increased red blood cell count and blood volume, and reduction of blood pressure. Cooper's famous aerobics program (1977) is based on findings such as these which illustrate the reduced risk of cardiovascular disease in individuals who follow a regular and demanding exercise program.

## Psychological Changes Associated with Running

Psychological changes associated with running have not been investigated until recently. Numerous testimonials such as that of Eileen Waters attest to the mental and emotional gains achieved through running. Early in 1973, Associated Press carried the story of Eileen Waters, one of the few American women to finish a 50-mile run. Eileen's younger sister had committed suicide several years prior to this run. Eileen had become depressed and then began eating compulsively

to cope with her depression. She began to run as a means of losing the weight she gained. As a by-product, she reported a marked decrease in her despair as well. "Running just keeps me going", Eileen stated, "gets me out of my bad moods. It makes me feel good to be alive" (The Complete Runner, 1974).

Enthusiastic testimonies such as this one prompted researchers to investigate the positive psychological effects of running on mental health. Many, however, have focused on personality variables of the "elite", or marathon, runner (Clitsome & Kostrubala, 1977; Gontag, Clitsome, & Kostrubala, 1977; Harris & Jennings, 1977). Fewer have investigated the effects of running among normal subjects on variables such as cognition, perception, behavior, affect and personality. Of these studies, only a very small number are truly experimental in nature. A discussion of the effects of running on a number of these psychological variables will now be presented.

## Personality Variables Affected by Running

The majority of research studies investigating the relationship between running and personality variables have compared marathoners with normals. Within the past ten years, however, a number of pre-experimental and quasi-experimental studies have assessed the effects of running programs on normals. Overall, the studies show rather modest gains or no significant change on a number of personality variables. For example, one pre-experimental study revealed that running led to several personality changes on the Cattell 16 Personality Factor Questionnaire, but the majority of personality variables were unaffected (Ismail & Trachtman, 1973). Twenty-eight men were divided into two groups -- a low-fitness group and a high-fitness group -- on the basis

of various physiological measures of physical fitness. Following a four month running program, the low-fitness group scores increased significantly in self-sufficiency, emotional stability and imagination. They also showed moderate increases in proneness to guilt. The authors suggest that this last finding may have been a temporary effect due to feelings of shame about being unable to get in shape immediately.

Another pre-experimental study characteristic of the experiments on the effects of running on personality variables compared a walking-jogging program and a cycling program (Buccola & Stone, 1975). Thirty-six men between the ages of 60 and 79 participated voluntarily in a 14 week program of walking-jogging or cycling. Pre- and post-testing on the Cattell 16 PF indicated a change on only two factors for the jogging group -- this group became less surgent (more sober) and more self-sufficient. In addition to demonstrating few personality changes, this study is further confounded by the fact that subjects volunteered for either the cycling or jogging group and were not randomly assigned, raising the question of possible confounding due to self-selection.

The majority of studies relating physical fitness to personality use Cattell's Sixteen Personality Factor Questionnaire (16 PF). Although the shortness of training programs may be one explanation for the lack of change in personality variables (Ismail & Young, 1977), it is also possible that the 16 PF is not sufficiently sensitive to change that does occur (Folkins & Sime, 1981). Because few of the factors on the 16 PF are theoretically expected to change following short-term intervention (Cattell, Eber, & Tatsuoka, 1970), it is difficult to understand why this

measure is so frequently chosen to assess the effects of fitness training.

One study using a measure other than the 16 PF looked at the California Psychological Inventory (CPI), State-Trait Anxiety Inventory (STAI) and the Type A and B Personality Questionnaire (Schultz, Dawes, & Park, 1982). Runners (individuals averaging 10 or more miles per week) obtained higher scores on the Dominance, Self-Acceptance, and Capacity for Status Scales and lower scores on the Socialization Scale than nonrunners. In addition, runners scored as less anxious on the Trait anxiety measure of the STAI. A problem with this study, however, is that it is an intact groups comparison -- individuals were not randomly assigned to groups.

In summary, research relating running to personality provides little evidence to support a claim that global changes on personality tests follow from fitness training (Folkins & Sime, 1981). One direction for future efforts might be to focus on a target variable that may be expected to change following fitness training rather than on personality change across a variety of factors. The measures used must be directly related to the areas in which change is expected (Heller & Monahan, 1977). For example, one study focused on the effects of a sports fitness camp on locus of control (Duke, Johnson, & Nowicki, 1977). Although they did not control for peer or leader effects, which is a flaw in their design, the children in this pre-experimental study did move from an external to an internal locus of control. Another approach in the research relating running to personality, and one which has resulted in the highest payoff, has been a focus on self-concept variables.

## Running and Self-Concept

The personality variable which has been most extensively studied in a number of different populations is self-concept. The assumption underlying the research in this area is that changes in the body resulting from running might be expected to alter the individual's body-image, which is highly correlated with and might be expected to influence self-concept (Zion, 1965). In recent years, research has generally confirmed the assumption that running programs improve self-concept although it should be noted that it is not yet clear whether improvement in actual or perceived physical fitness is the cause. There are a number of true experimental studies investigating the relationship between running and improved self-concept, however, and demonstration of improvements in self-concept following a running program appear to be well documented.

Improvement in self-concept following a running program was demonstrated in two experimental studies. Increased physical fitness was also demonstrated in both experiments. A comparison of the two studies is interesting because of self-concept changes in two very different populations: college students (Hilyer & Mitchell, 1979) and hospitalized alcoholics (Gary & Guthrie, 1972). The actual rather than the perceived improvement in physical fitness appears to have increased self-esteem in both populations. The low self-concept counseling students made considerable gains on measures of personal self, identity, and self-satisfaction, but very little gain on the concept of the physical self (Hilyer & Mitchell, 1979). Similarly, the correlations between the alcoholics' Self-Cathexis and Body-Cathexis Scales scores and the measures of physical fitness suggest that the self-concept changes were

not merely a reaction to the enthusiasm and positive self-evaluation that occurred during training.

Whether the improvement in self-concept is attributable only to better physical fitness and not at all to perceived fitness gains is not completely clear, however. Perceived physical fitness and self-concept scores were significantly correlated in a pre-experimental study of both high school and college subjects (Leonardson, 1977). Both physical fitness performance and body attitude were correlated with significant increases among male rehabilitation clients in positive self-attitude, self-acceptance and positive physical, intellectual and emotional-interpersonal behaviors (Collingwood,1972). The correlations between both physical fitness performance and body attitude with self-concept are interesting in light of the true experimental nature of this study. It appears probable that both actual and perceived fitness gains play a role in increasing self-esteem, although the relative contributions of each are difficult to determine at the present time.

It is interesting to note that, among numerous studies demonstrating increases in actual fitness, perceived fitness, or both and concomitant increases in self-concept scores, one pre-experimental study (Leonardson & Gargiulo, 1978) did not. Improvement in actual physical performance following a 10 week training program of supervised jogging on a twice a week basis was demonstrated, but no significant correlation between actual physical performance and self-concept was found. Although the results of this study do little to clarify the roles of actual versus perceived fitness in elevating self-esteem, they do suggest that the type of exercise program may be an important variable to consider. The running program described by Leonardson and

Gargiulo (1978) is a much less vigorous one than most described in the literature. There is some evidence to suggest, therefore, that an exercise program may have to be sufficiently strenuous to produce significant self-concept changes.

## Running and Depression

Avid exercisers and theorists in physical education report an improved sense of well-being associated with fitness. One area of particular interest to recent researchers has been the alleviation of depressive symptoms reported by runners. Numerous studies suggest that a strenuous running program does, in fact, alleviate depression.

One experimental study investigated the beneficial effects of running for patients seeking treatment for neurotic or reactive depression (Greist et al., 1979). Thirteen men and 15 women patients were randomly assigned to either a running program or to one of two kinds of psychotherapy (i.e., 10 session time-limited or time-unlimited). Outcome comparisons of the three groups indicated that the running treatment was benefical and as effective in alleviating depressive symptoms and target complaints as either of the psychotherapy treatments.

The changes in depression correlated with running do not appear to extend to all forms of exercise. Brown, Ramirez, and Taub (1978), in a quasi-experimental study, investigated the effects of various 10 week exercise programs (i.e., jogging, softball, tennis, varied exercise, wrestling and no exercise) on Zung depression scores (Zung, 1965). The strength of their findings is somewhat lessened because subjects were not randomly assigned to groups but chose the program in which they wanted to participate. In spite of this self-selection

factor, their study suggests an interesting implication for the results of strenuous versus light exercise. All subjects in each of the fitness programs exercised 30 minutes a day, three days a week. Depression scores decreased with wrestling, mixed exercise, tennis and jogging. There was no change, however, in the depression scores of softball team members or the group who had no exercise routine. Joggers showed the greatest reduction in depression scores of all groups. This evidence supports the hypothesis that any effective exercise regimen for depression must be relatively vigorous.

A follow-up study was attempted by the same authors to extend and validate the first study and to provide information about multidimensional mood change. In this second study, jogging for either five days a week or three days a week for a 10 week period resulted in significant reductions in depression scores of both the depressed group and the non-depressed control group. The subjects who did not exercise showed no change in depression scores. Again, however, the significance of these findings is somewhat confounded by the self-selection factor in this quasi-experimental study.

A group of severely depressed post-coronary males experienced significant improvement in their depression after four years of exercise-oriented rehabilitation (Kavanagh, Shephard, Tuck, & Qureshi, 1977). The implications of this study, however, are difficult to determine since they used a one-group pretest-posttest design and there are numerous competing explanations for the improvement in depression other than the exercise program.

In conclusion, the effects of running on depression have been researched by a number of investigators. The evidence to date

suggests that a strenuous running program is likely to be successful in alleviating depressive symptomatology. The experimental weaknesses in the majority of the designs of these studies, however, make it difficult to evaluate the overall significance of this finding.

Running and Anxiety

Physical exercise has also been demonstrated to have a positive effect on anxiety. State anxiety was found to decrease immediately following exercise and continued to decrease 20 to 30 minutes following either moderate or heavy physical activity (Morgan & Horstman, 1976). There is also evidence to suggest that trait anxiety may be affected by exercise. Three chronic psychiatric patients exhibited less post-test trait anxiety following a program of regular supervised jogging than did three chronic patients from the same setting who received an equal amount of attention but no jogging (Lion, 1978). The inferences which can be drawn from this experimental study are, however, limited because of the small sample size.

Like the studies investigating the effect of running on depression, studies of running and its impact on anxiety have been conducted on a variety of populations, with generally positive findings. A group of 40 middle-aged males who were considered to be at high risk for coronary heart disease, for example, significantly reduced both their depression and anxiety scores on the Multiple Affect Adjective Checklist (MAACL) after a 12 week exercise program (Folkins, 1976). It is important to note that significant decreases were found in this experimental study, even though the men had low mean scores at the outset of the program.

It is possible that individuals in the poorest physical and/or psychological condition will demonstrate the greatest improvement on

both physical and psychological measures, including measures of anxiety, following a strenuous exercise program (Folkins, 1972). Seventy-five junior college students enrolled in a jogging course demonstrated significant improvement on physical fitness measures in contrast with nonsignificant changes in 62 students enrolled in archery and golf courses. Interestingly, pretraining score differences were found primarily in the women indicating that those women who took the jogging course were less psychologically fit at the outset. Unfortunately, this quasi-experimental study was an intact groups comparison and individuals were not randomly assigned to groups. Nevertheless, in a within-group analysis, significant improvement in psychological fitness was noted for the women in the jogging course. A significant conclusion drawn from this study was that individuals in the worst physical and/or psychological condition will show the largest improvement on measures of both physical and psychological fitness.

In summary, research on the effects of physical fitness programs on anxiety have generally yielded positive outcomes. Psychological fitness may result from feedback from musculature (eg., heart and limbs) (Folkins et al., 1972). Single doses of exercise can be used to relieve electromyographic tension (deVries & Adams, 1972). Reduced electrical activity in the muscles may, therefore, be a significant feedback cue for an individual to rate himself or herself as less anxious (Folkins et al., 1972). Whatever the cause for reduced anxiety, the implementation of fitness programs in general and running programs in particular has resulted in improvement in mood states.

A problem with a majority of these studies, however, is that experimental fitness training is frequently offered to specially recruited

subjects who seek out the training (Folkins & Sime, 1981). This selection bias is a serious problem when comparisons are made with control subjects. The fact that experimental subjects know their status as "experimentals" may contribute to an improvement in their mood as a result of this attention factor (Folkins & Sime, 1981; Hanson, 1967). Nevertheless, the consistently positive findings of these studies are impressive.

The Effects of Exercise Programs on Children

The effect of running in children and adolescents has not been as extensively studied as it has been in adults. Studies which have investigated the effects of fitness training on personality and mood variables in children have generally employed movement skills training rather than cardiovascularly oriented training (Bruya, 1977; Hanson, 1971; Martinek, Cheffers, & Zaichowsky, 1978; Mauser & Reynolds, 1977). Of the three studies investigating the effects of movement skills training on self-concept, two (Bruya, 1977; Mauser & Reynolds, 1977) found no improvement. Mauser and Reynolds' (1977) pre-experimental study, however, investigated a small sample of only 12 children ranging in age from 4 to 12 years and did not employ a control group. Bruya's (1977) quasi-experimental design utilized intact groups in existing classes. An additional problem with this study is the utilization of a relatively non-strenuous exercise program.

The true experimental study (Martinek et al., 1978) did find significant differences in both body coordination and self-concept scores, in spite of a relatively non-strenuous fitness program, on the Martinek-Zaichowsky Self-Concept Scale for Children. The experimental group of 344 children ranging from Grades 1-5 participated in a 45

minute curriculum of perceptual-motor and gymnastic activity once a week for 10 weeks. In spite of significant improvements in both motor development and self-concept scores, correlations between self-concept and motor development were non-significant.

Another excellent experimental study investigated the effects of a physical development program on body-image concept of 60 trainable mentally retarded (TMR) children (Chasey, Swartz, & Chasey, 1974). Institutionalized TMR subjects were randomly assigned to one of three groups: Group 1, Experimental, participated in a daily 5-week physical development program including distance running, game and sport skills, gymnastics and basic movement skills; Group 2, Hawthorne Control, participated in a daily 5-week sedentary recreation program; and Group 3, Control, was pre- and post-tested but received no specialized program. A comparison between pre- and post-test Penetration responses on the Holtzman Inkbolt Technique indicated that there was a significant decrease for the Experimental group only, indicating a more positive body-image as a result of the physical development program.

One of the few studies investigating the effects of a purely cardiovascular fitness program on self-concept and peer approval in children (McGowan, Jarman, & Pedersen, 1974) found a significant difference in both cardiovascular endurance and self-concept for the experimental group compared with a control group after an 18 week training program. In spite of the experimental design of this study, conclusions are seriously confounded by the fact that experimental subjects were always told that they had won whenever they competed against a regular physical education class. The authors state that the wins were sometimes contrived and that victory was always assured for

the experimental group. The demonstrated increase in self-concept may, in fact, be solely due to elation felt over being part of a winning team and not at all attributable to fitness effects.

Very few studies have investigated the effects of any type of fitness program for children on variables other than self-concept. For example, no study could be found investigating any kind of physical fitness program and its effects on depression in children. Only one study (Hanson, 1971) could be found which looked at the effects of fitness training on anxiety. The study is experimental in design but, as is the case with most of the literature on children, movement skills training and not cardiovascular exercise was used as the treatment. Improvement in anxiety was noted, however, as measured by teacher ratings and by responses on the Holtzman Inkbolt Test.

Only one study demonstrated changes in locus of control. Significant changes from an external to an internal locus of control as well as significant improvement in six measures of physical fitness were demonstrated for 74 boys and 35 girls enrolled in an eight-week sports fitness camp (Duke et al., 1977). Because they did not control for peer or leader effects and did not use a control group implications of this pre-experimental study are limited.

In summary, fitness programs with elementary school age children have largely been confined to studying the effects of movement skills training on normal children (Bruya, 1977; Hanson, 1971; Martinek et al., 1978; Mauser & Reynolds, 1977) or to the effects of various physical fitness activities on special populations of children such as the mentally retarded (Chasey et al., 1974; Nunley, 1965). Interest in

aerobic exercise such as running has only recently begun to surface as health educators begin to evaluate cardiovascular risk in children.

Summary of the Running Literature

The literature on the physical and psychological effects of running can be briefly summarized. First, cardiovascular fitness resulting from running programs has been demonstrated in studies conducted with adults (Hilyer & Mitchell, 1979; Ismail & Young, 1977).

Second, psychological benefits resulting from a running regimen have also been demonstrated. Running programs have been used with alcoholics (Blue, 1979; Gary & Guthrie, 1972), psychiatric hospital patients (Dodson & Mullens, 1969), agoraphobics (Orwin, 1973; 1974), cardiac patients (Kavanagh et al., 1977; Leon & Blackburn, 1977) and normal adults (Ismail & Young, 1977; Schultz et al., 1982) with positive psychological changes. The beneficial effect of vigorous running programs has been documented in the treatment of negative mood states such as depression (Brown et al., 1979; Greist et al., 1979; Kavanagh et al., 1977) and anxiety (Folkins, 1976; Lion, 1978; Morgan & Horstman, 1976; Wood, 1977). Research relating running to personality has also generally demonstrated an increase in self-concept (Collingwood, 1972; Hilyer & Mitchell, 1979) although it should be noted that the literature in this area is not yet conclusive.

The effect of running in children and adolescents has not been as extensively studied as it has been in adults. Fitness programs with elementary school age children have largely been limited to investigating the effects of movement skills training on normal children (Bruya, 1977; Hanson, 1971; Martinek et al., 1978; Mauser & Reynolds, 1977) or to the effects of various physical fitness activities on special populations

of children such as the mentally retarded (Chasey et al., 1974; Nunley, 1965). Results of these studies suggest that self-concept in children may be improved through a movement skills program, although experimental results do not consistently show a positive correlation between fitness programs and improved self-concept. Only one study investigated the effects of movement skills training on anxiety (Hanson, 1971) and this experimental study did find a decrease in anxiety levels of four-year-olds participating in such a program. Likewise, only one study investigated the effects of a sports fitness camp on locus of control (Duke et al., 1977) and results of this study also were significant, showing changes from an external to an internal locus of control. No studies could be found investigating the effects of any type of fitness program on depression levels in children.

Of the few studies investigating the effects of children's fitness programs including some component of cardiovascular training, three found significant improvement in self-attitude. Chasey et al. (1974) found a significantly improved body-image as a result of their program. McGowan et al. (1974) also found improvements in self-concept, although their study is seriously confounded by possible attributions related to continual success and victory in team sports which were induced by the experimenters. No studies utilizing cardiovascular programs found nonsignificant relationships between participation in a fitness program and self-concept.

Obesity in Children

Obesity is currently a major health problem. It has been associated with a decrease in life expectancy and numerous chronic and degenerative diseases: heart disease, stroke, hypertension, cancers of

the gastrointestinal track and breast, diabetes, liver and gall bladder disease, and degenerative arthritis of the hips, knees and ankles. It is estimated that between ten and twenty percent of U. S. children are overweight or obese (Dintiman, 1980). Many studies indicate that obesity patterns are begun in children which are continued and accelerated in the adult years (Kahn, 1973; Penick & Stunkard, 1973; Waxler & Liska, 1975). These studies and others indicate the need for obesity intervention prior to adolescence.

> The presence of risk factors in the young, such as mild elevation of blood pressure, (even within the "normal" range), cigarette smoking, obesity and mild elevation of blood cholesterol (even in the "normal" range) all constitute highly dangerous conditions for the young because their influence will be present over many years (Schoenberger, 1982, p. 16, italics mine).

Obesity has been attributed to numerous causes, but two are mentioned repeatedly in the literature: inactivity and overeating. Several studies have reported, however, that obese and non-obese adolescents eat the same quantities of food but obese adolescents are much more inactive than adolescents of normal weight. Normal weight girls have been found to be 2.5 times more active than their obese peers (Bullen, Reed, & Mayer, 1964). Similar findings have been found for boys as well as girls (Mayer, 1968). Lack of exercise may contribute significantly to obesity in children as well as adolescents (Stimbert & Coffey, 1972). Based on evidence of these and other studies, increasing the activity level of obese children may result in reductions in amount of body fat.

In addition to potential weight loss and/or redistribution of body fat, exercise programs may offer the obese youngster psychological benefits as well. Only one study could be found, however, which investigated the psychological effects of a jogging program on obese adolescents (Collingwood & Willett, 1979). Although increases in positive self-attitude and self-acceptance were demonstrated, the results of the study are confounded by the small sample size (N=5) and by the lack of a control group. This study does suggest, however, that exercise may provide important psychological benefits for the obese child.

Childhood obesity can have devastating social and emotional consequences which often carry into adulthood. Society often labels obesity as a handicap, shortcoming, failing, disgrace, or weakness (Kalisch, 1972).

This stigma begins early in life, as is demonstrated in a study of 650 children, ages 10 to 11 years (Kaplan, 1979). The children were shown six black and white line drawings: 1) a child with no physical handicap, 2) a child with crutches and a brace on one leg, 3) a child in a wheelchair, 4) a child with one hand missing, 5) a child with a disfigurement of the mouth, and 6) an obese child. The results indicated that the normal child was chosen as the nicest to play with and to have as a friend while the obese child was consistently the least preferred child. A follow-up study using adults as subjects demonstrated that they also found the obese child the least likable and desirable (Kaplan, 1979).

Obese individuals are devalued by society and they subsequently often devalue themselves. The obese child often has a poor body image

(Stanley, Glaser, Levin, Adams, & Coley, 1973; Stunkard & Mendelson, 1967), a sense of failure and inferiority (Neumann, 1977; Weil, 1971), depression (Stunkard & Mendelson, 1973), anxiety (Waxler & Liska, 1975), and a passive, external approach to life situations (Stanley et al., 1973; Weil, 1971). Because physical fitness programs have been demonstrated by some researchers to have a more pronounced effect in elevation of mood states for individuals who are more distressed or physically unfit at the outset (deVries, 1968; Folkins et al., 1972; Lion, 1978), a running program for obese children may be expected to have an even more significant positive impact than on children of normal weight.

## Rationale and Hypotheses

The purpose of this study was to assess the effects of two exercise programs on self-concept, locus of control, depression and anxiety as well as cardiovascular fitness. The running program was expected to be more strenuous than the routine exercise program. For this reason, children who were involved in the vigorous running program were expected to demonstrate a greater level of physical fitness than the children participating in the standard program, as indicated by improvement in number of sit-ups completed during a 60-second time period and improvement in the nine minute timed run. It was expected that children participating in the running program (hereafter referred to as the Running Group) would show reduced depression and anxiety relative to children participating in the routine exercise program (hereafter referred to as the Routine Exercise Group). It was also predicted that children in the Running Group would demonstrate a more internal locus of control and a greater increase in self-concept than children participating in the Routine Exercise Group. In addition to the effects of the running program, the effects of sex and pre-treatment scores on both physical and psychological post-treatment scores were evaluated. The following hypotheses were examined:

1. After sequentially partialling out the effects of pre-treatment sit-up scores, sex, race, and skinfold measurement, Running Group children will show higher sit-up scores than Routine Exercise Group children at post-testing.
2. After sequentially partially out the effects of pre-treatment timed run scores, sex, race, and skinfold measurement,

Running Group children will show higher timed run scores than Routine Exercise Group children at post-testing.

3. After sequentially partialling out the effects of pre-treatment Children's Depression Inventory (CDI) scores, sex, race, skinfold measurement, and pre-treatment CNS-IE scores, Running Group children will show lower scores on the CDI than Routine Exercise Group children at post-testing.
4. After sequentially partialling out the effects of pre-treatment State-Trait Anxiety Inventory for Children (STAIC) scores, sex, race, and skinfold measurement, Running Group children will show lower scores on the A-trait measure of the STAIC than Routine Exercise Group children at post-testing.
5. After sequentially partialling out the effects of pre-treatment Children's Nowicki-Strickland Internal-External Control Scale (CNS-IE) scores, sex, race, and skinfold measurement, Running Group children will show lower scores on the CNS-IE than Routine Exercise Group children at post-testing.
6. After sequentially partialling out the effects of pre-treatment Piers-Harris Self-Concept Scale scores, sex, race, and skinfold measurement, Running Group children will show higher scores on the Piers-Harris Scale than Routine Exercise Group children at post-testing.

# Method

## Subjects

Subjects were 121 fifth grade students (M age = 135.0 months; range = 120-160 months) who attended two selected Chesterfield County Schools (i.e., Hening Elementary School and Hopkins Elementary School). These two schools were chosen because the Chesterfield School Administration considered them to be roughly comparable in socioeconomic status and racial composition.

Children were in the fifth grade. Three fifth grade classes from Hening Elementary (N=50) were assigned to the Running Group and three fifth grade classes from Hopkins Elementary (N=71) were assigned to the Routine Exercise Group. Classes were selected on the basis of overall average to above average academic ability as assessed by the teachers at each school. All children in each of these selected classes were eligible for the study, regardless of race or sex.

## Assessment Measures

Physical measures. Physical fitness measures were administered to children in both treatment groups at two times: prior to actual treatment and at post-treatment (see Appendix A for the Schedule for the Running Group and the Routine Exercise Group). The three measures used were ones that appear most frequently in the literature on overall physical fitness: the timed run, number of sit-ups completed during a 60-second time period and skinfold measurement. These tests are also generally included in standard tests of fitness administered to children at the beginning of the school year and are therefore familiar to them. These measures will now be described.

Timed run. A 100-meter tape was placed on the grass in an oval resembling a one-quarter mile track. A maximum of 10 children was tested at one time. Each child wore a "pinny" with a large number pinned to it. Two raters recorded the number of laps run by each child in nine minutes. Children were also asked to place a numbered clothespin on the 100 meter tape when they finished their run. The two raters then checked the tape at the conclusion of the run to see what portion of 100 meters each child ran on his or her final lap. Scores were recorded to the nearest meter with a total determined by multiplying the number of laps by 100 and adding the nearest meter recorded by the raters from the placement of each child's clothespin on the tape (eg., Johnny crossed the start/finish line 17 times, giving him a score of 1700 meters, and he placed his clothespin at the 27 meter mark, so his total run was 1727 meters.) Norms are reported by Davis (1979) and can be seen in Appendix B.

Sit-ups. Children were paired with one child holding the other's feet. The child being tested lay on his or her back with knees bent so the heels were six to eight inches from the buttocks. Arms were folded across the chest, hand to opposite shoulder. The "holder" applied pressure only to the other child's feet. When the go signal was given, the child sat up, keeping the arms crossed at all times. One point was given for each sit-up completed during a 60-second time period. A child in the up position when time was called received credit for a completed sit-up. Davis' (1979) sit-up norms are reported in Appendix C.

Skinfold measurement. Tricep skinfold measurements using the Advance Adipometer Skinfold Caliper were taken for children in both treatment groups to determine amount of body fat for each subject. A point mid-way between the elbow and shoulder joints was located and all the skin on the back of the arm was gathered. The child was then instructed to bend his or her arm to a 90 degree angle and the measurement was taken. Two measurements were taken and results were recorded in millimeters. The mean measurement was used as a measure of obesity. Obese and average weight children participated in the same program, however, regardless of amount of body fat.

Teacher measures. In order to provide a gross assessment of the types and quantity of exercise in which each group participated, teachers were asked to fill out a brief daily exercise form (see Appendix D). In addition, teachers of children in the Running Group were asked to chart the number of laps completed by each child daily (see Appendix E).

Psychological measures. Each of the children also completed the Children's Depression Inventory (CDI), the Trait anxiety measure of the State-Trait Anxiety Inventory for Children (STAIC), Children's Nowicki-Strickland Internal-External Control Scale (CNS-IE), and Piers-Harris Children's Self-Concept Scale. All psychological measures were completed by each child on two occasions: pre-treatment and post-treatment. Psychological measures were simultaneously administered to both treatment groups. All of the psychological tests were completed within 1½ hours. A brief description of each of these measures will now follow.

Children's Depression Inventory. The CDI (Kovacs, 1980) was modelled after the 21-item Beck Depression Inventory (Beck, Ward, Mendelson, Mock, & Erbaugh, 1961), which assesses affective, behavioral, social, attitudinal and vegetative symptoms of depression, and which has been considered one of the best adult depression rating scales (Becker, 1974). The current 27-item self-rating scale has been administered to 875 Canadian children, aged 10 - 17 years, in several Toronto public schools (Friedman & Butler, 1979). A preliminary analysis of the data indicated that this version of the inventory has fairly solid psychometric properties. Its internal consistency is adequate (coefficient alpha = .86) and the item-total score correlations are all statistically significant (.31 to .54) (Kovacs, 1980).

For the 875 youngsters, CDI scores ranged from 0 to 51 (mean = 9.27; S. D. = 7.29; mode = 7) with no discernable age or sex effects. The bulk of the children obtained very low scores on this inventory, which is to be expected in a "normal" population. The validity of the scale is supported by Friedman and Butler's (1979) finding that high CDI scorers tend to have low self-esteem (CDI - Piers - Harris correlation = .66). Friedman and Butler also reported that the CDI appears to be a reasonably stable index of symptoms assessed over a one-month interval ($r$ = .72, $N$ = 28). The CDI is still being validated against independent psychometric/diagnostic evaluations in populations comprised of psychiatric and medical outpatients. Preliminary analyses suggest that the inventory does discriminate between child guidance and pediatric outpatient groups, with child guidance groups obtaining significantly higher CDI scores ($p < .002$).

The CDI was read aloud by the assessor and administered in a group setting. Children were given individual answer sheets and instructed to choose one sentence from each group of three statements which best described how he or she had been feeling or thinking in the last two weeks. A copy of the CDI is given in Appendix F.

State-Trait Anxiety Inventory for Children. The STAIC (Spielberger, 1973) was developed as a research tool for the study of anxiety in elementary school children. It contains a 20 item scale (A-trait) designed to measure the relatively stable predisposition to experience anxiety states as well as another 20 item scale (A-state) designed to measure variations in anxiety over time. Only the STAIC A-trait scale was administered for this study.

The STAIC was initially developed in 1969. A total of 1554 elementary school children in grades 4-6 were used as the normative sample. Both black and white children were represented. The alpha reliability internal consistency coefficients for A-trait were .78 for males and .81 for females (Endler, 1978). The test-retest reliability coefficients for A-trait were .65 for males and .71 for females. Evidence for the concurrent validity of the STAIC A-trait was based on correlations between the scale and both the CMAS and GASC. For a sample of 75 children the STAIC A-trait correlated .75 with the CMAS and .63 with the GASC. The STAIC is considered to be a useful scale for research in clinical settings because of its good theoretical basis, adequate norms, adequate reliability, and moderate validity (Endler, 1978).

The STAIC A-trait was read aloud by the assessor and administered in the classroom setting. Individual answer sheets were

passed out and children were asked to decide how they "usually feel", choosing one adjective from a list of three given for each of 20 statements. A copy of the STAIC A-trait is given in Appendix G.

Children's Nowicki-Strickland Internal-External Control Scale. The CNS-IE (Nowicki & Strickland, 1973) was developed to provide a generalized measure of locus of control for children over a wide age range. Items in the CNS-IE were constructed based on Rotter's (1966) definition of locus of control, and they describe reinforcement situations in a variety of areas such as affiliation, achievement, and dependency. The original 102-item scale was refined to give 40 questions.

This scale was administered to 1017 children, the majority of which were Caucasian, representing all socioeconomic levels. The ages sampled were children in the third through the twelfth grades. The children did not differ significantly in IQ. Estimates of internal consistency via the split-half method, corrected by the Spearman-Brown formula, were $r$ = .63 for Grades 3, 4, and 5. This reliability was considered satisfactory in light of the fact that the items are not arranged according to difficulty. Since the test is additive and the items are not comparable, the split-half reliabilities were judged to underestimate the true internal consistency of the scale (Nowicki & Strickland, 1973). Test-retest reliabilities sampled at three grade levels, six weeks apart, were .63 for the third grade, .66 for the seventh grade and .71 for the tenth grade. In addition, scores were not related to social desirability or intelligence test scores but were correlated with achievement (Nowicki & Strickland, 1973).

The CNS-IE was audio-taped and administered in a group setting. Children were given individual answer sheets and asked to circle "yes"

if they believed the statement was true and "no" if they thought it was false. A copy of the CNS-IE is given in Appendix H.

Piers-Harris Children's Self-Concept Scale. The Piers-Harris Children's Self-Concept Scale (Piers & Harris, 1964), entitled "The Way I Feel About Myself", was designed primarily for research on the development of children's self-attitudes and correlates of these attitudes. It is an 80-item self-report instrument developed for children over a wide age range.

To judge the homogeneity of the test, the Kuder-Richardson Formula 21, which assumes equal difficulty of items, was employed on a standardization group of four third-grade classes, four sixth-grade classes, and four tenth-grade classes with resulting coefficients ranging from .78 to .93. The Spearman-Brown odd-even formula was applied for half the Grade 6 and Grade 10 samples, with resulting coefficients of .90 and .87, respectively (Piers & Harris, 1969). In addition, a test-retest coefficient of .77 was found for 244 fifth graders at both two month and four month intervals (Wing, 1966).

Children's self-reports have typically corresponded only slightly with the way their teachers and peers rate them (Powell, 1948; Ullmann, 1952). Correlations with fourth and sixth graders ranged from non-significant to .49 (Piers, 1965). Cox (1966) found correlations of .43 and .31 between the Piers-Harris and teacher and peer ratings of socially effective behavior for a group of children in grades 6 through 9 from 97 families. Correlations with similar ratings of superego strength were higher (.40 and .52).

Tests of construct validity, however, confirmed predictions of significantly different self-concept scores for certain groups. As

predicted, 88 adolescent institutionalized retarded females scored significantly lower on the scale than either normals of the same chronological age, or normals of the same mental age (Piers & Harris, 1964). In addition, institutionalized retardates manifested significantly more negative self-attitudes than noninstitutionalized retardates (Gorlow, Butler, & Guthrie, 1963).

The Piers-Harris was audio-taped and administered in a group setting. Each child was given an individual answer sheet and asked to circle "yes" if the statement was generally like him or her and "no" if it was generally not like him or her. A copy of the Piers-Harris is given in Appendix I.

Procedure

Appendix A summarizes the proposed timetable for both Running Group and Routine Exercise Group subjects. The procedure for the study will be described in chronological steps.

Step 1 (Contacting teachers): All of the fifth grade teachers in Hening Elementary School and Hopkins Elementary School were contacted by the examiner regarding possible participation in this study. Teachers in both groups were informed that the purpose of the study was to assess the physical and psychological effects of movement programs for children. Although teachers in each group were fully informed about the program designed for their particular school, they were not informed about the specifics of the program developed for the other school. Although teachers of all four classes at Hopkins Elementary School agreed to participate in the study, one class was not included to make the numbers of participating students roughly equivalent at both schools. All three fifth grade teachers at Hening

Elementary School agreed to participate and all three classes were included in the study.

In return for their participation in the study, several benefits were offered both to the two participating schools and also to the entire Chesterfield County School System. Teachers were told that results of the study would be printed and made available to them at the conclusion of the study. If the expected physical fitness gains and psychological benefits were demonstrated, the experimenter offered to write a manual outlining the running program and discussing its implementation within the Chesterfield County School System. Dr. Bob Davis, Associate Professor of Physical Education at V.C.U., agreed to act as an on-going consultant not only for the schools directly involved with this study, but to any school within this school system wanting to implement such a program.

Step 2 (Distribution of consent forms): Two weeks prior to the collection of pre-test data, consent forms were distributed to all children in each of the classes whose teachers agreed to participate in the study (see Appendix J). Parents were asked to sign the form, indicating whether they would permit their child to participate in the study, and asked to return it to school with their child.

Parents were informed that the purpose of the study was to assess the effects of the physical education program in which their child was already participating. As can be seen in Appendix J, parents were asked if their child had any significant physical handicap which would limit or exclude him or her from the study. If parents wished their child to be involved in the program but only to a limited degree, special provisions were made whenever possible to allow the handicapped

child to participate as much as he or she was able. For example, several asthmatic children needed frequent rest intervals. In these cases, the child's teacher urged the child not to push himself or herself too hard and carefully observed the child both during and after exercise for any breathing difficulties. Similar individualized arrangements were made for children with other physical limitations. In addition, parents who agreed to their child's participation in the study were asked to send a note to school on days when they did not wish their child to participate in strenuous physical activity (eg., if the child was recovering from the flu, he or she may have attended school but was not permitted to engage in vigorous movement).

Any parents not returning the consent form within one week were contacted by phone regarding their child's involvement in the program. Any fifth grade child was included in this study if his or her teacher and parents agreed to the child's participation.

Step 3 (Administration of pre-test measures): During the week of April 11, 1983, the four self-report psychological measures discussed earlier were administered to all children (i.e., the State-Trait Anxiety Scale for Children, A-trait; Piers-Harris Children's Self-Concept Scale; Children's Depression Inventory, and Children's Nowicki-Strickland Internal-External Control Scale). The approximate total time required for the administration of these tests was 1½ hours. Six female graduate students administered the psychological measures. The STAIC-T was administered first to children in both groups followed by the audio-taped Piers-Harris, the CDI, and finally, the audio-taped CNS-IE. The order of test administration was the same in both treatment groups and across test sessions. A general introduction

which was presented to the children about these measures can be seen in Appendix K.

During this same week, each child was tested on physical fitness measures. These fitness measures were administered at both schools on two consecutive days. One of the participating Hening fifth grade classes and two of the participating Hopkins fifth grade classes were randomly assigned to the first day of testing. The remaining two Hening classes and one Hopkins class were randomly assigned to the second day. Fitness testing was scheduled at the same time on both days. Assessors recorded each child's skinfold measurement and his or her performance on the 60-second sit-up test. Skinfold measurement was used to identify obese children but was not expected to change for normal or obese children because of the relative shortness of the study. In addition, each child completed a nine minute timed run. Physical measures were administered by Dr. Bob Davis and the experimenter.

Step 4 (Beginning of exercise programs): The following week marked the beginning of the actual running program for the children at Hening Elementary. Children at Hopkins Elementary received no specialized training although they did receive a standard physical education program. Children in the Routine Exercise Program, like the children in the Running Program, attended regular physical education classes. In addition, children in both groups were given daily 10-20 minute exercise periods, supervised by their classroom teachers. Children in the Routine Exercise Group received a variety of physical fitness activities during this time. Children in the Routine Exercise Group spent the greatest proportion of their total exercise time playing kickball (72%). The remaining 28% of their exercise time was divided

fairly equally among running, silent ball, free play, and fitness tests. Children in the Running Group received a running program a maximum of three days a week and a variety of fitness activities on the remaining days. Children in the Running Group spent the greatest proportion of their total exercise time running (66%). They spent an additional 18% of their exercise time playing kickball. The remaining 16% of their time was divided among playing hockey, dodgeball, free play, track skills, and fitness tests.

Teachers at both schools were asked to fill out the "Daily Exercise Form" (see Appendix D). Teachers were asked to list the daily physical activity, approximate duration, and whether the children exercised continuously or intermittently.

The running program for children in Hening Elementary followed the general guidelines outlined by Davis (1982) and were conducted by the teachers of each class in the Running Group. Children in the Running Group were given daily 10-20 minute exercise periods, supervised by their classroom teachers. A maximum of three periods weekly was devoted to running. Children were encouraged to see how many laps they could complete by running, walking or a combination of the two, around a marked area of approximately 300 meters. After 20 minutes, each child reported his or her laps to the classroom teacher, who then recorded them on the "Running for Fun and Fitness Form" (see Appendix E). This form was used to calculate the class' total laps, but the form was not posted in order to avoid embarrassment for slower runners.

Because running laps can become boring, some incentives were used to keep the children's interest. The running program was

organized as a low level competition between teams. A large map was displayed in a prominent area of the school and each class' progress was charted on the map. The total laps for each class were divided by a number selected by the program director, who was the physical education teacher at Hening Elementary. The size of the number determined how fast the teams progressed, but the same number was applied to all teams. If, for example, the Red Team ran 345 laps and the Blue Team ran 240, a divisor of 15 would result in a total of 23 meters' progress for the Red Team and 16 meters for the Blue Team. Progress of both teams was then marked on a map.

Geography has been the main classroom focus of Davis' "Running for Life" programs (Davis, 1982). Children at Hening Elementary "ran" to a number of amusement parks in the South (e.g., Epcot Center, Safari Land, Six Flags Over Georgia, Carrowinds). A banner proclaiming the team who ran the greatest distance was awarded weekly. Teachers provided the "week banner", map, and marking utensils to chart the classes' progress. A large assembly was held at the conclusion of the Running Program to reward all the children for their participation.

Step 5 (Administration of post-test measures): At the end of five weeks, during the week of May 23, 1983, students in both the Running Group and the Routine Exercise Group were re-assessed. Psychological and physical measures were administered to both groups in the same sequence and format as pre-test measures.

## Results

Date analyses were performed in a series of steps. First, *t* - tests were run on pre-treatment test scores because it was important to establish that groups were equivalent on physical and psychological measures prior to intervention.

Pre-treatment scores on sit-ups, skinfold measurement, timed runs, CDI, STAIC-T, CNS-IE, and Piers-Harris were considered the dependent variables for this analysis. Membership in the Running Group vs. membership in the Routine Exercise Group was considered the independent variable.

Multiple regression analyses were then calculated to determine the influence of the two exercise programs on changes in children's depression (CDI), trait anxiety (STAIC-T), locus of control (CNS-IE), and self-concept (Piers-Harris Self-Concept Scale). The effects of the two programs were also assessed on three physical fitness measures: the timed run, 60-second sit-up test, and skinfold measurement. Multiple regression prediction equations were calculated to ascertain which independent variables were significant predictors of post-treatment scores (dependent variables). Hierarchical analyses were conducted to determine an ordered partitioning of the total variance of each dependent measure (Cohen & Cohen, 1975). The ordering of variables was based on the presumed contribution each variable would make toward the total variance. The predictors assumed to contribute the most variance were added first in each equation, followed by the other variables in descending order of their presumed contribution toward the total variance of each dependent measure. A

correlation matrix was calculated to determine to what degree pre-scores post-scores, and pre- and post- scores were inter-related. A repeated measures ANOVA was finally computed to determine whether participation in either exercise program produced significant physical or psychological gains.

Pre-score t-tests revealed significant differences between the Running Group and Routine Exercise Group on pre-treatment sit-up scores ($t(115) = -4.12$, $p < .001$). Mean number of sit-ups completed by the Routine Exercise Group was greater than the number completed by the Running Group. Pre-treatment scores on the remaining physical and psychological tests were not significantly different (see Table 1). This suggests that the two groups were essentially equivalent prior to treatment on all measures but number of sit-ups.

To test Hypothesis 1, a multiple regression equation was calculated on the effect of experimental condition on post-treatment sit-up scores after the hierarchical effects of pre-treatment sit-up scores, sex, race, and pre-treatment skinfold measurement were partialled out. As can be seen in Table 2, pre-treatment sit-up scores were the best predictor of post-treatment sit-up scores ($F\ (1,120) = 33.31$, $p < .001$), accounting for the largest proportion of the variance. Sex, race, pre-treatment skinfold measurement, and treatment condition did not add significantly to the prediction of outcome. Thus, treatment condition did not influence children's post-treatment sit-up scores.

To test Hypothesis 2, a multiple regression equation was calculated on the effect of experimental condition on post-treatment timed run (meters post) scores after the hierarchical effects of pre-treatment timed run scores, sex, race, and pre-treatment skinfold measurement

Table 1

Means, Standard Deviations and T-Tests on Pre-Scores

| Variables | Running Group N | Running Group M | Running Group SD | Routine Exercise Group N | Routine Exercise Group M | Routine Exercise Group SD | T Value |
|---|---|---|---|---|---|---|---|
| Sit-Ups | 50 | 31.86 | 8.16 | 67 | 38.13 | 8.14 | -4.12 *** |
| Skinfold | 51 | 14.27 | 5.96 | 71 | 13.94 | 5.51 | 0.31 |
| Meters Run | 47 | 1464.13 | 213.38 | 66 | 1450.17 | 210.24 | 0.35 |
| STAIC-T | 48 | 35.31 | 7.07 | 69 | 37.54 | 7.07 | -1.67 |
| CDI | 48 | 9.65 | 7.19 | 69 | 8.75 | 7.19 | 0.66 |
| Piers-Harris | 48 | 53.35 | 13.11 | 69 | 53.52 | 12.74 | -0.07 |
| CNS-IE | 48 | 15.29 | 4.41 | 69 | 15.08 | 4.59 | 0.24 |

*** $p < .001$

Table 2

Results of Hierarchical Regression to Predict Sit-Ups - Post

| Variables added | $R^2$ | Change in $R^2$ | Beta | F-test[a] |
|---|---|---|---|---|
| Sit-Ups-Pre | .25 | .25 | .47 | 33.31*** |
| Sex | .27 | .03 | -.13 | 2.48 |
| Race | .28 | .00 | -.05 | .42 |
| Skinfold-Pre | .28 | .00 | .06 | .59 |
| Treatment Condition | .30 | .02 | -.15 | 3.17 |

N = 121

[a] Significance test on the increment in $R^2$ at each step.

* $p < .05$. ** $p < .01$. *** $p < .001$

Table 3

Results of Hierarchical Regression to Predict Meters - Post

| Variables added | $R^2$ | Change in $R^2$ | Beta | F-test[a] |
|---|---|---|---|---|
| Meters-Pre | .10 | .10 | .25 | 8.20 ** |
| Sex | .16 | .06 | .25 | 7.86 ** |
| Race | .16 | .00 | -.02 | .07 |
| Skinfold-Pre | .16 | .00 | -.07 | .62 |
| Treatment Condition | .16 | .00 | -.03 | .10 |

$N = 121$

[a] Significance test on the increment in $R^2$ at each step.

* $p < .05$. ** $p < .01$. *** $p < .001$

were partialled out. As can be seen in Table 3, pre-treatment timed run scores were the best predictor of post-treatment timed run scores ($F$ (1,120)= 8.20, $p<.001$), accounting for the largest proportion of the variance. Sex added significantly to the prediction of outcome ($F$ (1,119)= 7.86, $p<.01$). Race, pre-treatment skinfold measurement, and treatment condition did not add significantly. Thus, treatment condition did not influence children's post-treatment timed run scores.

To test Hypothesis 3, a multiple regression equation was calculated on the effect of experimental condition on post-treatment CDI (depression) scores after the hierarchical effects of pre-treatment CDI scores, sex, race, pre-treatment skinfold measurement, and pre-treatment CNS-IE scores were partialled out. As can be seen in Table 4, pre-treatment CDI scores were the best predictor of post-treatment CDI scores ($F$ (1,120)= 5.01, $p<.05$), but only 3% of the variance was accounted for by this predictor. None of the remaining variables was significant in predicting outcome. Thus, treatment condition did not influence children's depression scores.

To test Hypothesis 4, a multiple regression equation was calculated on the effect of experimental condition on post-treatment STAIC-T (trait-anxiety) scores after the hierarchical effects of pre-treatment STAIC-T scores, sex, race, and pre-treatment skinfold measurement were partialled out. As can be seen in Table 5, only the first variable, pre-treatment STAIC-T scores, was significant in determining outcome ($F$ (1,120)= 5.79, $p<.05$) and only 5% of the variance was accounted for by this predictor. Sex, race, pre-treatment skinfold measurement, and experimental condition did not add significantly to the

Table 4

Results of Hierarchical Regression to Predict CDI - Post

| Variables added | $R^2$ | Change in $R^2$ | Beta | F-test[a] |
|---|---|---|---|---|
| CDI-Pre | .03 | .03 | .63 | 5.01* |
| Sex | .03 | .00 | -.01 | .01 |
| Race | .03 | .00 | -.00 | .00 |
| Skinfold-Pre | .03 | .00 | .01 | .00 |
| CNS-IE-Pre | .05 | .02 | -.49 | 3.01 |
| Treatment Condition | .05 | .00 | -.01 | .01 |

$\underline{N}$ = 121

[a] Significance test on the increment in $R^2$ at each step.

* $\underline{p}$ ‹.05. ** $\underline{p}$ ‹.01. *** $\underline{p}$ ‹.001

Table 5

Results of Hierarchical Regression to Predict STAIC-T - Post

| Variables added | $R^2$ | Change in $R^2$ | Beta | F-test[a] |
|---|---|---|---|---|
| STAIC-T-Pre | .05 | .05 | .22 | 5.79* |
| Sex | .05 | .00 | -.06 | .45 |
| Race | .05 | .00 | .03 | .13 |
| Skinfold-Pre | .05 | .00 | .00 | .00 |
| Treatment Condition | .05 | .00 | -.03 | .09 |

$N$ = 121

[a] Significance test on the increment in $R^2$ at each step.

* $p < .05$. ** $p < .01$. *** $p < .001$

prediction of outcome. Thus, treatment condition did not influence children's trait-anxiety scores.

To test Hypothesis 5, a multiple regression equation was calculated on the effect of experimental condition on post-treatment CNS-IE (locus of control) scores after the hierarchical effects of pre-treatment CNS-IE scores, sex, race, and pre-treatment skinfold measurement were partialled out. As can be seen in Table 6, none of the variables was significant in determining outcome. Thus, treatment condition did not influence children's locus of control scores.

To test Hypothesis 6, a multiple regression equation was calculated on the effect of experimental condition on post-treatment Piers-Harris (self-concept) scores after the hierarchical effects of pre-treatment Piers-Harris scores, sex, race, and pre-treatment skinfold measurement were partialled out. As can be seen in Table 7, only the first variable, pre-treatment Piers-Harris scores, was significant in determining outcome ($F$ (1,120)= 23.18, $p<.001$). Sex, race, pre-treatment skinfold measurement, and experimental condition did not add significantly to the prediction of outcome. Thus, treatment condition did not influence children's self-concept scores.

A correlation matrix was computed to determine the extent to which pre-scores, post-scores, and pre- and post-scores were inter-related. This matrix was calculated to determine whether there were significant correlations between physical and psychological measures even though a causal connection could not be established by a series of multiple regression equations. Pre-scores on all psychological measures were significantly inter-correlated with each other (see Table 8) as were post-scores on all psychological measures (see Table 9). High

Table 6

Results of Hierarchical Regression to Predict CNS-IE - Post

| Variables added | $R^2$ | Change in $R^2$ | Beta | F-test[a] |
|---|---|---|---|---|
| CNS-IE-Pre | .02 | .02 | .14 | 2.14 |
| Sex | .02 | .01 | -.07 | .54 |
| Race | .02 | .00 | -.01 | .01 |
| Skinfold-Pre | .02 | .00 | .02 | .04 |
| Treatment Condition | .02 | .00 | -.03 | .14 |

N = 121

[a] Significance test on the increment in $R^2$ at each step.

Table 7

Results of Hierarchical Regression to Predict Piers-Harris - Post

| Variables added | $R^2$ | Change in $R^2$ | Beta | F-test[a] |
|---|---|---|---|---|
| Piers-Harris-Pre | .16 | .16 | .41 | 23.18 *** |
| Sex | .19 | .02 | -.14 | 2.75 |
| Race | .20 | .01 | -.09 | 1.29 |
| Skinfold-Pre | .20 | .01 | -.07 | .63 |
| Treatment Condition | .21 | .01 | -.10 | 1.46 |

N = 121

[a] Significance test on the increment in $R^2$ at each step.

* $p < .05$. ** $p < .01$. *** $p < .001$

Correlation Matrix of Demographic and Pre-Score Data

| | Rx | Sex | Race | Age | SUPR | SKPR | MTRPR | STPR | CDIPR | PHPR | IEPR |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Treatment Group (Rx) | 1.00 | .10 | .10 | .00 | -.27 | .03 | .00 | -.01 | .09 | .04 | .08 |
| Sex | | 1.00 | .14 | .24 | .07 | -.14 | .19 | -.03 | .06 | .20 | .08 |
| Race | | | 1.00 | .00 | .00 | -.03 | .00 | .05 | .04 | -.10 | .04 |
| Age | | | | 1.00 | .00 | .01 | -.02 | .10 | .15 | .10 | .13 |
| Sit-Ups Pre-(SUPR) | | | | | 1.00 | -.08 | -.10 | -.11 | -.09 | .10 | .28 |
| Skinfold-Pre (SKPR) | | | | | | 1.00 | -.22 | -.12 | -.06 | -.20 | -.07 |
| Meters-Pre (MTRPR) | | | | | | | 1.00 | -.31 | -.38 | -.07 | -.35 |
| STAIC-T-Pre (STPR) | | | | | | | | 1.00 | .90 | .32 | .88 |
| CDI-Pre (CDIPR) | | | | | | | | | 1.00 | .30 | .95 |
| Piers-Harris-Pre(PHPR) | | | | | | | | | | 1.00 | .47 |
| CNSI-IE-Pre (IEPR) | | | | | | | | | | | 1.00 |

Note. All $r$'s $>.18$ in absolute value are significant at $p < .05$.

Correlation Matrix of Post-Score Data

| | SUPO | SKPO | MTRPO | STPO | CDIPO | PHPO | IEPO |
|---|---|---|---|---|---|---|---|
| Sit-Ups-Post (SUPO) | 1.00 | -.04 | -.06 | .34 | .34 | .29 | .33 |
| Skinfold-Post (SKPO) | | 1.00 | .00 | -.10 | -.07 | -.17 | -.05 |
| Meters-Post (MTRPO) | | | 1.00 | -.32 | -.31 | -.16 | -.30 |
| STAIC-T-Post (STPO) | | | | 1.00 | .96 | .51 | .90 |
| CDI-Post (CDIPO) | | | | | 1.00 | .52 | .92 |
| Piers-Harris-Post (PHPO) | | | | | | 1.00 | .65 |
| CNS-IE-Post (IEPO) | | | | | | | 1.00 |

Note: All r's $>$ .18 in absolute value are significant at $p < .05$.

pre-scores on meters run were significantly correlated with low depression scores (CDI) ($r$=-.38, $p$<.05), low trait-anxiety scores (STAIC-T) ($r$= -.31, $p$<.05), and a more internal locus of control (CNS-IE) ($r$= -.35, $p$<.05), on pre-tests (see Table 8). High post - scores on meters run were also significantly correlated with low depression scores (CDI) ($r$= -.31, $p$<.05), low trait-anxiety scores (STAIC-T) ($r$= -.32, $p$<.05), and a more internal locus of control (CNS-IE) ($r$= -.30, $p$<.05) on post-tests (see Table 9). High pre-treatment scores on sit-ups were significantly correlated with better self-concept (Piers-Harris Self-Concept Scale) ($r$= .26, $p$<.05), higher depression scores (CDI) ($r$= .28, $p$<.05), higher trait-anxiety scores (STAIC-T) ($r$= .28, $p$<.05), and a more external locus of control (CNS-IE) ($r$= .28, $p$<.05) on post-tests (see Table 10). High post-scores on sit-ups were significantly correlated with better self-concept (Piers-Harris Self-Concept Scale) ($r$= .29, $p$<.05), but with higher depression scores (CDI) ($r$= .34, $p$<.05), higher trait-anxiety scores (STAIC-T) ($r$= .34, $p$<.05), and a more external locus of control (CNS-IE) ($r$ = .33, $p$<.05) on post-tests (see Table 9).

The general failure to find significant differential treatment effects led to calculation of a repeated measures ANOVA to ascertain whether participation in either exercise program produced significant physical or psychological changes (see Table 11). Mean scores for all physical and psychological measures were found to be significantly different pre- to post-treatment, in the direction of improved physical and mental health. Mean pre-sit-up ($M$ = 35.05) and post-sit-up scores ($M$= 38.42) were found to be significantly different ($F$ (1,104)=2.73, $p$<.001). Mean pre-skinfold ($M$= 14.37) and post-skinfold measurements ($M$= 13.51) were

Correlation Matrix of Demographic and Pre-Score Data with Post-Score Data

| | Treatment Condition (Rx) | Sex | Race | Age | Sit-Ups-Pre | Skinfold-Pre | Meters-Pre | STAIC-T-Pre | CDI-Pre | Piers-Harris-Pre | CNSI-IE Pre |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Sit-Ups-Post | -.29 | -.12 | -.08 | -.04 | .50 | .04 | -.01 | -.02 | -.03 | -.12 | -.06 |
| Skinfold-Post | .10 | -.11 | -.03 | .07 | -.13 | .84 | -.34 | .06 | .16 | -.13 | .16 |
| Meters-Post | -.01 | .30 | .01 | -.03 | -.02 | -.16 | .32 | .04 | .03 | .17 | .06 |
| STAIC-T-Post | -.03 | -.07 | .03 | -.07 | .28 | -.02 | .03 | .22 | .18 | -.15 | .13 |
| CDI-Post | .01 | -.01 | .00 | -.01 | .28 | .01 | .03 | .13 | .17 | -.15 | .11 |
| Piers-Harris-Post | -.11 | -.07 | -.16 | -.02 | .26 | -.13 | -.05 | .08 | .07 | .40 | .12 |
| CNS-IE-Post | -.03 | -.07 | -.02 | -.04 | .28 | .02 | -.02 | .13 | .14 | -.07 | .13 |

Note: All $r$'s $>.18$ in absolute value are significant at $p < .05$.

Table 11

Comparison of Pre-and Post-Means

| | Pre-Scores | | Post-Scores | | |
|---|---|---|---|---|---|
| Variables | M | SD | M | SD | F |
| Sit-Ups | 35.05 | 8.75 | 38.42 | 8.10 | 23.73*** |
| Skinfold | 14.37 | 5.77 | 13.51 | 5.53 | 24.26*** |
| Meters | 1472.17 | 206.98 | 1504.92 | 220.97 | 7.35** |
| STAIC-T | 36.38 | 6.80 | 32.62 | 6.46 | 51.20*** |
| CDI | 8.72 | 6.48 | 6.65 | 6.37 | 13.78*** |
| Piers-Harris | 54.00 | 12.32 | 58.20 | 12.11 | 26.20*** |
| CNS-IE | 15.03 | 4.35 | 13.69 | 4.35 | 11.51*** |

* $p < .05$. ** $p < .01$. *** $p < .001$

found to be significantly different ($F$ (1,101) = 24.26, $p < .001$). Mean pre-run scores ($M$= 1472.17) and post-timed run scores ($M$=1504.92) were found to be significantly different ($F$ (1,94)= 7.35, $p < .01$). Mean pre-STAIC-T ($M$=36.38) and post-STAIC-T (trait-anxiety) scores ($M$= 32.62) were found to be significantly different ($F$ (1,107)= 51.20, $p < .001$). Mean pre-CDI ($M$=8.72) and post-CDI (depression) scores ($M$=6.65) were found to be significantly different ($F$ (1,107)= 13.78, $p < .001$). Mean pre-Piers-Harris ($M$=54.00) and post-Piers-Harris (self-concept) scores ($M$= 58.20) were found to be significantly different ($F$ (1,105)= 26.20, $p < .001$). Mean pre-CNS-IE ($M$=15.03) and post-CNS-IE (locus of control) scores ($M$=13.69) were found to be significantly different ($F$ (1,106)=11.51, $p < .001$). This suggests that physical and psychological changes occured equally across both groups.

Finally, a general evaluation of the quality and quantity of physical exercise which each group received was evaluated by investigation of the teachers' Rating of Daily Exercise Form. Both groups received similar amounts of exercise (R Group=68 exercise periods; RE Group=67 exercise periods). The Running Group, however, received more vigorous exercise than the Routine Exercise Group. The Running Group spent the greatest proportion of its total exercise time in running (66%) while the Routine Exercise Group spent the greatest proportion of its total exercise time playing kickball (72%).

## Discussion

This study examined the effects of two exercise programs on children's physical fitness and mental health. Both groups significantly improved their scores on two tests of fitness (i.e., sit-ups completed in 60 seconds and meters completed in a 9 minute timed run) and four psychological measures (i.e.,CDI, STAIC-T, CNS-IE, Piers-Harris Self-Concept Scale). In addition, skinfold measurement was significantly improved for both groups, which was not expected due to the shortness of the intervention program. Clearly, changes were significant and in the expected direction.

There were, however, no significant differential treatment effects across groups. The improvement across groups, as well as the lack of significant differential effects between groups, will now be discussed. The section will conclude with suggestions for future investigations.

### Lack of Differential Treatment Effects

Children in both groups made significant physical and psychological changes. The gains were not, however, produced solely in the Running Group, as was predicted, but in both exercise groups. The weakness of the intervention, and the fact that the no-treatment control group was not, in actuality, a no-treatment group, may account for this lack of significant differential treatment effects. The Running Group appeared to have received more strenuous exercise than the Routine Exercise Group, according to the Teachers' Rating of Daily Exercise Form, but it is probable that children in both groups engaged in more daily physical activity than teachers noted on this form. Warmer weather may have caused children in both groups, for example,

to play more vigorously outdoors after school during the intervention phase of the study than they did prior to pre-testing. Because no parental or self-report record of daily exercise was attempted, total amount of exercise for each group is impossible to ascertain. Data analyses do indicate, however, that children in both groups made significant physical gains as measured by decreased skinfold measurement and increased sit-up and timed run scores. These physical gains are encouraging and suggest that the implementation of either a non-strenuous or vigorous monitored exercise program can have significant physical benefits.

Demand characteristics may have contributed to overall physical and psychological improvement across groups. Children and teachers in both groups received attention from the experimenters and a break from the routine school day. Children in both groups also received certificates and ribbons for good running scores. The general effects of enthusiasm alone could have produced significant improvement for children in both schools. Teachers' awareness of the study goals could have contributed to overall physical and psychological gains. In addition, the effects of teacher monitoring may have played a role in students' performances on physical and psychological measures.

The psychological measures used may also have contributed to equivalence of change across groups. Both exercise programs were implemented in populations of normal fifth graders. The interventions were designed to enhance already adequate psychological functioning, and not to remediate psychopathological deficits. The difference between adaptive and maladaptive functioning is not considered to be one of degree (Cowen, 1977 & 1980; Cowen & Gesten, 1980). Adaptive

and maladaptive behaviors do not lie on either end of a continuum. Studies of adequate and psychopathological behaviors (Cowen, 1977 & 1980; Cowen & Gesten, 1980) , in fact, suggest that adaptive behavior includes the presence of certain constructive actions and habits and not merely the absence of destructive actions. The four psychological measures used were not designed to assess these positive skills. None was sufficiently sensitive to increases in already highly functioning areas. The need for adequate measures to assess adaptive functioning is a critical one, not only in the investigation of mind and body interactions, but for the field of psychology as a whole. The four psychological measures used in this study may also have been too global to assess discrete and specific changes which may have occurred. Children's body-images or perceptions of themselves as physically fit, for example, may have improved over the course of the study although such gains could not be seen in a global measure of self-concept such as the Piers-Harris Self-Concept Scale.

It is also possible that pre-treatment differences between groups may have contributed to lack of differential treatment effects. The two groups were, in fact, significantly different on pre-treatment sit-up scores. Mean number of sit-ups executed by the Routine Exercise Group was greater than the number completed by the Running Group. They were not, however, significantly different prior to treatment on any of the four psychological measures nor on pre-treatment skinfold measurement or timed run scores. The disparity in pre-treatment sit-up scores is likely due to differences in test administration between the two groups. Standardized instructions were given to the physical education teachers at both schools. The teacher in the school in which

the Routine Exercise Group was run, however, reported that he had incorrectly administered the test to one of the fifth grade classes. This necessitated a second administration. Each child in this class received two scores, but only the higher of the two was reported. It is therefore likely that the initial differences between the two groups were not "real" differences, but only a result of this error in test administration. Lack of differential treatment effects does not therefore appear to be attributable to pre-treatment group differences.

Equivalence of change across groups may be attributable to maturational effects. Children in both groups may have increased their physical fitness scores at post-testing simply because they were older and therefore somewhat stronger than at pre-testing. Skinfold measurement may have significantly decreased because ten, eleven, and twelve year-old children frequently experience rapid bursts of growth with concomitant decreases in percentage of body fat. It is possible that maturational effects also played a role in improved psychological functioning at post-testing. Because of the short time interval between pre- and post-testing (i.e., five weeks), however, it is unlikely that maturational effects posed a significant threat to the internal validity of either physical or psychological measures.

High Running Scores

Interestingly, good runners demonstrated positive psychological fitness as well. High scores on the timed run test were significantly correlated with low scores on tests of depression and anxiety as well as with a more internal locus of control. These correlations were demonstrated on both pre- and post-tests. The intervention was apparently not strong enough to significantly impact mean scores on the

timed run test between pre- and post-testing, but those children who obtained high scores on the running test also demonstrated good scores on three tests of psychological functioning. It is impossible to determine what caused these physical and psychological changes. Physical fitness may produce psychological benefits, healthy psychological functioning may cause physical fitness gains or the two may operate in a synergistic fashion. Thus, a connection between running and mental health is suggested, although a causal link cannot be established on the basis of the present study.

Prediction of Post-Test Scores

Physical fitness pre-test scores did contribute significantly to prediction of post-test physical fitness scores. Pre-treatment sit-up scores were the best predictor of post-treatment sit-up scores and pre-treatment timed run scores also were the best predictor of post-treatment timed run scores. In contrast with the significant contribution provided by pre-test scores toward prediction of post-test physical fitness scores, pre-test scores on psychological measures did not contribute significantly to prediction of post-test scores on the same measures. In fact, none of the predictors thought to contribute to post-test psychological scores was found to be both significant and to account for a sizable proportion of the total variance. It is also possible, however, that psychological constructs are more variable than physical fitness measures. The inability to predict post-test psychological scores suggests that the validity and reliability of children's self-report measures may need to be further studied.

Sit-up Post-Scores

One inexplicable finding was a positive correlation between sit-up scores and high self-concept scores, and with poorer post-test scores on other psychological measures. High post-scores on sit-ups were significantly correlated with higher depression scores, higher trait-anxiety scores and a more external locus of control. This finding is difficult to interpret and does not appear meaningful in light of the study's other findings. When a large number of statistical analyses are calculated, some correlations may be significant due to chance. The positive correlation between high sit-up scores and high self-concept scores may, therefore, be attributable to chance.

Implications For Future Studies

Clearly, more work needs to be done in the area of physical fitness and psychological gains. First, it is important to determine how children naturally develop physical prowess. It is also important to understand the nature of the relationship between the development of physical health and mental health. It is only by comprehending how this process occurs that effective physical fitness intervention programs can be designed.

Intervention programs designed to improve physical fitness must be sufficiently strong enough to significantly increase the level of activity in which children are already engaging. Second, assessment measures used to ascertain possible psychological gains in normal populations must be capable of assessing adaptive functioning and not merely presence or absence of psychopathology. Third, the effects of demand characteristics such as general enthusiasm and teacher monitoring need

to be identified and controlled or utilized and evaluated. Further studies in this field are certainly needed and could contribute greatly toward a better understanding of the mind and body interaction in children.

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# APPENDIX A

## Schedule for Running and Routine Exercise Groups

Appendix A

Schedule for Running and Routine Exercise Groups

| | Weeks of Study | | | | |
|---|---|---|---|---|---|
| | 4 weeks prior to study | 2 weeks prior to study | 1 | 2 | 6 |
| RUNNING GROUP | Teachers approached about participation in study | Consent forms distributed | Physical & psychological measures administered | Beginning of 5 week running program<br><br>Teachers began collecting daily exercise records | Conclusion of running program<br><br>Physical & psychological measures re-administered |
| ROUTINE EXERCISE GROUP | Same as above | Same as above | Same as above | Continuation of regular exercise program<br><br>Teachers began collecting daily exercise records | Physical & psychological measures re-administered |

# APPENDIX B

## Norms for the Nine-minute Run

# Appendix B

## Norms for the Nine-Minute Run

| Rating | Age 10 | 11 |
|---|---|---|
| Excellent | 1900 | 2000 |
| Good | 1600 | 1700 |
| Average | 1200 | 1500 |
| Poor | 800 | 900 |

# APPENDIX C

## Norms for the Sixty-Second Sit-Up Test

# Appendix C

## Norms for the Sixty-Second Sit-Up Test

| | Age | | |
|---|---|---|---|
| Rating | 9 | 10 | 11 |
| Excellent | 34 | 40 | 44 |
| Good | 28 | 35 | 36 |
| Average | 24 | 26 | 26 |
| Poor | 12 | 13 | 15 |

# APPENDIX D

Example of Daily Exercise Form

Appendix D

Example of Daily Exercise Form

| | MON | TUES | WED | THURS | FRI |
|---|---|---|---|---|---|
| TYPE OF EXERCISE | Jumping Rope | Kickball | Raining: class did not exercise | Dodgeball | Free play: Walking, sitting |
| APPROXIMATE # OF MINUTES | 10 | 20 | -- | 15 | 10 |
| CONTINUOUS OR DISCONTINUOUS | 1 | 2 | -- | 2 | 3 |

CONTINUOUS VS DISCONTINUOUS: Significantly less than 50% of the period: 1 | Approximately 50% of the period: 2 | Significantly more than 50% of the period: 3

# APPENDIX E

Example of Running for Fun and Fitness Form

Appendix E

Example of Running for Fun and Fitness Form

1 week record of laps run

| Child's Name | MON | TUES | WED | THURS | FRI |
|---|---|---|---|---|---|
| Joe A. | 3 | A | OTHER EXERCISE | 4 | BAD WEATHER |
| Mary B. | 2 | 4 | | N | |
| Tommy C. | 4 | 3 | | 5 | |

A = Absent
N = Note from home (eg., no exercise)

# APPENDIX F

Children's Depression Inventory (CDI)

## Appendix F
## CD INVENTORY

Kids sometimes have different feelings and ideas.

This form lists the feelings and ideas in groups. From each group, pick one sentence that describes you best for the past two weeks. After you pick a sentence from the first group, go on to the next group.

There is no right answer or wrong answer. Just pick the sentence that best describes the way you have been recently. Put a mark like this X next to your answer. Put the mark in the box next to the sentence that you pick.

Here is an example of how this form works. Try it. Put a mark next to the sentence that describes you best.

Example:

_____ I read books all the time.

_____ I read books once in a while.

_____ I never read books.

Remember, pick out the sentences that describe your feelings and ideas in the PAST TWO WEEKS.

1. _____ I am sad once in a while.

_____ I am sad many times.

_____ I am sad all the time.

2. _____ Nothing will ever work out for me.

_____ I am not sure if things will work out for me.

_____ Things will work out for me O.K.

3. _____ I do most things O.K.

_____ I do many things wrong.

_____ I do everything wrong.

4. _____ I have fun in many things.

_____ I have fun in some things.

_____ Nothing is fun at all.

5. _____ I am bad all the time.

_____ I am bad many times.

_____ I am bad once in a while.

6. _____ I think about bad things happening to me once in a while.

_____ I worry that bad things will happen to me.

_____ I am sure that terrible things will happen to me.

7. _____ I hate myself.

_____ I do not like myself.

_____ I like myself.

8. _____ All bad things are my fault.
_____ Many bad things are my fault.
_____ Bad things are not usually my fault.

9. _____ I do not think about killing myself.
_____ I think about killing myself but I would not do it.
_____ I want to kill myself.

10. _____ I feel like crying every day.
_____ I feel like crying many days.
_____ I feel like crying once in a while.

11. _____ Things bother me all the time.
_____ Things bother me many times.
_____ Things bother me once in a while.

12. _____ I like being with people.
_____ I do not like being with people many times.
_____ I do not want to be with people at all.

13. _____ I cannot make up my mind about things.
_____ It is hard to make up my mind about things.
_____ I make up my mind about things easily.

14. _____ I look O.K.
_____ There are some bad things about my looks.
_____ I look ugly.

15. _____ I have to push myself all the time to do my schoolwork.
_____ I have to push myself many times to do my schoolwork.
_____ Doing schoolwork is no big problem.

16. _____ I have trouble sleeping every night.

_____ I have trouble sleeping many nights.

_____ I sleep pretty well.

17. _____ I am tired once in a while.

_____ I am tired many days.

_____ I am tired all the time.

18. _____ Most days I do not feel like eating.

_____ Many days I do not feel like eating.

_____ I eat pretty well.

19. _____ I do not worry about aches and pains.

_____ I worry about aches and pains many times.

_____ I worry about aches and pains all the time.

20. _____ I do not feel alone.

_____ I feel alone many times.

_____ I feel alone all the time.

21. _____ I never have fun at school.

_____ I have fun at school only once in a while.

_____ I have fun at school many times.

22. _____ I have plenty of friends.

_____ I have some friends but I wish I had more.

_____ I do not have any friends.

23. _____ My schoolwork is all right.

_____ My schoolwork is not as good as before.

_____ I do very badly in subjects I used to be good in.

24. _____ I can never be as good as other kids.

_____ I can be as good as other kids if I want to.

_____ I am just as good as other kids.

25. _____ Nobody really loves me.

_____ I am not sure if anybody loves me.

_____ I am sure that somebody loves me.

26. _____ I usually do what I am told.

_____ I do not do what I am told most times.

_____ I never do what I am told.

27. _____ I get along with people.

_____ I get into fights many times.

_____ I get into fights all the time.

The End

THANK YOU FOR FILLING OUT THIS FORM

# APPENDIX G

State-Trait Anxiety Inventory for Children (STAIC-Trait)

## Appendix G

### HOW-I-FEEL QUESTIONNAIRE

DIRECTIONS: A number of statements which boys and girls use to describe themselves are given below. Read each statement and decide if it is hardly-ever, or sometimes, or often true for you. Then for each statement, put an X on the line in front of the word that seems to describe you best. There are no right or wrong answers. Do not spend too much time on any one statement. Remember, choose the word which seems to describe how you usually feel.

1. I worry about making mistakes _____ hardly-ever _____ sometimes _____ often
2. I feel like crying . . . . . _____ hardly-ever _____ sometimes _____ often
3. I feel unhappy . . . . . _____ hardly-ever _____ sometimes _____ often
4. I have trouble making up my mind . . . . . _____ hardly-ever _____ sometimes _____ often
5. It is difficult for me to face my problems . . . . . _____ hardly-ever _____ sometimes _____ often
6. I worry too much . . . . . _____ hardly-ever _____ sometimes _____ often
7. I get upset at home . . . . _____ hardly-ever _____ sometimes _____ often
8. I am shy . . . . . _____ hardly-ever _____ sometimes _____ often
9. I feel troubled . . . . . _____ hardly-ever _____ sometimes _____ often
10. Unimportant thoughts run through my mind and bother me _____ hardly-ever _____ sometimes _____ often
11. I worry about school . . . . _____ hardly-ever _____ sometimes _____ often
12. I have trouble deciding what to do . . . . . _____ hardly-ever _____ sometimes _____ often
13. I notice my heart beats fast _____ hardly-ever _____ sometimes _____ often
14. I am secretly afraid . . . . _____ hardly-ever _____ sometimes _____ often
15. I worry about my parents . . _____ hardly-ever _____ sometimes _____ often
16. My hands get sweaty . . . . . _____ hardly-ever _____ sometimes _____ often
17. I worry about things that may happen . . . . . _____ hardly-ever _____ sometimes _____ often
18. It is hard for me to fall asleep at night . . . . . _____ hardly-ever _____ sometimes _____ often

19. I get a funny feeling in my stomach . . . . . _____ hardly-ever _____ sometimes _____ often

20. I worry about what others think of me . . . . . _____ hardly-ever _____ sometimes _____ often

# APPENDIX H

## Children's Nowicki-Strickland Internal - External Control Scale (CNS-IE)

## Appendix H

Circle the appropriate answer as it applies to you.

Yes No 1. Do you believe that most problems will solve themselves if you just don't fool with them?

Yes No 2. Do you believe that you can stop yourself from catching a cold?

Yes No 3. Are some kids just born lucky?

Yes No 4. Most of the time do you feel that getting good grades means a great deal to you?

Yes No 5. Are you often blamed for things that just aren't your fault?

Yes No 6. Do you believe that if somebody studies hard enough he or she can pass any subject?

Yes No 7. Do you feel that most of the time it doesn't pay to try hard because things never turn out right anyway?

Yes No 8. Do you feel that if things start out well in the morning that it's going to be a good day no matter what you do?

Yes No 9. Do you feel that most of the time parents listen to what their children have to say?

Yes No 10. Do you believe that wishing can make things happen?

Yes No 11. When you get punished does it usually seem its for no good reason at all?

Yes No 12. Most of the time do you find it hard to change a friend's (mind) opinion?

Yes No 13. Do you think that cheering more than luck helps a team to win?

Yes No 14. Do you think that it's nearly impossible to change your parent's mind about anything?

Yes No 15. Do you believe that your parents should allow you to make most of your decisions?

Yes No 16. Do you feel that when you do something wrong there's very little you can do to make it right?

Yes No 17. Do you believe that most kids are just born good at sports?

Yes No 18. Are most of the other kids your age stronger than you are?

Yes No 19. Do you feel that one of the best ways to handle most problems is just not to think about them?

Yes No 20. Do you feel that you have a lot of choice in deciding who your friends are?

Yes No 21. If you find a four leaf clover do you believe that it might bring you good luck?

Yes No 22. Do you often feel that whether you do your homework has much to do with what kind of grades you get?

Yes No 23. Do you feel that when a kid your age decides to hit you, there's little you can do to stop him or her?

Yes No 24. Have you ever had a good luck charm?

Yes No 25. Do you believe that whether or not people like you depends on how you act?

Yes No 26. Will your parents usually help you if you ask them to?

Yes No 27. Have you felt that when people were mean to you it was usually for no reason at all?

Yes No 28. Most of the time, do you feel that you can change what might happen tomorrow by what you do today?

Yes No 29. Do you believe that when bad things are going to happen they are going to happen no matter what you try to do to stop them?

Yes No 30. Do you think that kids can get their own way if they just keep trying?

Yes No 31. Most of the time do you find it useless to try to get your own way at home?

Yes No 32. Do you feel that when good things happen they happen because of hard work?

Yes No 33. Do you feel that when somebody your age wants to be your enemy there's little you can do to change matters?

Yes No 34. Do you feel that it's easy to get friends to do what you want them to?

Yes No 35. Do you usually feel that you have little to say about what you get to eat at home?

Yes No 36. Do you feel that when someone doesn't like you there's little you can do about it?

Yes No 37. Do you usually feel that it's almost useless to try in school because most other children are just plain smarter than you are?

Yes No 38. Are you the kind of person who believes that planning ahead makes things turn out better?

Yes No 39. Most of the time, do you feel that you have little to say about what your family decides to do?

Yes No 40. Do you think it's better to be smart than to be lucky?

# APPENDIX I

Piers-Harris Children's Self-Concept Scale

Appendix I

HOW I FEEL ABOUT MYSELF

Here are a set of statements. Some of them are true of you and so you will circle the yes. Some are not true of you and so you will circle the no. Answer every question even if some are hard to decide, but do not circle both yes and no. Remember, circle the yes if the statement is generally like you, or circle no if the statement is generally not like you. There are not right or wrong answers. Only you can tell us how you feel about yourself, so we hope you will mark the way you really feel inside.

1. My classmates make fun of me ..... yes no
2. I am a happy person ..... yes no
3. It is hard for me to make friends ..... yes no
4. I am often sad..... yes no
5. I am smart..... yes no
6. I am shy..... yes no
7. I get nervous when the teacher calls on me ..... yes no
8. My looks bother me..... yes no
9. When I grow up, I will be an important person..... yes no
10. I get worried when we have tests in school..... yes no
11. I am unpopular..... yes no
12. I am well behaved in school..... yes no
13. It is usually my fault when something goes wrong.... yes no
14. I cause trouble to my family..... yes no
15. I am strong..... yes no
16. I have good ideas..... yes no
17. I am an important member of my family..... yes no
18. I usually want my own way..... yes no
19. I am good at making things with my hands..... yes no
20. I give up easily..... yes no
21. I am good in my school work..... yes no

22. I do many bad things..... yes no
23. I can draw well..... yes no
24. I am good in music..... yes no
25. I behave badly at times..... yes no
26. I am slow in finishing my school work..... yes no
27. I am an important member of my class..... yes no
28. I am nervous..... yes no
29. I have pretty eyes..... yes no
30. I can give a good report in front of the class..... yes no
31. In school I am a dreamer..... yes no
32. I pick on my brother(s) and sister(s)..... yes no
33. My friends like my ideas..... yes no
34. I often get into trouble..... yes no
35. I am obedient at home..... yes no
36. I am lucky..... yes no
37. I worry a lot..... yes no
38. My parents expect too much of me..... yes no
39. I feel like being the way I am..... yes no
40. I feel left out of things..... yes no
41. I have nice hair..... yes no
42. I often volunteer in school..... yes no
43. I wish I were different..... yes no
44. I sleep well at night..... yes no
45. I hate school..... yes no
46. I am among the last to be chosen for games..... yes no
47. I am sick a lot..... yes no
48. I am often mean to other people..... yes no
49. My classmates in school think I have good ideas..... yes no

50. I am unhappy..... yes no

51. I have many friends..... yes no

52. I am cheerful..... yes no

53. I am dumb about most things..... yes no

54. I am good looking..... yes no

55. I have lots of pep..... yes no

56. I get into a lot of fights..... yes no

57. I am popular with boys..... yes no

58. People pick on me..... yes no

59. My family is disappointed in me..... yes no

60. I have a pleasant face..... yes no

61. When I try to make something, everything seems to go wrong..... yes no

62. I am picked on at home..... yes no

63. I am a leader in games and sports..... yes no

64. I am clumsy..... yes no

65. In games and sports, I watch instead of play..... yes no

66. I forget what I learn..... yes no

67. I am easy to get along with..... yes no

68. I lose my temper easily..... yes no

69. I am popular with girls..... yes no

70. I am a good reader..... yes no

71. I would rather work alone than with a group..... yes no

72. I like my brother (sister)..... yes no

73. I have a good figure..... yes no

74. I am often afraid..... yes no

75. I am always dropping or breaking things..... yes no

76. I can be trusted..... yes no

77. I am different from other people..... yes no

78. I think bad thoughts..... yes no

79. I cry easily..... yes no

80. I am a good person..... yes no

# APPENDIX J

Consent Form

# Appendix J

Dear Parent:

Research suggests that improved levels of physical fitness may be related to increased self-esteem and lowered levels of depression and anxiety. A project, with the approval of the Chesterfield County School System, will be conducted by the fifth grade teachers at both Hening and Hopkins Elementary Schools and by Mrs. Lynne Einhaus, a doctoral candidate in psychology at Virginia Commonwealth University. The project will investigate children's levels of physical fitness and their feelings about themselves. It will be assisted by Dr. Arnold Stolberg and Dr. Bob Davis at Virginia Commonwealth University.

All of the children in the fifth grade at your child's school will participate in their regularly scheduled exercised program. For the purposes of this study, we are asking permission to administer written questionnaires to the children and asking them to complete a 9 minute run/walk test. A copy of each of the questionnaires is on file with your child's teacher for any parent wishing to see them. The completion of the questionnaires and the walk/run test is optional. Children participating in this study will be given questionnaires to complete, asking them how they feel about themselves. The first test session is scheduled for the week of April 11, 1983 and the second session is scheduled for the week of May 23, 1983. The test session and walk/run test will take place in school at times when your child's teacher determines it will not cause him or her to miss necessary classroom work. Each session will take approximately 1½ hours.

In discussing this project or the findings, we will not include the names of the children or the names of the schools in the study. Participation is entirely voluntary. Children with physical handicaps may participate, even if it is to a very limited degree. Every effort will be made to allow every child to participate at his or her own pace, with special precautions taken whenever necessary. In addition, if you would prefer your child not to exercise on any particular day, please send a note to school with him or her on that day. If at any time you or your child decide to stop, you are both free to do so. If you have any questions about the study, please call Lynne Einhaus at 353-5243.

Please sign the bottom portion of this letter and return it to your child's teacher indicating, by checking the appropriate blank, if it is agreeable to you that your child take part in this project.

Thank you very much for your help.

Philip Sword
Barbara Walke
Alice Magee
Frances Wadkins
Lynne Einhaus

____ I agree to allow my child to participate in the study to be conducted by Lynne Einhaus. I understand that I may withdraw my child from this study at any time. (If you have agreed to your child's participation in this study, does he or she have any specific physical problems we should be aware of? ____ Please explain fully on the back of this form.)

____ I do not wish my child to participate in the study to be conducted by Lynne Einhaus.

Child's Name _____

Parent/Guardian signature _____

Date _____

# APPENDIX K

## Instructions for Psychological Measures

# Appendix K

## Instructions for Psychological Measures

My name is Lynne Einhaus. I want to thank all of you for letting me visit your class today. Actually, I take classes, too -- over at V.C.U. I'm studying to be a psychologist. Who knows what kinds of things psychologists study? (Pause for children's comments.) Well, a psychologist studies what people think, how people feel and how they behave.

Today you can help me be a better psychologist. I'm trying to find out how fifth graders feel about themselves. So, I'll be passing out some answer sheets in just a minute and asking you some questions about how you're feeling. Your honest answers will help me get a better idea of how fifth graders feel.

I will be giving you four different questionnaires. That might sound like a lot, but they go pretty quickly. Two of them I'll read out loud and two are on a tape. You can read along on your answer sheet and mark your answers down.

I'll be asking you to write your name, whether you're a boy or girl, and your date of birth on the front of your questionnaire. But the only person who will see your answers is me. Your teacher and the other students in your class will not read your answers. Remember-- answer each question honestly so I can find out how fifth graders really feel. Any questions? OK, let's start!

# APPENDIX L

Article to be Submitted for Publication

Appendix L

Article to be Submitted for Publication

# Effects of Exercise on Children's Physical and Mental Health

Physical exercise has become increasingly popular in recent years. The running movement, in particular, has drawn an enthusiastic band of supporters. Numerous studies have emerged in an attempt to demonstrate the purported positive relationship between the improved physical fitness resulting from a regular running program and mental health variables.

## Effects of Running on Adults

Running programs have been used with alcoholics (Blue, 1979; Gary & Guthrie, 1972), psychiatric hospital patients (Dodson & Mullens, 1969), agoraphobics (Orwin, 1973), cardiac patients (Kavanagh, Shepard, Tuck, & Qureshi, 1977; Leon & Blackburn, 1977), and normal adults (Ismail & Young, 1977; Schultz, Dawes, & Park, 1982) with positive psychological changes. The beneficial effects of vigorous running programs have been documented in the treatment of painful mood states such as depression (Brown, Ramirez, & Taub, 1979; Greist, Klein, Eischens, Faris, Gurman, & Morgan, 1979; Kavanagh, et. al., 1977) and anxiety (Lion, 1978; Wood, 1977). Research relating running to personality has also generally demonstrated an increase in self-concept (Collingwood, 1972; Hilyer & Mitchell, 1979) although it should be noted that the literature in this area is not yet conclusive.

## Effects of Running on Children

The effect of running on children and adolescents has not been as extensively studied as it has been in adults. Fitness programs with elementary school age children have largely been limited to investigating the effects of movement skills training on normal children (Bruya, 1977; Hanson, 1971; Martinek, Cheffers, & Zaichowsky, 1978; Mauser & Reynolds, 1977) or to the effects of various physical fitness activities on special populations of children such as the mentally retarded (Chasey, Swartz, & Chasey, 1974; Nunley, 1965). Results of these studies suggest that self-concept in children may be improved through a movement skills program, although experimental results do not consistently show a positive correlation between fitness programs and improved self-concept. Only one study investigated the effects of movement skills training on anxiety (Hanson, 1971) and this experimental study did find a decrease in anxiety levels of four-year-olds participating in the program. Likewise, only one study investigated the effects of a sports fitness camp on locus of control (Duke, Johnson, & Nowicki, 1977) and results from this study also were significant, showing changes from an external to an internal locus of control. No studies could be found investigating the effects of any type of fitness program on depression levels in children.

Of the few studies investigating the effects of children's fitness programs including some component of cardiovascular training, two found significant improvement in self-attitude (Chasey et. al., 1974; McGowan, Jarman, & Pederson, 1974). No studies utilizing cardiovascular programs demonstrated insignificant relationships between participation in a fitness program and self-concept.

The purpose of the present study was to assess the effects of two exercise programs on children's self-concept, locus of control, depression, and anxiety as well as cardiovascular fitness. The running program was expected to be more strenuous than the routine exercise program. Because there is some evidence to suggest that vigorous exercise is more beneficial than non-vigorous exercise (Leonard & Gargiulo, 1978), children who were involved in a vigorous running program were expected to demonstrate a greater level of physical fitness than the children participating in a less strenuous standard program, as indicated by improvement in number of sit-ups completed during a 60-second time period and improvement in the nine minute timed run. It was expected that children participating in the running program (hereafter referred to as the Running Group, or "R") would show reduced depression and anxiety relative to children participating in the Routine Exercise Group, or "RE"). It was also predicted that R children would demonstrate a more internal locus of control and a greater increase in self-concept than RE children.

## Method

### Subjects

Subjects were 121 fifth grade students from two elementary schools in the Richmond, Virginia area. Schools were matched on SES and academic performance on standardized academic tests. All fifth grade students in both schools were eligible for the study. Both males and females participated. T-tests were calculated to insure that both groups were equivalent at pre-test. Skinfold measurements, timed run scores, depression, anxiety, and self-concept were found

to be equivalent. The groups were not equivalent on pre- sit-up scores.

Instruments

Skinfold measurement. First, tricep skinfold measurements using the Advance Adipometer Skinfold Caliper were taken for all children to determine amount of body fat for each subject. Two measurements were taken and the mean measurement was used as a measure of obesity.

Timed run. A 100-meter tape was placed on the grass in an oval. A maximum of 10 children was tested at one time. Two raters recorded the number of laps run by each child in nine minutes.

Sit-Ups. Children were paired with one child holding the other's feet. When the go signal was given, children completed as many sit-ups as they could in a 60-second time period. Each child reported his or her score to the physical education teacher.

Rating of daily exercise activity. Teachers were asked to fill out a brief Daily Exercise Form to provide a gross assessment of the types and quantity of exercise in which each group participated. Teachers of children in the Running Group also charted the number of laps each child completed daily.

Children's Depression Inventory. The CDI (Kovacs, 1980) is a 27-item self-report rating scale which assesses affective, behavioral, social, attitudinal and vegetative symptoms of depression. Its internal consistency is adequate (coefficient alpha = .86) and the item-total score correlations are all statistically significant (.31 to .54) (Kovacs, 1980). The validity of the scale is supported by Friedman and Butler's (1979) finding that high CDI scorers tend to have low self-esteem (CDI - Piers-Harris correlation = .66). The

CDI also appears to be a reasonably stable index of symptoms over a one month interval ($r$ = .72, $N$ = .28) (Friedman & Butler, 1979). The CDI was read aloud by a female examiner and administered in the classroom.

State-Trait Anxiety Inventory for Children. The STAIC (Spielberger, 1973) contains a 20 item self-report scale (A-trait) designed to measure the relatively stable predisposition to experience anxiety as well as another 20 item scale (A-state) to measure variations in anxiety over time. Only the A-trait scale was administered for this study. Evidence for the concurrent validity of the STAIC A-trait was based on a correlation of .75 between the scale and the CMAS and a correlation of .63 with the GASC, two other measures of anxiety in children (Endler, 1978). The test-retest reliability coefficients for A-trait were .65 for males and .71 for females (Endler, 1978). The STAIC A-trait was read aloud by a female examiner and administered in the classroom.

Children's Internal-External Control Scale. The CNS-IE (Nowicki & Strickland, 1973) is a 40 item, self-report measure of locus of control developed for children. CNS-IE scores do not appear to be related to social desirability or intelligence test scores but were correlated with achievement (Nowicki & Strickland, 1973). Test-retest reliabilities sampled at three grade levels six weeks apart were .63 for the third grade, .66 for the seventh grade, and .71 for the tenth grade (Nowicki & Strickland, 1973). The CNS-IE was audio-taped and administered in the classroom.

Piers-Harris Children's Self-Concept Scale. The Piers-Harris (Piers & Harris, 1964) is an 80 item, self-report measure designed to test children's self-attitudes. Test-retest reliability appears

adequate, based on a coefficient of .77 found for 244 fifth graders at two and four month intervals (Wing, 1966). Tests of construct validity found that 88 adolescent institutionalized retarded females scored significantly lower on the scale than either normals of the same chronological age or normals of the same mental age (Piers & Harris, 1964). The Piers-Harris was audiotaped and administered in the classroom.

Procedure

Fifty fifth graders from one elementary school in the Richmond, Virginia area were assigned to the Running Group. A second group of 71 fifth graders from a matched elementary school within the same school system were assigned to the Routine Exercise Group. Schools were matched on SES and academic performance on standardized academic tests. Children in both groups were tested on the four self-report measures listed above (i.e., CDI, STAIC-T, CNS-IE, Piers-Harris) and on three physical fitness measures (timed run, sit-ups, tricep skinfold measurement) prior to the implementation of either exercise program. Both physical and psychological measures were administered during the same week for children in both schools.

The following week marked the beginning of both exercise programs. Children in the Routine Exercise Group (RE) received no specialized training although they did receive a standard physical education program. All children attended regular physical education classes. In addition, children in both groups were given daily 10 - 20 minute exercise periods, supervised by their classroom teachers. RE children received a variety of physical fitness activities during this time. R children received a running program a maximum of three days a week and a variety of fitness activities on the remaining days.

Teachers were asked to list the daily physical activity, approximate duration, and whether the children exercised continuously or intermittently.

Psychological and physical measures were again administered to both groups at the conclusion of the five week exercise programs. All measures were administered in the same sequence and format as pre-test measures.

## Results

Data analyses were performed in a series of steps. First, *t*-tests were run on pre-treatment test scores because it was important to establish that groups were equivalent on physical and psychological measures prior to intervention. Pre-treatment scores on sit-ups, skinfold measurement, timed runs, CDI, STAIC-T, CNS-IE, and Piers-Harris were considered the dependent variables for this analysis. Membership in the Running Group vs. membership in the Routine Exercise Group was considered the independent variable.

Pre-score *t*-tests revealed significant differences between the Running Group and Routine Exercise Group on pre-treatment sit-up scores ($t$ (115) = -4.12, $p < .001$). Mean number of sit-ups completed by the Routine Exercise Group was greater than the number completed by the Running Group. Pre-treatment scores on the remaining physical and psychological tests were not significantly different. This suggests that the two groups were essentially equivalent prior to treatment.

Multiple regression analyses were conducted to determine the influence of the two exercise programs on changes in children's depression (CDI), trait anxiety (STAIC-T), locus of control (CNS-IE), and self-concept (Piers-Harris Self-Concept Scale). The

effects of the two programs were also assessed on three physical fitness measures: the timed run, 60-second sit-up test and skinfold measurement. Hierarchical analyses were conducted to determine an ordered partitioning of the total variance of each dependent measure, which was based on the presumed contribution each variable would make toward the total variance (Cohen & Cohen, 1975).

A series of multiple regression equations were calculated on the effect of experimental condition on each physical and psychological post-treatment score after the hierarchical effects of pre-treatment scores on the same measure, sex, race, and pre-treatment skinfold measurement were partialled out. Experimental condition did not influence the post-treatment score on any measure.

The general failure to find significant treatment effects led to the calculation of a repeated measures ANOVA to ascertain whether participation in either exercise program or both programs produced significant physical or psychological changes. Mean scores for all physical and psychological measures were found to be significantly different pre- to post-treatment, in the direction of improved physical and mental health (see Table 1).

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Insert Table 1 about here

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Mean pre-sit-up ($\underline{M}$ = 35.05) and post-sit-up scores ($\underline{M}$ = 38.42) were found to be significantly different ($\underline{F}$ (1,104) = 2.73 $\underline{p}$ $<$.001). Mean pre-skinfold ($\underline{M}$ = 14.37) and post-skinfold measurements ($\underline{M}$ = 13.51) were found to be significantly different ($\underline{F}$ (1,101) = 24.26,

Table 1

Comparison of Pre-and Post-Means

| | Pre-Scores | | Post-Scores | | |
|---|---|---|---|---|---|
| Variables | M | SD | M | SD | F |
| Sit-Ups | 35.05 | 8.75 | 38.42 | 8.10 | 23.73*** |
| Skinfold | 14.37 | 5.77 | 13.51 | 5.53 | 24.26*** |
| Meters | 1472.17 | 206.98 | 1504.92 | 220.97 | 7.35** |
| STAIC-T | 36.38 | 6.80 | 32.62 | 6.46 | 51.20*** |
| CDI | 8.72 | 6.48 | 6.65 | 6.37 | 13.78*** |
| Piers-Harris | 54.00 | 12.32 | 58.20 | 12.11 | 26.20*** |
| CNS-IE | 15.03 | 4.35 | 13.69 | 4.35 | 11.51*** |

* $p < .05$. ** $p < .01$. *** $p < .001$

$p < .001$). Mean pre-run scores ($M$ = 1472.17) and post-timed run scores ($M$ = 1504.92) were found to be significantly different ($F$ (1,94) = 7.35, $p < .01$). Mean pre-STAIC-T ($M$ = 36.38) and post-STAIC-T (trait-anxiety) scores ($M$ = 32.62) were found to be significantly different ($F$ (1,107) =51.20, $p < .001$). Mean pre-CDI ($M$ = 8.72) and post-CDI (depression) scores ($M$ = 6.65) were found to be significantly different ($F$ (1,107) = 13.78, $p < .001$). Mean pre-Piers-Harris ($M$ = 54.00) and post-Piers-Harris (self-concept) scores ($M$ = 58.20) were found to be significantly different ($F$ (1,105) = 26.20, $p < .001$). Mean pre-CNS-IE ($M$ = 15.03) and post CNS-IE (locus of control) scores ($M$ = 13.69) were found to be significantly different ($F$ (1,106) = 11.51, $p < .001$). This suggests that physical and psychological changes occurred equally across both groups.

Finally, a general estimation of the quality and quantity of physical exercise which each group received was evaluated by investigation of the teachers' Rating of Daily Exercise Activity Form (R Group = 68 exercise periods; RE Group = 67 exercise periods). The Running Group, however, received more vigorous exercise than the Routine Exercise Group.

The Running Group spent the greatest proportion of its total exercise time in running (66%) while the Routine Exercise Group spent the greatest proportion of its total exercise time playing kickball (72%).

## Discussion

This study examined the effects of two exercise programs on children's physical fitness and mental health. Both groups significantly improved their scores on two tests of fitness (i.e.,

sit-ups completed in 60 seconds and meters completed in a nine minute timed run) and on four psychological measures (CDI, STAIC-T, CNS-IE, Piers-Harris Self-Concept Scale). In addition, skinfold measurement was significantly improved for both groups, which was not expected due to the shortness of the intervention program. Clearly, changes were significant and in the expected direction.

There were, however, no significant differential treatment effects across groups. The improvement across groups, as well as the lack of significant differential effects between groups, will now be discussed. The section will conclude with suggestions for future investigations.

Lack of Differential Treatment Effects

Children in both groups made significant physical and psychological changes. The gains were not, however, produced solely in the Running Group, as was predicted, but in both exercise groups. The weakness of the intervention, and the fact that the no-treatment control group was not, in actuality, a no-treatment group, may account for this lack of significant differential treatment effects. The Running Group appeared to have received more strenuous exercise than the Routine Exercise Group, according to the teachers' daily exercise form, but it is probable that children in both groups engaged in more daily physical activity than teachers noted on this form. Warmer weather may have caused children in both groups, for example, to play more vigorously outdoors after school during the intervention phase of the study than they did prior to pre-testing. Because no parental or self-report record of daily exercise was attempted, total amount of exercise for each group is impossible to ascertain. Data analysis does indicate, however, that children in

both groups made significant physical gains as measured by decreased skinfold measurement and increased sit-up and timed run scores. These physical gains are encouraging and suggest that the implementation of either a non-strenuous or vigorous monitored exercise program can have significant physical benefits.

Demand characteristics may have contributed to overall physical and psychological improvement across groups. Children and teachers in both groups received attention from the experimenters and a break from the routine school day. Children in both groups also received certificates and ribbons for good running scores. The general effects of enthusiasm alone could have produced significant improvements for children in both schools. Teachers' awareness of the study's goals could have contributed to overall physical and psychological gains. In addition, the effects of teacher monitoring may have played a role in students' performances on physical and psychological measures.

The psychological measures used may also have contributed to equivalence of change across groups. Both exercise programs were implemented in populations of normal fifth-graders. The interventions were designed to enhance already adequate psychological functioning, and not to remediate psychopathological deficits. The difference between adaptive and maladaptive functioning is not considered to be one of degree (Cowen, 1977, & 1980; Cowen & Gesten, 1980). Adaptive and maladaptive behaviors do not lie on either end of a continuum. Adaptive behavior appears to include the presence of certain constructive actions and habits and not merely the absence of destructive actions. The four psychological measures used were not designed to assess these positive skills. None was sufficiently sensitive to increases in already highly functioning areas. The need

for adequate measures to assess adaptive functioning is a critical one, not only in the investigation of mind and body interactions, but for the field of psychology as a whole.

It is also possible that pre-treatment differences between groups may have contributed to lack of differential treatment effects. The two groups were, in fact, significantly different on pre-treatment sit-up scores. Mean number of sit-ups executed by the Routine Exercise Group was greater than the number completed by the Running Group. They were not, however, significantly different prior to treatment on any of the four psychological measures nor on pre-treatment skinfold measurement or timed run scores. The disparity in pre-treatment sit-up scores is likely due to differences in test administration between the two groups. The teacher in the school in which the Routine Exercise Group was run reported that he had incorrectly administered the test to one of the fifth grade classes. It is therefore likely that the initial differences between the two groups were not "real" differences, but only a result of this error in test administration. Lack of differential treatment effects does not appear to be attributable to pre-treatment group differences.

Implications and Suggested Direction for Future Studies

Clearly, more work needs to be done in the area of physical fitness and psychological gains. First, it is important to determine how children naturally develop physical prowess. It is also important to understand the nature of the relationship between the development of physical health and mental health. It is only by comprehending how this process occurs that effective physical fitness intervention programs can be designed. Intervention programs designed to improve physical fitness must be sufficiently strong enough to

significantly increase the level of activity in which children are already engaging. Second, assessment measures used to ascertain possible psychological gains in normal populations must be capable of assessing adaptive functioning and not merely presence or absence of psychopathology. Third, the effects of demand characteristics such as general enthusiasm and teacher monitoring need to be identified and controlled. Further studies in this field are certainly needed and can contribute greatly toward a better understanding of the mind and body interaction in children.