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A PATH ANALYSIS OF THE BIOPSYCHOSOCIAL VARIABLES

RELATED TO EXERCISE PERFORMANCE AND ADHERENCE

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Mary Clearing-Sky

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Robert A. Caldwell
Major professor

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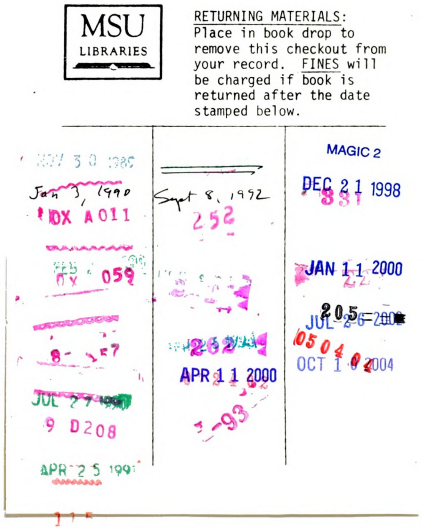
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A PATH ANALYSIS OF THE BIOPSYCHOSOCIAL VARIABLES RELATED TO EXERCISE PERFORMANCE AND ADHERENCE

By

Mary Clearing-Sky

A DISSERTATION

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ABSTRACT

A PATH ANALYSIS OF THE BIOPSYCHOSOCIAL VARIABLES RELATED TO EXERCISE PERFORMANCE AND ADHERENCE

By

Mary Clearing-Sky

Path analysis was utilized to examine the assumptions of a hypothesized model of the causal relationships of several physical, psychological, and psychosocial variables influencing exercise adherence and performance. The model extracted variables from human performance, exercise adherence, social learning, and cognitive mediation theories. Social support, empathy, self-concept, physical fitness, perceived fitness, goals, anticipated satisfaction with performance, anticipated satisfaction with adherence, self-efficacy for performance, self-efficacy for adherence, and self-motivation were predicted to affect each other and exercise performance and adherence.

Eighty-five male and female college students completed questionnaires and exercise tests in the first week of three ten-week exercise and conditioning classes. Missing data and class attrition created sampling problems. Fifty-four cases in Week 1 and 44 in Week 10 were usable in the path analyses. The Harvard Step Test, the Twelve-Minute Run, the Tennessee Self-Concept Scale, self-efficacy scales,

Dishman's (Falls, Baylor, & Dishman, 1980) Self-motivation Inventory, and several scales developed for this study were utilized. A planned follow-up was abandoned due to low returns.

Sonstroem's (1984) exercise adherence theory was consistently supported. Fitness affected perceived fitness which in turn predicted attitudes toward exercise performance and adherence. Fitness also predicted adherence and performance.

Bandura's (1977) self-efficacy theory was partially supported. Self-efficacy mediated the effect of goals, perceived fitness, and social support on adherence. Self-efficacy did not positively influence performance or mediate the effects of perceived fitness, goals, and self-concept on performance as expected.

Garland's (1985) cognitive mediation theory was partially supported. Anticipated satisfaction with adherence mediated between goals and performance. Anticipated satisfaction with performance, self-efficacy for performance, and self-efficacy for adherence did not influence performance as expected.

Dishman's (1982a) exercise adherence theory was partially supported. Fitness influenced performance and adherence and several variables affecting adherence. Self-motivation did not significantly influence performance or adherence as expected.

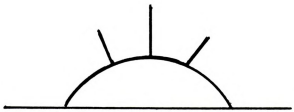
Social support had a significant effect on perceived fitness and self-efficacy for adherence. The separation of adherence and performance aspects of measures suggested by the present study was supported by the divergent results wherever these separations were made.

To enhance adherence, it is suggested that exercise program leaders and exercisers should emphasize social support, adherence and performance goals, periodic fitness and performance tests, as well as reinforcement of the exercisers' perceptions of their progress, fitness, performance, goal attainment, ability to adhere, and adherence.

The study emphasizes the value of path analysis in the multivariate study of adherence. Further research needs include long-term studies of adherence, direct comparison of the explanatory power of theories of exercise adherence, improved measurement devices, and standardized definitions of variables.

DEDICATION

To Madgequomoqua, the original Rolling Thunder Clearing Sky Woman, who gave me life and taught me that industry, education, and speaking English would help me "get ahead" in the White Man's World and that gentleness, caring, and appreciation of the Earth would help me live in the Natural World.



ACKNOWLEDGMENTS

I wish to acknowledge Bob Caldwell and Deb Feltz for their assistance in focusing and identifying a viable area of study among my many interests, and for their help in conceptualizing a project that utilized several of those interests. I wish to thank them both for their teaching, support, and patience through the lengthy process of proposal, data collection, analysis and interpretation, and reporting. I want to also thank Deb Feltz for her aid in assuring that I had subjects when registration problems nearly eliminated my project.

John Hurley once again demanded the precision and polish expected of those to be called scholar upon completing their degree requirements. I appreciate John's ability to demand quality as well as to smile and laugh at "stupid" errors and be a colleague in my progress.

I thank Dozier Thornton for his regular expressions of interest and concern for my project and me. His suggestion that I also examine social support and empathy was important to the study. His support, empathy, and caring were important to me.

Finally, I acknowledge my beautiful family: Jim, Elizabeth, Thomas, and Nanette, whose love, encouragement,

and sacrifice assured the time and freedom I needed to pursue a fifth love.

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Chapter 1

INTRODUCTION

In the last decade researchers have reported several physiological and psychological benefits of vigorous exercise. An exercise revolution has resulted which "may improve life-style, cardiovascular health, and longevity" (Paffenbarger, Hyde, Wing, & Steinmetz, 1984, p. 491). In a recent two-year period an estimated 50% increase in exercisers occurred in American society. However, the dropout rate in exercise programs has continued to be 30-70% throughout the last decade, and exercise adherence[1] has become an intriguing problem (Danish, 1983; Dishman, 1982c; Dishman,1985; Dishman, Ickes, & Morgan, 1980; Falls, Baylor, & Dishman, 1980; Sachs, 1982; Snyder & Spreitzer; 1984). Research attempts to understand who will persist in the hard work and discipline required to maintain an exercise program have resulted.

Several variables have been empirically related to the performance[2] of various exercise, sport, or other activities or tasks. Several studies have also examined variables related to adherence or persistence in the activity as a specific issue. Critically, the same variables relate to both performance and adherence which in turn affect each other. Adherence or persistence of effort

often leads to improved performance which often leads to continued adherence. The effects of these variables on adherence versus performance have not been clearly or consistently separated either theoretically or methodologically. The present study separated the adherence and performance measures and the adherence and performance aspects of two other measures in order to clarify the separate phenomena. The purpose of the present study was to examine the relationship of several of these variables to each other and to adherence to and performance of an exercise activity.

Dishman (1982c) suggested that an important step in exercise research is the testing of these relationships in a multivariate analysis. The present study developed and tested a hypothesized model of the causal relationships of several physical, psychological, and psychosocial variables influencing exercise adherence and performance. To test this biopsychosocial model, repeated measures of these variables were collected from 42 women and 43 men students enrolled for one term in exercise and conditioning classes at Michigan State University. Measures were collected at Week 1 and Week 10 of the 10 week course. In Week 1, 85 students provided data. In Week 10, 75 students provided data. Fifty-four cases in Week 1 and 44 cases in Week 10 were usable in the path analyses.

The present study also attempted to determine which factors were involved in the decision to adhere to an

exercise program or to quit exercising despite its widely known benefits. Such information can help in our efforts to understand and promote adherence to exercise and other health-seeking behaviors. It may also contribute to the understanding and promotion of compliance[3] with the treatment of illness, such as compliance to an obesity management plan, a diabetes management plan, or a cardiac rehabilitation plan.

Chapter II

Literature Review

Researchers and wellness promoters in medicine and psychology have cited several benefits of exercise for physical and psychological health. As a result, many people have begun exercising. However, the number of people who drop out of exercise programs has remained high. Observation of this drop out problem has led to several studies of adherence. This chapter reviews (a) several variables that have been shown to affect performance in exercise and other activities, (b) variables that have been linked specifically to exercise adherence (c) the benefits of exercise, and (d) the exercise adherence problem.

Performance Variables

Several biological, psychological, and psychosocial variables have been shown to function as predictors of exercise behavior or participation in sports. These variables include perceived physical state, self-concept, goals, anticipated satisfaction with performance, and self-efficacy.

Perceived Physical State

Thoughts one has about one's physical condition have an important influence on one's performance of physical tasks. In Bandura's (1977) theory of self-efficacy, (the belief

that one can successfully perform a specific behavior required to produce a specific outcome), cognition about physical condition is a strong predictor of self-efficacy. Such cognitions provide a source of information upon which self-efficacy expectations are built. Bandura's theory predicts perceived physical states would influence performance indirectly through self-efficacy. Feltz and Mugno's (1983) study supported this aspect of Bandura's theory. The perceived autonomic arousal of their student divers influenced performance through self-efficacy.

Self-concept

Physical fitness also influences self-concept (Brown, Livingston, & Morrow, 1982; Sonstroem, 1974, 1978, 1984; Trujillo, 1983). The attitudes, beliefs, or cognitions one holds toward the self make up self-concept. Several studies have found that improvement in self-concept resulted from increases in physical fitness (see Sonstroem, 1984 for a recent review). Trujillo (1983) found the self-esteem of the college women in weight training and running exercise programs increased. Sonstroem's (1974, 1978, 1984) findings suggest exercise increased self-esteem or improved self-concept. Brown et al. (1982) found that physical self-concept, measured by a subscale of the Tennessee Self-Concept Scale, improved more than global self-concept in a group of college women who participated in a conditioning program. Brown et al.'s (1982) study illustrated the importance of studying selected aspects of self-concept.

Examining the opposite effect, Olszewska (1982) found positive self-concept predictive of effective performance in sport behavior.

Goals

Goals, self-set standards for performance, have been shown to affect behavior in a number of tasks including exercise. The influence appears to be mediated by self-efficacy and persistence, with persistence being influenced by self-efficacy (Bandura & Shunk, 1981; Garland, 1985; Shunk, 1984). Goals, goal setting, and cognitions regarding goals have been demonstrated to affect both self-efficacy and the execution of behaviors. Bandura and Schunk suggested goals were used to evaluate behavior. Children in their study made their self-satisfaction conditional upon those standards. Anticipated satisfaction with one's achievement serves as an inducement to persist toward the goal until those self-standards are met. Setting goals provides a source of ongoing information about one's behavior that affects self-efficacy, that in turn influences persistence and strength of effort. Goals can also serve in the development and maintenance of intrinsic interest in an activity which also affects persistence. "Most of the activities that people enjoy doing for their own sake originally had little or no interest for them...However, through favorable continued involvement, almost any activity can become imbued with consuming significance" (Bandura & Schunk, p. 587). Bandura and Schunk found children who set

goals completed math tasks rapidlly, had high self-efficacy, and high interest in math. Schunk achieved similar results with children formerly deficient in math skills.

Garland (1985) also found goals important in predicting task activity and achievement. Subjects performing a laboratory task and having high goals had both higher self-efficacy and greater achievement. Tu and Rothstein (1979) found that goals set by junior high school students or teachers interacted with students' dependence or independence to determine exercise persistence and performance. Independence-oriented students improved at a significantly faster rate when they set their own goals, while dependence-oriented students improved significantly faster when the teacher set goals.

Anticipated Satisfaction With Performance

Studies have reported both negative and positive associations of anticipated satisfaction with performance. Garland (1985) postulated two cognitive constructs that mediate between goals and performance: performance expectancy which is similar to Bandura's (1977) self-efficacy construct, and performance valence, anticipated satisfaction with the performance itself (not with expected outcomes). Garland found performance valence negatively associated with performance. People who aspired to achievement of higher goals expected some dissatisfaction and performed at higher levels. Both performance valence and self-efficacy were predictive of magnitude and duration

of effort. Individuals sought to minimize anticipated self-dissatisfaction with substandard performance or to increase self-satisfaction through increasing effort. Others have found anticipated satisfaction with performance to be positively associated with performance (Bandura, 1977). Bandura and Schunk reported that anticipated satisfaction with performance served as in inducement to persist (see Goals above).

Self-efficacy

Self-efficacy has also been recognized as an important component in human behavior. Bandura (1977) proposed a theory of self-efficacy to explain changes in behavior. Bandura's self-efficacy is the belief that one can successfully perform the specific behavior required to produce a specific outcome. Bandura views self-efficacy as a common cognitive mechanism mediating all behavioral change. Self-efficacy affects one's choice of activities and behavioral settings, and the amount and persistence of effort expended in performance (Bandura, 1977; Bandura & Adams, 1977; Bandura, Adams, & Beyer, 1977; Bandura & Schunk, 1981). The level and strength of efficacy expectations are built upon and altered by four principal sources of information: performance accomplishments, vicarious experience, verbal persuasion, and physiological states. Performance accomplishment or personal mastery is the most powerful source of efficacy information. Successful performance will modify future efficacy

expectations. Given necessary skills and proper incentives, self-efficacy is a major determinant of behavior (Bandura, 1977).

Self-efficacy theory has been tested in a wide array of psychological experiments. Self-efficacy has been found to predict behaviors in experiments that studied fear and phobias (Bandura, Adams, Hardy, & Howells, 1980), intellectural and social skills (Bandura & Schunk, 1981; Kazdin, 1980), and self-regulatory behaviors such as dealing with addictions (Marlatt & Gordon, 1980) or coronary rehabilitation (Bandura, 1982). Recent self-efficacy tests have seen diverse applications in such topics as weight rehabilitation (Bernier & Poser, 1984; Weinberg, Hughes, Critelli, England, & Jackson, 1984), school performance (Schunk, 1984), and coping with chronic obstructive pulmonary disease (COPD) (Kaplan, Atkins, & Reinsch, 1984). (See reviews by Bandura, 1982; Bandura, 1984; Bandura, Adams, Hardy, & Howells, 1980). Self-efficacy was reported to affect these behaviors by influencing the subjects' amount and persistence of effort.

Sport psychologists have tested whether self-efficacy predicts sport performance. Self-efficacy has been found to predict performance in gymnastics (Lee, 1982), children's sport (Roberts, Kleiber, & Duda, 1981), and diving performance (Feltz, 1980, 1982; Feltz, Landers, & Raeder, 1979; Feltz & Mugno, 1983). It has been demonstrated that self-efficacy predicts performance in leg-strength and

endurance tasks and that manipulating efficacy by deception alters that performance (Weinberg, Gould, & Jackson, 1979; Weinberg, Gould, Yukelson, & Jackson, 1981; Weinberg, Yukelson, & Jackson, 1980).

Adherence Variables

Many biological, psychological, and psychosocial variables have been posited to function as antecedents or predictors of adherence to exercise behavior (Albinson & Moore, 1983; Brownell, 1984; Carmody, Senner, Malinow & Matarazzo, 1980; Danish, 1983; Dishman, 1981, 1982a, 1982b, 1982c, 1985; Dishman, Sallis, & Orenstein, 1985; Falls et al., 1982; Gayle, Eckhoff, Mogel, & Rodnick, 1984; Goodrick, Warren, Hartung, & Hoepful, 1984; Haskell & Blair, 1980; Keefe & Blumenthal, 1980; Laffrey & Isenberg, 1983; Paolone, 1983; Sachs, 1979, 1982; Serfass & Gerberich, 1984; Slenker, Price, Roberts, & Jurs, 1984; Snyder & Spreitzer, 1984). Dishman et al.'s (1985) review of the exercise and adherence literature listed 37 exercise predictors that have been studied. The following studies suggested the variables that were subsequently examined in the present study.

Perceived Fitness

Dishman et al.'s (1985) review reported that two studies found no association between perceived physical competence and adherence to an exercise program. Dishman's (1982c) review suggested beliefs in one's physical ability had been found to predict initial involvement in physical

activity, but not long term adherence. Snyder and Spreitzer (1984) found perceived athletic ability one of three significant predictors of exercise adherence. The inconsistent results may be due to the use of different populations, study methods, and measures. Dishman et al. (1985) referred to Dishman's (1981, 1982b) retrospective studies of the medical records of cardiac testing and exercise prescription program subjects, many of whom were cardiac rehabilitation patients. Snyder and Spreitzer' subjects were persons actually contacted for follow-up adherence information up to 5 years after an exercise program. These subjects had initially expressed an interest in physical fitness, had a stress test, and an exercise prescription. Because standardized definitions and measurements are not in use (Dishman et al.), and methods and populations differ, it is difficult to interpret these inconsistent results. Sonstroem (1974, 1978, 1984) theorized that perceived athletic ability influences adherence through its affect on self-concept.

Self-concept

Review of the literature failed to locate a study utilizing physical self-concept per se as an exercise adherence predictor. Perceived physical competence mentioned above may have been measuring the same construct. Little standardization of definitions existed in the literature (Dishman et al., 1985). Brown et al.'s (1982) finding that physical training directly affects self-concept

suggested self-concept may mediate the effect of physical fitness on adherence. In Sonstroem's (1974, 1978, 1984) adherence theory, general self-esteem or self-concept is enhanced by increases in perceived athletic ability and leads to furthur attraction to and involvement in physical activity. Thus, it appeared important to study both perceived fitness and a more general physical self-concept.

Physical States

Exercise and health programs have often measured physical states but few researchers have included such measures in studies of adherence (Dishman, 1981). The following studies suggested physical states have a direct effect on exercise adherence. Dishman and Gettman (1980) found body weight and percent body fat significantly related to adherence. Dishman et al.'s (1980) study reported that of several variables tested only body fat, weight, and self-motivation were significant predictors of exercise adherence. Persons high in self-motivation and low in body weight and body fat were high in adherence (Dishman, 1981, 1982a, 1982b, 1982c, 1985; Dishman et al.,1980; Falls, et al., 1980).

Goals

Review of the literature revealed two studies that provided some evidence that adherence depends on goal attainment or expected goal attainment. Tu and Rothstein's (1979) study suggested that goal types interacted with

personality types to predict adherence. Student or teacher-set goals interacted with the children's dependent or independent personalities to predict adherence. Independence-motivated children performed better when they set their own goals. Dependence-motivated children performed better when the teacher set goals. The intention to jog, a general goal, correlated highly (r = .82) with jogging behavior in Riddle's (1980) study of nonexercisers and joggers.

Social Support

Social support (the caring, encouragement, assistance, and positive attitudes toward exercise of significant others) has also been linked to exercise adherence. Support appeared to be a component of setting or situation that Dishman (1982b) suggested was important to adherence. Participants in a physical activity program whose spouses had favorable attitudes toward exercise had better compliance patterns than those whose spouses had negative or neutral attitudes (Heinzelmann & Bagley, 1970). Bandura (1982) reported the significant relationship of the spouse's estimation of patient self-efficacy to exercise compliance in cardiac rehabilitation.

Godin and Shephard (1985) reported that in their study of 20 couples social support significantly facilitated male spouses' beginning and adhering to an exercise program. Dishman et al.'s (1985) review of the literature cited several studies that concluded social support of spouse,

exercise partners, or program staff strongly predicts exercise adherence. Two studies found no association of social reinforcement of program staff or exercise partners with adherence. It may be that social support of intimates is more effective in maintaining adherence than support of staff or exercise partners. Hirsch (1981) suggested social support maintains critical identities and role changes during life transitions. One's attempt to change one's life-style by becoming an exerciser certainly qualifies as such a transition. It appeared that support of the role or self-concept of exerciser would enhance one's adherence to an exercise program.

Empathy

In the medically-oriented compliance literature, rapport (mutuality or understanding, trust, and caring) in the social relationship between the medical practitioner and the patient has been reported to be basic to appointment keeping and compliance (DiMatteo & DiNicola, 1982; DiMatteo, Friedman, & Taranta, 1979; Friedman & DiMatteo, 1979; Truax & Carkhuff, 1965). Rapport has been found to depend in part upon empathy, the practioner's ability to understand the patient's communications and relate that understanding to the patient. Empathy, it has been suggested, is crucial to compliance (Hurtado, Greenlick, & Columbo, 1973; Nelson, Gold, Hutchinson, & Benezra, 1975). Empathy has not been empirically linked to adherence as narrowly defined in this study. The construct is quite similar to social support and

it's operation in compliance appeared similar to the influence of social support on compliance and adherence.

Self-efficacy

Several of the studies reviewed under Performance Variables suggested self-efficacay had its effect on performance through its effect on persistence of effort. Accomplishment in weight management (Bernier & Poser, 1984; Weinberg et al., 1984), management of fear and phobias (Bandura et al., 1980), addiction control (Marlatt & Gordon, 1980), school performance (Schunk, 1984), and children's sports (Roberts et al., 1981), required continued effort that appeared to be sustained by self-efficacy beliefs.

Exercise compliance per se was predicted by high self-efficacy in cardiac rehabilitation patients (Bandura, 1982) and chronic obstructive pulmonary disease patients (Kaplan et al., 1984). Albinson and Moore (1983) reported that exercisers high in self-efficacy were significantly more likely to continue in their exercise programs. Dishman et al.'s (1985) review of the literature cited unpublished observations that perceived self-efficacy and self-estimates of the likelihood of adherence have predicted future exercise activity.

Self-motivation

Bandura (1977) suggested self-efficacy information affects self-motivation and thus persistence of effort. Falls et al. (1980) found motivation, a general disposition

to persevere, to be one of the most frequently examined factors in medical compliance literature. More than 85 percent of the studies they reviewed that utilized the motivation construct found it to be a significant factor in influencing compliance. Falls et al. (1980) tested the power of several psychological and biological factors to predict adherence to exercise in a group of rowers and a group of joggers. Self-motivation was the best discriminator of adherence compared to aesthetic experience, locus of control, and physical estimation, attraction, and attitudes toward physical activity.

In another Dishman study (1981), self-motivation, body weight, and body fat were the only significant predictors of exercise adherence. Gayle and Eckhoff (1984) however, reported very low correlations of self-motivation as well as several other posited exercise predictors. Snyder and Spreitzer (1984) also reported a very low correlation for self-motivation and exercise adherence.

Exercise Benefits

Physiological Benefits

Several studies have suggested regular, vigorous exercise reduces the risk of cardiovascular and other diseases (Hagberg, 1986; Mustafa, Garrett, & Freeman, 1984; Paolone, 1983; Sharkey, 1975; Shephard, 1984; Snyder & Spreitzer, 1984; Spirduso, 1985; Stamford, 1984; Thompson & Martin, 1984; Van Andel & Austin, 1984). Cardiovascular

fitness has been correlated with physical fitness and regular, vigorous exercise (Blair, Goodyear, Gibbons, & Cooper, 1984; Falls et al., 1980; Haskell & Blair, 1980; Kaplan, 1984; Merkin & Hoffman, 1978; Paffenbarger et al., 1984; Serfass & Gerberich, 1984). Increases in maximum oxygen consumption (deVries, 1970, 1979), cardiac output, stroke volume, heart volume, and decreases in heart rate (Falls et al., 1982) and blood pressure (Blair, Collingwood, Reynolds, Smith, Hagan, & Sterling, 1984; Blair, Goodyear, Gibbons, & Cooper, 1984) as well as changes in lipids and lipidprotein level (Goldberg, Elliot, Schutz, & Kloster, 1984), are reported in those persons engaged in vigorous exercise.

Dishman's (1985) review reported that exercise may decrease Type A-coronary prone behavior and may decrease the endocrine response to stress. Shephard, Corey, and Cox (1982) found reduced health risk behavior in their fitness and fitness education program participants. After six months participants had increased physical activity, decreased or quit smoking and alcohol consumption, and had reduced blood pressure. Sinyor, Schwartz, Peronnet, Brisson, and Seraganian (1983) reported quicker physiological recovery from experimentally induced stress in exercisers. Body composition and weight of vigorous exercisers also differed from that of nonexercisers and was an important correlate of cardiovascular fitness (Falls et al., 1983; Hagberg, 1986) as well as a source of psychic

pleasure to the person living a culture that idealized thinness. Exercisers had less fat relative to fat-free body mass than nonexercisers (deVries, 1970; Falls et al., 1980). Exercise has been widely recommended as an adjunctive treatment for obesity and excessive cholesterol rather than diet or drugs alone (Paffenbarger et al., 1984). Muscular strength, the ability to contract muscles against a resistance, and muscular endurance, the ability to repeat the contraction or sustain it, improve with exercise (Falls et al., 1980; Merkin & Hoffman, 1978; Ryan, 1980). The Olympic Issue of the Journal of the American Meical Association (Lundberg, 1984) was devoted entirely to exercise and sport research and featured an editorial acclaiming the effects of exercise on cardiovascular health (Kaplan, 1984).

Psychological Benefits

Several psychological benefits of regular, vigorous exercise have been reported. Vigorous exercise has been linked with improved mood, self-concept, stress management, and work behavior (Dishman, 1982a; Folkins & Sime, 1982; Parent & Whall, 1984; Sheehan, 1984). Anti-depressive and anti-anxiety effects have been reported (Bahrke & Morgan, 1978; Greist, Klein, Eischens, Faris, Gurman, & Morgan, 1978; Greist, Eischens, Klein, & Faris, 1979; Morgan, 1979, 1981, 1985). Sinyor et al. (1983) reported aerobically fit subjects recovered faster from experimentally induced psychosocial stress. Others reported subjects managed

stress better as a result of exercise (Blair, Collingwood, Reynolds, Smith, Hagan, Sterling, 1984; Walsh, 1983). Laffrey and Isenberg (1983) found exercise led to feelings of well-being, increased capacity to work, increased ability to relax, improved self-image, and decreased anxiety and depression. Blumenthal, Sanders, Needels, & Wallace (1982) found exercisers had more vigor and less anxiety, tension, depression, and fatigue than nonexercisers. Exercisers in several studies reported a "feeling better" phenomenon (Carmack & Martens, 1979; Kau & Fischer, 1974; Morgan, 1979, 1985).

Improvement in self-concept, self-esteem, and subjective well-being of exercisers was reported by several investigators and reviewers (Arends, 1983; Brown, Morrow, & Livingston, 1982; Dishman, 1982a; Harris, 1981a, 1981b; Hilyer & Mitchell, 1979; Jasnowski, Holmes, Solomon, & Aguir, 1981; Jorgenson & Jorgenson, 1979; Laffrey & Isenberg, 1983; Parent & Whall, 1984; Riddle, 1980; Sachs & Pargman, 1979; Sonstroem, 1974, 1978, 1984; Trujillo, 1983; Young & Ismail, 1976, 1977). Several other studies have provided additional evidence that vigorous exercise is connected to positive mental health characteristics (Brownell, 1984; Blair, Collingwood, Reynolds, Smith, Hagan, & Sterling, 1984; Dishman, 1982c, 1985; Dishman, Ickes, & Morgan, 1980; Gunn & Zwingmann, 1984; Eagan, 1984; Haskell & Blair, 1980; Heaps, 1978; Muir-Gray, Young, & Ennis, 1983; Mustafa, Garrett, & Freeman, 1984; Snyder & Spreitzer, 1984;

Thompson & Martin, 1984; Tucker, 1983; Van Andel & Austin, 1984).

Morgan (1985) concluded that there is "considerable evidence attesting to the affective beneficence of vigorous exercise" (p. 94). Morgan reported that was also the conclusion of the participants of an exercise and mental health workshop sponsored by the National Institute of Mental Health in 1984 where the following consensus statements were formulated:

1. Physical fitness is positively associated with mental health and well being.
2. Exercise is associated with the reduction of stress amd emotions such as state anxiety.
3. Anxiety and depression are common symptons of failure to cope with mental stress, and exercise has been associated with a decreased level of mild to moderate depression and anxiety.
4. Long-term exercise is usually associated with reductions in traits such as neuroticism and anxiety.
5. Severe depression usually requires professional treatment, which may include medication, electro-convulsive therapy, and/or psychotherapy, with exercise as an adjunct.
6. Appropriate exercise results in reductions in various stress indices such as neuromuscular tension, resting heart rate, and some stress hormones.
7. Current clinical opinion holds that exercise has beneficial emotional effects across all ages and both sexes.
8. Physically healthy people who require psychotropic medication may safely exercise when and medications are titrated under close medical supervision. (p. 95)

Adherence Problems

Clearly, several studies have provided suggestive evidence of the benefit of vigorous exercise. Health care professionals and the public have appeared enthusiastic to

prescribe and utilize exercise to derive such benefits. Despite the enthusiasm and evidence of benefit, adherence problems have continued (Albinson & Moore, 1983; Brownell, 1984; Carmody, Senner, Malinow, & Matarazzo, 1980; Danish, 1983; Dishman 1981, 1982a, 1982b, 1982c, 1985; Dishman et al., 1985; Falls et al., 1982; Gayle, Eckhoff, Mogel, & Rodnick, 1984; Goodrick, Warren, Hartung, & Hoepful, 1984; Haskell & Blair, 1980; Keefe & Blumenthal, 1980; Laffrey & Isenberg, 1983; Paolone, 1983; Sachs, 1980; Serfass & Gerberich, 1984; Slenker, Price, Roberts, & Jur 1984; Snyder & Spreitzer, 1984). Exercise program dropouts have remained at 30-70% during the last decade (Falls et al.) even though the evidence for physiological and psychological benefits of exercise has recruited many new exercisers. Lack of adherence to health-promoting behaviors and lack of compliance with treatment programs are well known problems in the health care field (DiMatteo & DiNicola, 1982). These problems share many similarities with the exercise dropout problem (Dishman, 1982c). Non-compliance with diabetes, obesity, and smoking management programs is a serious problem (Surwit, 1983). Inability or unwillingness to merely finish a full course of antibiotics to treat an infection is also common.

The emphasis on the consequences of exercise in previous research has obscured the problem of sustained involvement. Dishman (1982c) suggested exercise benefit is a moot question if people continue to drop out. An

important concern is the discovery of factors that contribute to exercise adherence. Studying factors that are related to adherence to an exercise program will promote our understanding of persistence in such activity. That understanding could enhance our ability to help people adhere to an exercise program. Information about adherence factors may also be utilized by those researchers examining the related issue of compliance to medically prescribed treatment.

Chapter III

The Present Study

Multivariate Relationships in Exercise Adherence and Performance

Review of the literature thus yielded a number of social, psychological, and physical variables that have been shown to affect persistence in and/or accomplishment of a behavior. A variety of theoretical and empirical links have been made among these variables as their effects on adherence and/or accomplishment of a behavior have been studied. Examination of the posited links suggested that the variables are related to one another and that their interrelations in turn influence adherence and/or accomplishment of various behaviors. The clearest expositions of the paths of these inter-relationships were found in the writings of Bandura (1977, 1982), Bandura and Adams (1977), Dishman (1982a, 1982b,1982c), Feltz (1980), Feltz and Mugno (1982), and Garland (1985). A brief summary of those theoretical/empirical connections follows. Several researchers provided evidence that social support and empathy influence persistence in an activity (Bandura, 1982; Heinzelmann & Bagley, 1970; Hurtado et al., 1973; Nelson et al., 1975). Bandura (1982) reported a significant relationship of significant others' beliefs about patients' self-efficacy to exercise adherence in cardiac

rehabilitation. Support of significant others may provide information that one uses to bolster one's self-concept (Hirsch, 1981) or strengthen one's self-efficacy. Another source of information regarding self-concept and self-efficacy is one's physical state or one's perceived physical state. Olszewska's (1982) data regarding self-concept of exercisers supported the theory that self-concept influences performance. Sonstroem's theory predicted that improved self-concept would lead to further physical activity. Bandura's (1977) theory predicted perceived physical states would influence performance indirectly through self-efficacy. Feltz' (1980) and Feltz and Mugno's (1982) data regarding springboard diving behavior supported this aspect of Bandura's theory. Physical states have a direct impact on adherence and performance of a physical activity (Dishman & Gettman, 1981). One's fitness level sets limits on the amount of activity one can physically tolerate.

Goals and goal setting also have an impact on self-efficacy (Bandura & Schunk, 1981; Schunk, 1984; Garland, 1985). Goals reflect one's cognitions about one's ability (Garland, 1985) and one's physical state. Goal setting and achievement have been posited to influence self-efficacy directly (Garland, 1985) or through anticipated satisfaction with performance achievements (Bandura & Schunk, 1981). Goals may also influence adherence as they interact with other personality variables (Tu & Rothstein, (1979). The level of anticipated satisfaction with one's

accomplishments will affect motivation (Bandura, 1977) persistence in and performance of an activity (Bandura, 1977, 1982; Bandura & Schunk, 1984; Garland, 1985). Self-efficacy affects self-motivation, adherence, and performance in that activity (Bandura, 1977, 1982; Bandura & Schunk, 1984; Roberts et al., 1981; Weinberg et al., 1981).

Adherence or persistence in an activity has often been treated as an integral part of performance. While it is true that a close relationship exists, it is also important to conceive of and measure adherence and performance separately wherever possible. Separate measures will both (a) clarify the boundaries of the two closely related phenomena and (b) allow a methodology with which to study both the influence of the many antecedent variables on adherence and performance and the relationships of adherence and performance to each other.

The preceding discussion served as a rationale for the model that was the focus of this study. Dishman (1982c) suggested that an important statistical procedure in exercise research is a multivariate analysis of the several variables posited to influence exercise adherence. It appeared that a multivariate model that posited the interrelationships of several of the variables reviewed above and their relationships to adherence and performance was necessary. Such a model was developed and tested. The variables chosen to be examined and their definitions are listed below.

Variables and Their Definitions

Physical fitness, the physical state, capacity, or ability of the individual.

Perceived Fitness, how one views one's physical fitness.

Social Support, the caring and encouragement the individual receives from the social environment.

Empathy, the understanding the individual receives from the social environment.

Self-concept, attitudes and beliefs about one's self.

Goals, self-set standards for frequency of training.

Self-efficacy for Performance, the belief that one can successfully perform a specific behavior required to produce a specific outcome.

Self-efficacy for Adherence, the belief that one can successfully continue to perform a specific behavior over time.

Anticipated Satisfaction with Performance, the belief regarding how pleased one will be with one's performance.

Anticipated Satisfaction with Adherence, the belief regarding how pleased one will be with one's adherence.

Self-motivation, a general disposition or attitude toward perseverance.

Performance, the quality of the exercise behavior.

Adherence, the persistence of effort in continuing to perform a task.

The hypothesized models of the predicted relationships of these variables following the rationale above are presented in diagramatic form in Figures 1 and 2. Each arrow represents a predicted path of influence. For example, the arrow extending to self-concept from social support represents the prediction that self-concept is directly influenced by social support (see Hypothesis 2 below). When such a network of causal relationships is posited, a traditional experimental paradigm is difficult to employ.

Path analysis was selected as the primary technique in the analysis of this model. Path analysis allows the investigation of the various influences where experimental paradigms are difficult to design. Path analysis tested whether the hypothesized model fits a set of data by comparing the observed relationships among the variables with the predicted relationships. Path analysis also allowed an estimation of the relative direct and indirect effects (Feltz, 1980). Duncan (1975) stated that the advantages of using path analysis lie in

> ...(1) making our arguments consistent (so that we are not altering our premises surreptitiously in the course of a discussion), (2) making our conclusions precise (so that it is easier to see what evidence is, and what is not, compatible with them), and thereby (3) rendering

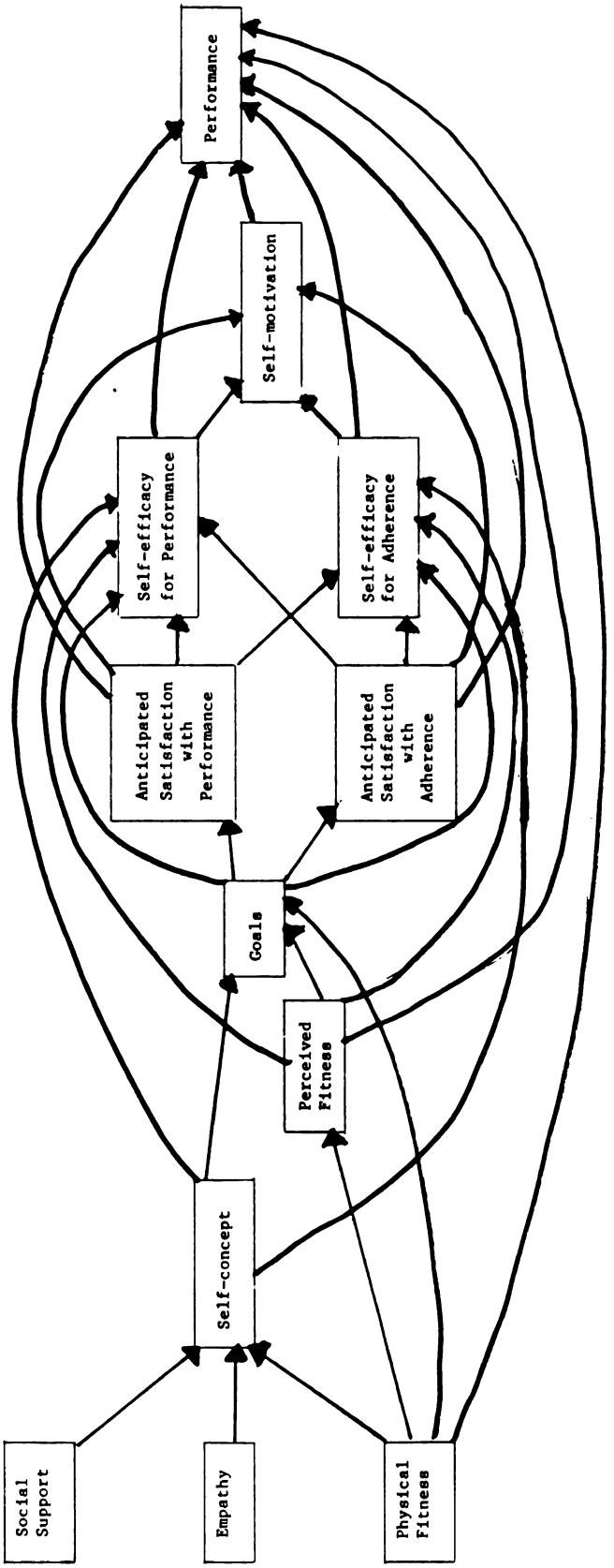


Figure 1. Hypothesized Model, Week 1.

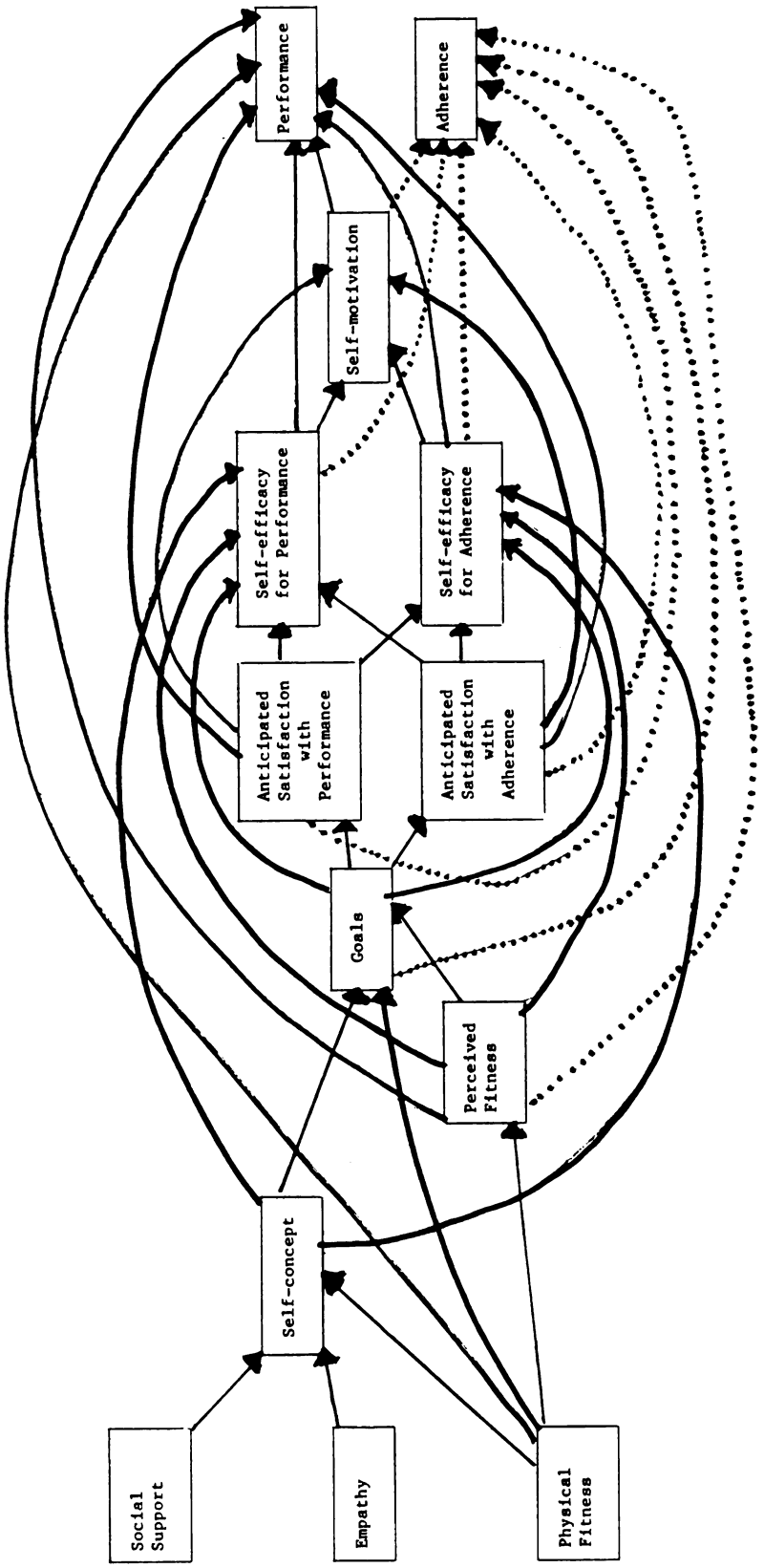


Figure 2. Hypothesized Model, Week 10.

> our conclusions susceptible of empirical refutation (p. 13).

Path analysis is not a method for discovering causal directions. It is a technique for testing the directions of causation specified by a model (Kenny, 1979). The present model was recursive, testing only one-way causal direction hypotheses. This does not deny the two-way flow of causal direction that could be tested with a more complex, nonrecursive model. It is simply a reflection of the choice to study a limited portion of a growing set of assumptions and theories in the theory building occurring in the exercise adherence/health compliance area. The variables are also not exhaustive, but reflect the most viable research and theory in this area. The number of variables is limited to retain the power of the path analysis. Path analysis is reduced in power by a large number of variables and a small sample.

Diagrammatic representation of the path analysis for the hypothesized model is presented here for greater comprehension of the cause and effect network. However, due to the large number of variables and possible paths, presenting the results in such a diagram would be cumbersome and perhaps impede comprehension. Thus the data are presented in table form and diagrams are utilized only when smaller amounts of information are being presented.

The hypotheses involved in the path model are listed below. Additional hypotheses, which were tested utilizing t-tests and a MANOVA, are listed following that.

Path Model Hypotheses

The following hypotheses were tested by path analysis at Week 1 and Week 10 in order to support or reject the model (see Figures 1 and 2).

1. Self-concept is directly influenced by social support, empathy, and physical fitness.

2. Physical fitness is the only predictor of perceived fitness.

3. Goals is directly influenced by self-concept, perceived fitness, and physical fitness.

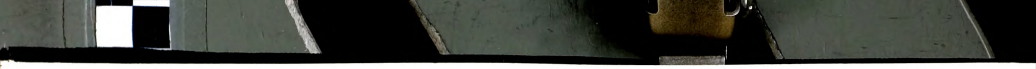
4. Goals is the only predictor of anticipated satisfaction with performance.

5. Goals is the only predictor of anticipated satisfaction with adherence.

6. Self-efficacy for performance is directly influenced by self-concept, perceived fitness, goals, anticipated satisfaction with performance, and anticipated satisfaction with adherence.

7. Self-efficacy for adherence is directly influenced by self-concept, perceived fitness, goals, anticipated satisfaction with performance, and anticipated satisfaction with adherence.

8. Self-motivation is directly predicted by self-efficacy for performance, self-efficacy for adherence,



anticipated satisfaction with performance, and anticipated satisfaction with adherence.

9. Performance is directly influenced by self-motivation, self-efficacy for performance, self-efficacy for adherence, anticipated satisfaction with performance, anticipated satisfaction with adherence, perceived fitness, and physical fitness.

10. Adherence is directly predicted by self-motivation, self-efficacy for performance, self-efficacy for adherence, anticipated satisfaction with performance, anticipated satisfaction with adherence, perceived fitness, and physical fitness. Adherence was not tested until Week 10 when adherence data were available.

Other Hypotheses and Analyses

The hypotheses and analyses beyond the path analyses were:

1. Subjects who initially set goals and were high in self-efficacy and perceived fitness and low in anticipated self-satisfaction with performance in the pretest would experience greater increases in their distance on the 12-minute run than subjects who initially did not set goals and were low in self-efficacy and perceived fitness and high in anticipated satisfaction with performance.

2. Subjects with greater distance increases would experience increases in self-efficacy for performance and perceived fitness over the 10 weeks and still experience low anticipated satisfaction with performance. Subjects with

smaller distance increases would experience little or no change in self-efficacy, perceived fitness, or anticipated satisfaction with performance.

3. Physical fitness measures would not change significantly from Week 1 to Week 10 (due to the short period of time since exercise was begun).

4. A MANOVA was planned to test the data for significant change in the 9 variables suggested by the 3 hypotheses above.

Chapter IV

Methods

Subjects

Subjects were 43 male and 42 female college students enrolled in three sections of an exercise and conditioning course in the Health and Physical Education (HPE) Department of Michigan State University. The course sections were selected by the students for schedule convenience. The students were from 18 to 28 years old with a mean age of 20.49. Thirty-four of the students were former high school athletes. They had been members of track and field, football, basketball, and tennis teams. Of this group, 7 were Black Americans, 2 were foreign-born Orientals, 1 was Mexican-American, and 1 was Native American. The remainder were White Americans. Several were already in training for amateur 10k races. (The classes had been changed by the HPE Department during registration from track and field to exercise and conditioning.) Only one student appeared somewhat obese. Because of the large number of former and amateur athletes, the group could not be considered a representative sample of college students.

Due to missing data, the actual number of cases analyzed in the first week's path analyses was 54. In addition, 10 students dropped the class. Drop-out excuses included an appendicitis, a broken foot, and schedule

problems. Thus the number of cases was 44 in the tenth week. The nonpath analyses utilized a specific combination of variables. Only cases which had no missing data for these variables in Week 1 and Week 10 could be used. This combination of specified cases resulted in different numbers. The reader is advised to observe the degrees of freedom to avoid confusion. Of the 54 cases used in Week 1, 30 subjects were women and 24 were men. They ranged in age from 18 to 28 years old. Twenty were former high school athletes. Of the 44 cases used in Week 10, 25 subjects were women and 19 were men. They were from 18 to 28 years old. Seventeen were former high school athletes. Four of these students had been injured during the term and suffered from problems such as strained muscles. Eighteen were ill during the term with such illnesses as flu, mononucleosis, and allergies. Mean class attendance for the group was 16.89 days of 18.

Method

During the first class of the term the general nature of the research and data collection was explained and the participation of class members was invited. Volunteers were asked to sign a consent form allowing the collection of data and a release of information form allowing a confidant to verify their exercise in the follow-up measures (see Appendix A). The planned follow-up subsequently failed (see end of Methods). Measures were collected in Week 1 and Week 10 (see Appendix B). The classes met twice a week for 1 hour

and 15 minutes, and students were encouraged by the instructor to exercise 2 to 3 additional times per week. The course usually consisted of (a) pretest measures of fitness such as resting heart rate and the Harvard Step Test, (b) development and implementation of individualized conditioning programs, and (c) a posttest. The course was altered for the present study only in that a broader range of measures was taken, and follow-up information was to be acquired by mail and telephone. Conditioning program choices included running, swimming, weight lifting, and stationary bike. After programs were developed, each class consisted of a 15 minute stretching and warmup routine followed by a workout in the individualized programs. The instructor and I participated in the stretch and warm up and were available to answer questions. I often did my own running while the students were exercising. Course grades were based only on attendance and a conditioning log kept by each student (see Appendix C). The tests were performed according to the testing schedule (see Appendix D).

Measures

Three measures of physical fitness were performed: the Harvard Step Test, Resting Heart Rate, and Body Weight.

Harvard Step Test. The heart rate, taken 15 seconds after stepping up and down on the Harvard Step-Test apparatus at the rate of 22.5 complete ascents and descents per minute for 5 minutes, provided a measure of aerobic

fitness. The apparatus is simply a box 40 cm in height for men and 33 cm for women.

Resting Heart Rate. An average of 5 heart rate measures taken on consecutive days before rising out of bed in the morning was utilized for the pretest and post-test. The student was instructed to feel the pulse on the wrist, count the number of beats in 10 seconds and multiply by 6. The 5 rates were averaged during the analyses.

Body Weight. Each student was to be weighed on a standard scale and their weight was recorded. A Pearson Correlation indicated that the three physical measures, Harvard Step Test, Resting Heart Rate, and Weight were not well correlated ($r = -.39$ for Harvard Step Test and Resting Heart Rate, $r = .22$ for Weight and Harvard Step Test, $r = -.044$ for Resting Heart Rate and Weight). In addition to the lack of correlation, the Resting Heart Rate was regarded as unreliable because students admitted forgetting to take it before rising or averaging days to give readings for forgotten days. The standard scale was unavailable and the weights were provided by students weighing themselves on a variety of scales. The Harvard Step Test is a well known, respected measure of perceived fitness. Therefore only the Harvard Step Test was used for the physical fitness variable.

Perceived Social Support Inventory. The social support variable was derived by averaging the 6 items of the social support scale (see Appendix A). A six item Likert-like

measure of perceived social support assessed the degree to which subjects believed close associates supported their exercise behavior. This measure was examined for readability and for test-retest reliability by administering it to ten University secretaries participating in exercise programs outside the University. The measure was administered on two occasions, ten days apart. Test-retest reliability on the pilot sample equalled 73.3% exact agreement. That is, 73.3% of the items were answered on the second occasion exactly as they had been on the first. The measure of reliability (Cronbach's alpha) of the social support scale was .86 in Week 1 and .88 in Week 10.

Perceived Empathy Inventory. The empathy variable was derived by averaging the 3 empathy questions. This 3 item Likert-like measure examined the degree to which subjects believed the instructor understood, cared about, or encouraged their efforts. Test-retest reliability on the pilot sample equalled 63.4% (N = 9). The empathy inventory achieved an Alpha of .97 in Week 1 and .73 in Week 10.

A Pearson Correlation was calculated between the social support and empathy variables ($r = .33$ in Week 1 and $r = .62$ in Week 10). Since the two variables were not highly correlated they remained separate variables in the analyses. The criterion level for this and all other analyses was $p \leq .05$.

Tennessee Self-Concept Scale: Physical Self Subscale. The physical self-concept variable was the total score of

the 18 items of the physical self subscale of the Tennessee Self-Concept Scale (TSCS). The TSCS is a 100 item scale that has been reported to reliably assess the multidimensional aspects of self (Brown et al., 1982; Fitts, 1965). Trujillo (1983) suggested the TSCS was among the most frequently used means for assessing self-concept. Brown et al. reported its use in several studies relating physical fitness and self-concept. Suinn (1972) concluded the TSCS was among the better measures that combined group discrimination with self-concept information. Test-retest reliability for the subscale reported by Brown et al. was .92. In the present study the physical self-subscale measured .50 on Cronbach's Alpha, the lowest reliability of all the measures used. Items 3, 11, and 12, which had negative correlations to the total score and contributed most to the low alpha, were reviewed for coding error and the possibility of reverse scoring due to misunderstanding of the item by the subjects. This appeared not to be the case. To remain consistent with the previous research use of the instrument, the decision was made to use the scale as written.

Perceived Fitness Scale. The perceived fitness variable was derived by averaging the 2 perceived fitness scores. Pearson correlations revealed they were highly correlated measures ($r = .86$ in Week 1, $r = .91$ in Week 10). This scale consists of a two-item Likert-like scale assessing the subjects' estimations of their level of

physical fitness. Test-retest reliability on the pilot sample equalled 70% exact agreement (N = 10). Because there were only 2 items, Pearson correlations were calculated. The items correlated r = .86 in Week 1 and r = .91 in Week 10.

Goals. The measure for the variable, goals, was the number of times per week the student planned to exercise. This goal appeared in the plan sheet required by the instructor.

Anticipated Satisfaction with Performance. The anticipated satisfaction with performance and the anticipated satisfaction with adherence variables were single estimations of percent satisfaction and needed no further treatment. The Anticipated Satisfaction with Performance measure asked subjects how satisfied or pleased with performance they believed they would be. This rating was made on a 100-point scale ranging from very satisfied to completely dissatisfied.

Anticipated Satisfaction with Adherence. The Anticipated Satisfaction with Adherence measure asked subjects how satisfied or pleased with adherence they believed they would be. This rating was made on a 100-point scale ranging form very satisfied to completely dissatisfied.

Self-efficacy for Performance. The self-efficacy for performance variable was derived by averaging the 16 self-efficacy for performance scores. This measure assessed the

percent of certainty with which subjects believed they would complete a given number of quarter-mile laps around a track. The measure was a grid listing sixteen 1/8 mile segments along one axis and percent certainty from 0-100 in increments of 10 along the other axis (see Appendix A). Test-retest reliability in the pilot was 90 % exact agreement.

Self-efficacy for Adherence. Self-efficacy for adherence was derived by averaging the 7 self-efficacy for adherence scores. This measure assessed the percent of certainty with which the subject believed they would continue their exercise program over the 6 months following the class. The measure was a grid listing 1 to 7 days per week along one axis and 0-100 % along the other axis (see Appendix A). Test-retest reliability in the pilot was 80 % exact agreement.

Eastman and Marziller (1984) and Marziller and Eastman (1984) suggested both theoretical and methodological difficulties plague self-efficacy theory. They maintained efficacy expectations were not unambiguously differentiated from outcome expectations. Further, Bandura and his colleagues have not made clear what is being assessed. The construction and exploration of self-efficacy scales is a particularly thorny methodological problem requiring attention in future research (Eastman & Marziller, 1984).

The present study addressed Eastman and Marziller's criticisms. It drew on Garland's (1985) model which was

conceived independently of Bandura's self-efficacy concepts. Garland measured separately performance expectancy, similar to Bandura's self-efficacy, and performance valence or anticipated satisfaction with performance. Satisfaction with performance was thus differentiated from self-efficacy. The present study measured self-efficacy and anticipated satisfaction with performance to make that same distinction.

To improve the clarity of the self-efficacy measure, a definition of self-efficacy in this situation was used in the scale intructions. The self-efficacy scales read from 0-100 instead of 10-100, and the verbal labels that Eastman and Marziller (1984) suggested were misleading did not appear. The scale was used only as a measure of the subjects' beliefs about their ability to perform or adhere. Specific use was made of the words, performance and situation. Outcome expectancy words, such as fitness, better figure, better condition, and words such as probability, which Eastman and Marziller suggested confused the meaning of the scale, were avoided.

Dishman's Self-Motivation Inventory. The self-motivation variable was derived from the total score on Dishman's Self-Motivation Inventory. This 7-item Likert-like inventory assessed the subject's tendency to persevere or be motivated. The Self-Motivation Inventory achieved Cronbach's Alpha of .70 in Week 1 and .74 in Week 10.

Twelve Minute Run . The performance variable was the number of laps and quarter laps on the 1/8 mile track the subject ran in 12 minutes.

Adherence. The adherence variable was calculated at Week 10 by averaging the frequency of exercise reported by the participant in Weeks 4 through 10.

Other preliminary data treatment. Change in distance, self-efficacy, and perceived fitness scores required for the MANOVA were calculated by simple subtraction. Pearson Correlations were performed with the variables in each path analysis and are presented in Tables E-1 and E-2. These correlations were examined for intercorrelations and independence of measures. The same correlations are referred to in the path analyses.

Failure of the Follow-up. During the term the participants were told their efforts would be rewarded by placing the names of all persons who completed all forms in a lottery for two sport watches. The drawing was held after both follow-ups were completed. The first follow-up was due 10 weeks after the term ended. Letters were mailed a week in advance to the 85 subjects who began the class and to 85 confidants they had named to remind them to return the forms. Extra forms for the previous ten-week period and new forms for the next ten-week period were included along with stamped return envelopes. A week after the due date an effort was made to locate by telephone all everyone who had not returned a form. Phone calls were made to

the numbers given by the subjects. Public telephone operators in several states and university operators were contacted for updated numbers. Calls were placed several times a day to try to locate the subjects at a convenient time. Information forms were completed by telephone if the subjects said they didn't have the time to complete and mail the form. Seventeen forms were completed. Path analysis with this low number and several variables could not be justified.

At the time of the final follow-up, many students had returned to the University. Again 85 letters asking for the second follow-up form and 85 stamped return envelopes were sent to the subjects. Eighty-five letters and stamped envelopes were also sent to the confidants. A slightly higher return that was probably due to the proximity of the students occurred. Once again, several attempts were made to call everyone who had not returned a form. This time 26 of the 85 forms were completed, still far to few to justify the use of path analysis, especially with a large number of variables. After conferring with my path analysis consultant and my committee chair and with much sadness, I agreed that it was not appropriate to perform these final analyses. The longer term adherence information I had hoped to gain would have to wait for a replication with a more stable population.

Chapter V

Results

Path Analyses

Before proceeding with the path analyses it is important to remind the reader of the small sample size in the present study and offer a warning regarding the interpretation of the results. The use of path analytic techniques with a small sample and a large number of predictors is problematic (see Kerlinger & Pedhazur, 1973). The reader is advised to use some caution in interpreting the results of these analyses. The means and standard deviations for the variables in the path models are presented in Table 3. The correlations of the variables are shown in Tables E-1 and E-2.

Both the Week 1 and Week 10 models were considered to be recursive. This means that causal flow is unidirectional. A variable cannot be the cause and the effect of another variable at the same time. A recursive model permitted the use of the ordinary least squares solution to estimate path coefficients in each multiple regression analysis. Table 4 displays the total path analysis for the hypothesized and full models. The path analysis contained 9 regression analyses in Week 1, and 10 in Week 10, one for each criterion variable.

Table 3. Means and Standard Deviations for Variables in Path Analyses.

Week		Social Support	Empathy	Physical Self-concept	Physical Fitness	Perceived Fitness	Goals	ASP[1]	ASA[2]	SEP[3]	SEA[4]	Self-motivation	Performance	Adherence
1	M	2.50	2.91	56.26	45.63	3.33	5.25	79.10	80.42	48.48	70.29	24.62	12:53	--
	SD	1.11	1.67	5.63	8.31	.96	1.34	16.76	14.86	24.57	22.95	4.79	2.45	--
10	M	2.25	3.18	56.26	45.67	3.61	5.25	75.39	72.62	21.08	68.51	23.67	13.05	3.97
	SD	1.15	1.77	5.63	6.91	.90	1.34	15.82	16.98	17.37	18.13	4.76	2.28	1.22

[1]ASP = Anticipated Satisfaction with Performance.

[2]ASA = Anticipated Satisfaction with Adherence.

[3]SEP = Self-efficacy for Performance.

[4]SEA = Self-efficacy for Adherence.

The full model contains all possible paths between the variables. The techniques used to compare the ability of the hypothesized model and the full model (see Table 4) to explain the correlations shown in Tables E-1 and E-2 were (a) a Chi-square goodness of fit statistic testing the total path models, (b) a "Q" coefficient, testing the total path models and (c) a comparison of individual multiple regression equations within each path model by means of an F -test (Ott, 1977). The computational formulas for the "Q" coefficient and the F-test are found in Appendix G.

A Chi-square goodness-of-fit statistic was computed to examine how well the hypothesized model fit the data in comparison to the full model. As stated previously, the full model contains all possible pathways among the variables. Thus, it can explain all the correlations among the variables. If the Chi-square was nonsignificant the data fit the hypothesized model. Therefore, the Chi-square test also represents the overall ability of the hypothesized model to account for the correlations in Tables E-1 and E-2. The degrees of freedom for the Chi-square test are equal to the number of path coefficients hypothesized to be zero in the hypothesized model. For example, in Week 1 the degrees of freedom equal 31 since 31 possible paths are omitted in the hypothesized model (see Table 4). Thirty-one additional path arrows could be drawn on Figure 1 to represent those paths omitted on the hypothesized model.

Table 4. Standardized Regression Coefficients for Multiple Regression Analysis.

Hypothesis	Predictor Variable	Criterion Variables	Hypothesized Model Week 1	Hypothesized Model Week 10	Full Model Week 1	Full Model Week 10
1	Social Support		.058	.014	.058	.014
	Empathy	Self-concept	-.221	-.128	-.221	-.128
	Physical Fitness		.267	.112	.267	.112
2	Physical Fitness		.625* **	.493*	.618*	.467*
	Social Support	Perceived Fitness			.229*	.151
	Empathy				-.031	.096
	Self-concept				-.241*	.012
3	Self-concept		-.277	-.104	-.274	-.072
	Perceived Fitness		-.043	-.042	-.058	-.048
	Physical Fitness	Goals	.174	.192	.170	.239
	Social Support				.039	-.106
	Empathy				.029	.214
4	Goals		-.032 **	-.103 **	-.001	-.112
	Self-concept				.103	-.034
	Perceived Fitness	ASP[1]			.422*	.560*
	Social Support				.166	.063
	Empathy				-.333	-.053
	Physical Fitness				-.273	-.022
5	Goals		.028	-.077 **	-.019	-.107
	Self-concept				-.173	.059
	Perceived Fitness	ASA[2]			.125	.617*
	Social Support				.366	-.007
	Empathy				-.235	.038
	Physical Fitness				.001	-.011
6	Self-concept		-.071	-.033	-.112	-.039
	Perceived Fitness		-.015	-.387*	-.075	-.325
	Goals	Self Efficacy	-.038	.191	-.046	.244
	ASP[1]	for Performance	.190	.363	.210	.325
	ASA[2]		.077	.087	.130	.121
	Social Support				-.245	.068
	Empathy				.009	-.144
	Physical Fitness				.222	-.152
7	Self-concept		.019	-.174	-.101	-.158
	Perceived Fitness		.195	.117	-.027	.066
	Goals	Self Efficacy	.375* **	.554*	.345*	.554*
	ASP[1]	for Adherence	-.200	.246	-.139	-.263
	ASA[2]		.438*	.584*	.294*	.590*
	Social Support				.392*	.269*
	Empathy				-.051	.143
	Physical Fitness				.137	-.039

Table 4 (Continued)

Hypothesis	Predictor Variable	Criterion Variables	Hypothesized Model Week 1		Hypothesized Model Week 10		Full Model Week 1	Full Model Week 10
8	EP[3]		.280*		-.108		.224	-.058
	EA[4]		-.047		.393*		.058	.484*
	ASP[1]		.233		.444*		.183	.442*
	ASA[2]		.242		.055		.256	-.028
	Goals	Self-motivation					-.080	-.156
	Self-concept						.039	.091
	Perceived Fitness						.137	-.058
	Social Support						-.172	.061
	Empathy						-.104	.043
	Physical Fitness						.003	.162
9	Self-motivation		.073		.108		.039	.183
	EP[3]		.004		-.235		-.017	-.302*
	EA[4]		-.210		-.043		-.122	-.250
	ASP[1]		-.066		.087		-.109	.098
	ASA[2]		.242		.113	**	.379*	.206
	Perceived Fitness	Performance	.435*	**	.180		.623*	.199
	Physical Fitness		.294*		.330*		.130	.240
	Self-concept						.384*	.102
	Social Support						-.328*	-.123
	Empathy						.127	-.093
	Goals						.161	.395*
10	Self-motivation				.120			.272
	EP[3]				-.100			-.200
	EA[4]				.500*			.020
	ASP[1]				-.028			-.061
	ASA[2]				-.152	**		.089
	Perceived Fitness	Adherence			-.106			-.085
	Physical Fitness				.135			.032
	Self-concept							-.019
	Social Support							-.155
	Empathy							-.000
	Goals							.667*

[1] Anticipated Satisfaction with Performance.

[2] Anticipated Satisfaction with Adherence.

[3] Efficacy for Performance.

[4] Efficacy for Adherence

* = Significant F ($p \leq .05$) for individual path coefficients.

** = Significant F ($p \leq .05$) for comparison of hypothesized and full model individual regressions.

Since the Chi-square test is sensitive to sample size, a nonsignificant Chi-square could still result with a relatively poor fit of data, indicating in error that the model fit the data. Pedhazur (1982), therefore, suggests also conducting a "Q" coefficient test for the model that is not affected by sample size. The "Q" coefficient represents the ratio variance "explained" by the hypothesized model relative to that explained by the full model. "Q" varies from 0 to 1. Values closer to 1 indicate that the hypothesized model can explain nearly all explainable variance in the dependent variables.

After these overall comparisons were made, the individual multiple regression analyses (listed in Figure 3) between the hypothesized and full models were examined for significant differences between the models. For instance, in the Week 1 hypothesized model, physical fitness was considered to be the only predictor of perceived fitness in the second group of variables listed in Figure 3. Social support, empathy, and self-concept variables were hypothesized to be zero pathways in the model. That is, they were not considered to be significant predictors of perceived fitness. The hypothesized regression equation is then tested against the full regression equation that includes social support, empathy, and self-concept as predictor variables by means of an F-test (Ott, 1977). If the F-test is not significant, then the hypothesized predictor variable, physical fitness, adequately accounts

Figure 3. Predictor and Criterion Variables for Multiple Regression Equations in Week 1 and Week 10 Models.

Hypothesized Model Predictor Variables	Full Model Predictor Variables	Both Models' Criterion Variables
Social Support Empathy Physical Fitness	Social Support Empathy Physical Fitness	Self-Concept
Physical Fitness	Physical Fitness Social Support Empathy Self-Concept	Perceived Fitness
Self-Concept Perceived Fitness Physical Fitness	Self-Concept Perceived Fitness Physical Fitness Social Support Empathy	Goals
Goals	Goals Self-Concept Perceived Fitness Social Support Empathy Physical Fitness	ASP
Goals	Goals Self-Concept Perceived Fitness Social Support Empathy Physical Fitness	ASA
Self-Concept Perceived Fitness Goals ASP ASA	Self-Concept Perceived Fitness Goals ASP ASA Social Support Empathy Physical Fitness	SEP
Self-Concept Perceived Fitness Goals ASP ASA	Self-Concept Perceived Fitness Goals ASP ASA Social Support Empathy Physical Fitness	SEA
SEP SEA ASP ASA	SEP SEA ASP ASA Goals Self-Concept Perceived Fitness Social Support Empathy Physical Fitness	Self-Motivation

Figure 3 (Continued)

Hypothesized Model Predictor Variables	Full Model Predictor Variables	Both Models' Criterion Variables
Self-Motivation	Self-Motivation	Performance
SEP	SEP	
SEA	SEA	
ASP	ASP	
ASA	ASA	
Perceived Fitness	Perceived Fitness	
Physical Fitness	Physical Fitness	
	Self-Concept	
	Social Support	
	Empathy	
	Goals	
Self-Motivation	Self-Motivation	Adherence
SEP	SEP	
SEA	SEA	
ASP	ASP	
ASA	ASA	
Perceived Fitness	Perceived Fitness	
Physical Fitness	Physical Fitness	
	Self-Concept	
	Social Support	
	Empathy	
	Goals	

[1]Anticipated Satisfaction with Peformance

[2]Anticipated Satisfaction with Adherence

[3]Self-Efficacy for Performance

[4]Self-Efficacy for Adherence

for the variablity in perceived fitness without the need for the additional predictor variables of social support, empathy, and self-concept.

Examination of the overall fit of the hypothesized model to the data by the chi-square goodness-of-fit test resulted in nonsignificant values in both Week 1, $X^2(31) = 30.74$, and Week 10, $X^2(35) = 19.18$. This would ordinarily indicate a good fit to the hypothesized model. However, since the present study has a small sample size, the "Q" test is a better test of fit. The "Q" ratios were: Week 1, $Q = .263$, and Week 10, $Q = .119$, indicating that the fit was poor in both Weeks.

The next set of analyses was a comparison of individual multiple regression equations by means of an F-test. The hypotheses upon which the equations for the hypothesized model were constructed are stated below.

Path Model Hypotheses

1. Self-concept is directly influenced by social support, empathy, and physical fitness.

2. Physical fitness is the only direct predictor of perceived fitness.

3. Goals are directly influenced by self-concept, perceived fitness, and physical fitness.

4. Goals is the only predictor of anticipated satisfaction with performance.

5. Goals is the only predictor of anticipated satisfaction with adherence.

6. Self-efficacy for performance is directly influenced by self-concept, perceived fitness, goals, anticipated satisfaction with performance, and anticipated satisfaction with adherence.

7. Self-efficacy for adherence is directly influenced by self-concept, perceived fitness, goals, anticipated satisfaction with performance, and anticipated satisfaction with adherence.

8. Self-motivation is directly predicted by self-efficacy for performance, self-efficacy for adherence, anticipated satisfaction with performance, and anticipated satisfaction with adherence.

9. Performance is directly influenced by self-motivation, self-efficacy for performance, self-efficacy for adherence, anticipated satisfaction with performance, anticipated satisfaction with adherence, and physical fitness.

10. Adherence is directly predicted by self-motivation, self-efficacy for performance, self-efficacy for adherence, anticipated satisfaction with performance, anticipated satisfaction with adherence, and physical fitness.

Each path hypothesis was tested by performing a multiple regression analysis for the hypothesized and full models in Week 1 and Week 10. The full and hypothesized

versions of the multiple regression equations for all hypotheses except Hypothesis 1 were then tested using an F-test. The results of the F-tests follow:

Hypothesis 1 stated that social support, empathy, and physical fitness directly predict physical self-concept and is illustrated in Figure 4. The regression equations in the hypothesized and full models were the same for this hypothesis so no F-test was needed for comparison. None of the path coefficients leading to self-concept were significant for either Week 1 or Week 10, thus refuting the first hypothesis. As can be observed from Table 4, the path coefficient decreased in strength from Week 1 to Week 10. These results failed to support the assumption of this study that information about the self that one gains from such sources as one's own physical fitness would predict initial physical self-concept measures. Other studies have found increases in self-concept resulting from improved physical fitness (Brown, 1982; Sonstroem, 1984; Trujullo, 1983). The results also failed to support Hirsch's (1981) contention that social support would influence self-concept. Nor did the present study's contention that empathy would predict self-concept receive support.

Hypothesis 2 stated that physical fitness is the only direct predictor of perceived fitness and is illustrated in Figure 5. The full equations for Week 1 and Week 10 included social support, empathy, and self-concept as additional predictors of perceived fitness. The resulting

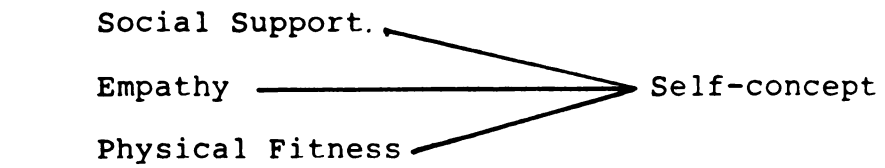


FIGURE 4. HYPOTHESIS 1 ILLUSTRATED.

(Connecting line indicates hypothesized predictor.)

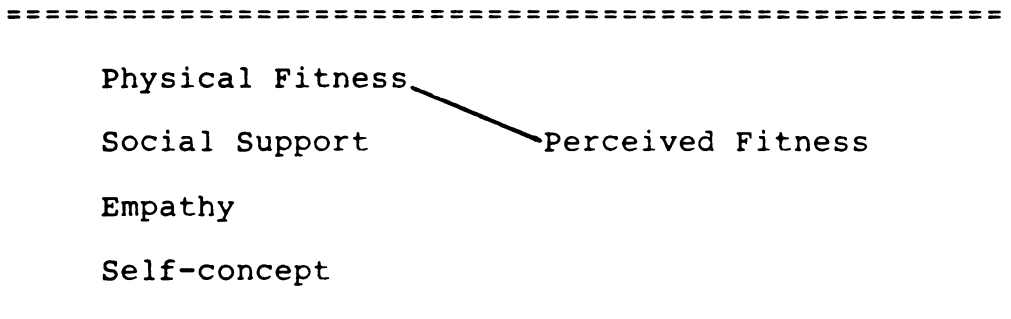


FIGURE 5. HYPOTHESIS 2 ILLUSTRATED.

F-tests (see Table G-5) indicated a significant difference between the full and hypothesized equations for the Week 1 models but not for the Week 10 models. This significant difference indicated that there were significant path coefficients other than physical fitness that should be examined in the full equation. In examining the full model for Week 1 (see Table 4), it can be seen that social support and self-concept were also significant predictors of perceived fitness, but self-concept was in the opposite direction than that hypothesized. A specific aspect of physical self-concept, perceived fitness was influenced by social support, thus providing support for Hirsch's (1981) social support theory and Sonstroem's (1974, 1978) exercise adherence theory. Physical self-concept had a negative influence on perceived fitness. The low correlation between them in Table E-1 suggests the two variables did measure separate constructs. At Week 10 (see Table 4), physical fitness was the only significant predictor of perceived fitness, fully supporting the hypothesis. Physical fitness significantly predicted perceived fitness at both Week 1 and Week 10, supporting Sonstroem's finding that fitness influences self-perception of fitness or athletic ability.

Hypothesis 3 stated that self-concept, perceived fitness, and physical fitness directly predict the extent to which one sets goals and is illustrated in Figure 6. The full equations for Week 1 and Week 10 included social support and empathy as additional predictors of goals. The

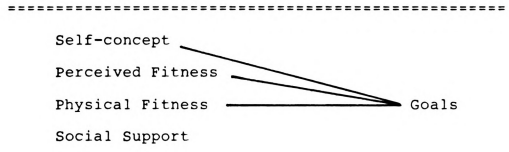


FIGURE 6. HYPOTHESIS 3 ILLUSTRATED.

resulting F-tests (see Table G-5), indicated no significant differences between the full and hypothesized equations for either Week 1 or Week 10. None of the path coefficients leading to goals were significant for either Week 1 or Week 10, thus supporting neither the third hypothesis nor the assumption of this study that exercise goals would be predicted by actual fitness and perception of one's self and fitness.

Hypothesis 4 stated that goals would be the only predictor of anticipated satisfaction with performance and is illustrated in Figure 7. The full equations for Week 1 and week 10 included self-concept, physical included self-concept, perceived fitness, social support, empathy, and physical fitness as additional predictors of anticipated satisfaction with performance. The resulting F-tests (see Table G-5), indicated a significant difference between the full and hypothesized equations for Week 1 and Week 10 models. This significant difference indicated that there were significant path coefficients other than goals that should be examined in the full equation. In examining the full model for Week 1 and Week 10 (see Table 4), it is apparent that goals was not a significant predictor whereas perceived fitness was a significant predictor of anticipated satisfaction for performance in both weeks. A substantial increase in the strength of the path coefficient for perceived fitness can also be observed. Since goals did not significantly predict anticipated satisfaction with

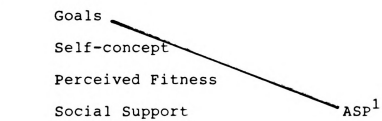


FIGURE 7. HYPOTHESIS 4 ILLUSTRATED.

ASP^1 Anticipated Satisfaction with Performance

performance, Garland's (1985) assumption that anticipated satisfaction with performance mediates between goals and performance was not supported. Hypothesis 4 was not supported. That perceived fitness predicted anticipated satisfaction with performance lends more support to Sonstroem's (1974, 1978) contention that self-concept or perceived athletic ability affects performance and attitudes toward performance.

Hypothesis 5 stated that goals is the only direct predictor of anticipated satisfaction with adherence and is illustrated in Figure 8. The full equations for Week 1 and Week 10 included self-concept, perceived fitness, social support, empathy, and physical fitness as additional predictors of anticipated satisfaction with adherence. The resulting F-tests (see Table G-5), indicated no significant differences betweeen the full and hypothesized equations for Week 1. There were no significant path coefficients in either the hypothesized model or the full model for Week 1. Therefore the hypothesis was not supported nor were any of the variables significant precictors of anticipated satisfaction with adherence.

There was, however, a significant difference between equations in Week 10, indicating that there were significant path coefficients other than goals that should be examined in the full equation. In examining the full model for Week 10, (see Table 4), it can be seen that perceived fitness was the lone significant predictor of

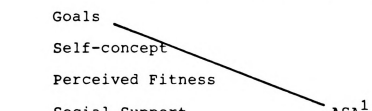


FIGURE 8. HYPOTHESIS 5 ILLUSTRATED.

anticipated satisfaction with adherence. Thus Hypothesis 5 was also not supported in Week 10 and perceived fitness was the lone significant predictor of anticipated satisfaction with adherence in Week 10. Goals did not predict anticipated satisfaction with adherence, failing to support this study's assumption that anticipated satisfaction with adherence mediates goals and adherence. That perceived fitness became a very strong predictor of anticipated satisfaction with adherence provides strong support for Sonstroem's (1974, 1978) theory that perceived fitness increases with training and increases positive attitudes toward continued physical activity.

Hypothesis 6 stated that self-concept, perceived fitness, goals, anticipated satisfaction with performance, and anticipated satisfaction with adherence directly influence self-efficacy for performance. Hypothesis 6 is illustrated in Figure 9. The full equations for Week 1 and Week 10 included social and Week 10 included social support, empathy, and physical fitness as additional predictors of self-efficacy for performance. The resulting F-tests (see Table G-5), indicated no significant differences between the full and hypothesized equations for either Week 1 or Week 10 models. In Week 1 (see Table 4), none of the path coefficients leading to self-efficacy for performance were significant, thus not supporting the hypothesis. In the hypothesized model for Week 10, (see Table 4), it can be seen that perceived fitness was the only significant

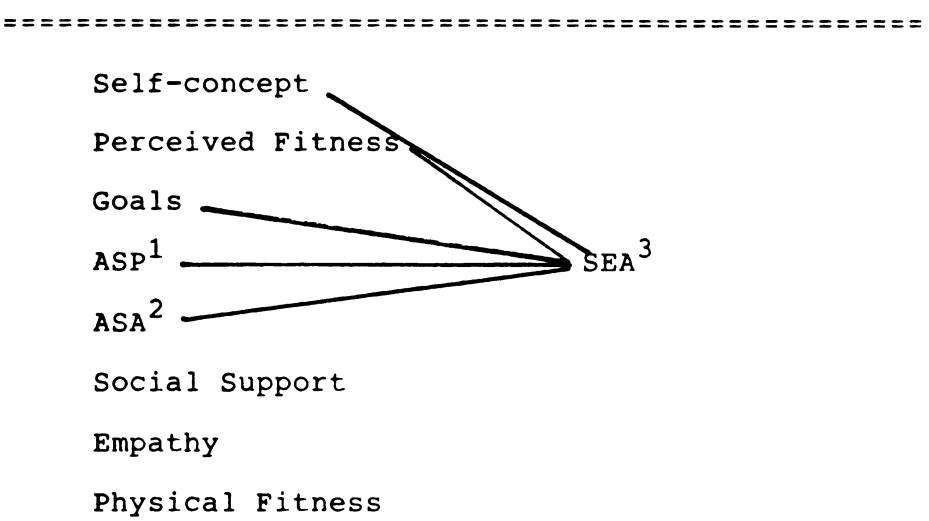


FIGURE 9. HYPOTHESIS 6 ILLUSTRATED.

[1] Anticipated Satisfaction with Performance
[2] Anticipated Satisfaction with Adherence
[3] Self-efficacy for Adherence

predictor of self-efficacy for performance, but in the direction opposite that predicted. The results did not provide support for that part of Bandura's (1977) self-efficacy theory that states that cognitions about physical condition is a strong predictor of self-efficacy. Bandura and Schunk's (1981) and Garland's (1985) findings that goals predict self-efficacy were not supported. The assumption of the present study that anticipated satisfaction with adherence and anticipated satisfaction with performance would predict self-efficacy for performance was also not supported.

Hypothesis 7 stated that self-concept, perceived fitness, goals, anticipated satisfaction with performance, and anticipated satisfaction with adherence directly predict self-efficacy for adherence. Hypothesis 7 is illustrated in Figure 10. The full equations in Week 1 and Week 10 included social support, empathy, and physical fitness as additional predictors of self-efficacy for adherence. The resulting F-tests (see Table G-5), indicated a significant difference between the hypothesized and full equations for the Week 1 but not for the Week 10 models. This significant difference indicated that there were significant path coefficients other that goals and anticipated satisfaction with adherence that should be examined in the full model. Examination of the full model for Week 1 and Week 10 (see Table 4) indicates that social support was also a significant predictor of self-efficacy for adherence.

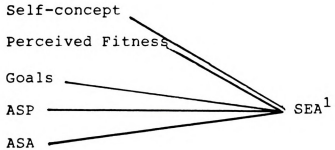


FIGURE 10. HYPOTHESIS 7 ILLUSTRATED.

[1]SEA Self-efficacy for Adherence

Reviewing the hypothesized model for Week 1, it can be seen that only two of the hypothesized paths, goals and anticipated satisfaction with adherence were significant. Thus the hypothesis was only partially supported.

The results indicate support for Bandura and Schunk's (1981) and Garland's (1985) findings that goals predict self-efficacy. It is important to note that goals predicted self-efficacy for adherence but not self-efficacy for performance. The contention of this study that adherence and performance elements of measures should be separated was also supported. The assumption of this study that anticipated satisfaction with adherence would predict self-efficacy for adherence was supported. Bandura and Schunk's finding that social support provides information that one uses to strengthen self-efficacy was supported. The path was directly from social support to self-efficacy and is not mediated by self-concept as the hypothesized model suggested. The results failed to support the assumption of this study that perceived fitness and physical self-concept would predict self-efficacy for adherence attempted in this study. The assumption that these variables would serve as sources of self-efficacy information, based on Bandura's (1977) contention that cognition about physical condition is a strong predictor of self-efficacy, was not supported. The results did not support the attempted connection of anticipated satisfaction with performance and self-efficacy

for adherence although anticipated satisfaction with adherence did predict self-efficacy for adherence.

Hypothesis 8 stated that self-efficacy for performance, self-efficacy for adherence, anticipated satisfaction with performance, and anticipated satisfaction with adherence directly influence self-motivation. Hypothesis 8 is illustrated in Figure 11. The full equations for Week 1 and Week 10 included goals, self-concept, perceived fitness, social support, empathy, and physical fitness as additional predictors of self-motivation. The resulting F-tests (see Table G-5) indicated no significant difference between the hypothesized and full equations for the Week or the Week 10 models. Examination of the path coefficients for Week 1 (see Table 4), indicates only one significant path coefficient. Thus the hypothesis was only partially supported. Self-efficacy for performance was the only significant predictor of self-motivation. There were no significant path coefficients in the full model for Week 1.

Examination of the path coefficients for Week 10 reveals that self-efficacy for adherence and anticipated satisfaction with performance are significant predictors of self-motivation in both the hypothesized and full models. Thus partial support of the hypothesis was indicated. Bandura's (1977) theory that self-efficacy affects self-motivation was supported by the results. Once again, differing results for self-efficacy for performance and

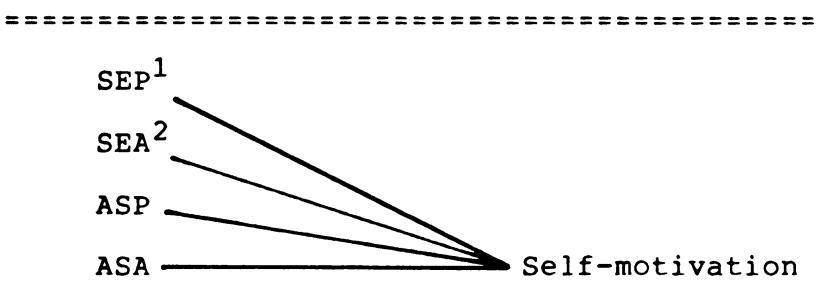


FIGURE 11. HYPOTHESIS 8 ILLUSTRATED.

[1] Self-efficacy for Performance
[2] Self-efficacy for Adherence

self-efficacy for adherence occurred. Self-efficacy for adherence but not self-efficacy for performance was a significant predictor of self-motivation, affirming the importance of separating adherence and performance elements of measures.

That anticipated satisfaction with performance was a significant positive predictor of self-motivation is contrary to Garland's (1985) finding that anticipated satisfaction with performance (performance valence in his words) was predictive of perseverence in a negative direction. Lower anticipated satisfaction with performance predicted higher performance and intensity of effort in Garland's study. The lack of significant influence of anticipated satisfaction with adherence on self-motivation failed to support this study's assumption that anticipated satisfaction with adherence would predict self-motivation.

Hypothesis 9 stated that self-motivation, self-efficacy for performance, self-efficacy for adherence, anticipated satisfaction with performance, anticipated satisfaction with adherence, perceived fitness, and physical fitness directly influence performanace. Hypothesis 9 is illustrated in Figure 12. The full equations for Week 1 and Week 10 included self-concept, social support, empathy, and goals as additional predictors of performance. The resulting F-tests (see Table G-5) indicated significant differences between the hypothesized and full equations for both Week 1 and Week 10. These significant differences indicated that there were

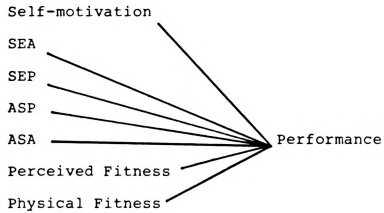


FIGURE 12. HYPOTHESIS 9 ILLUSTRATED.

significant path coefficients in addition to those hypothesized that should be examined in the full equations. Four significant path coefficients appeared in the full model for Week 1 (see Table 4) in contrast to only 2 in the hypothesized model. In the full model, anticipated satisfaction with adherence, perceived fitness, self-concept, and social support were significant predictors of performance. However, social support had a negative path coefficient, opposite the predicted direction. Perceived fitness and physical fitness were significant predictors of performance in the hypothesized model for Week 1, providing partial support for the hypothesis.

In Week 10, examination of the path coefficients shows that physical fitness dropped out as a significant predictor while self-efficacy for performance and goals were significant predictors of performance. However, self-efficacy has a negative coefficient, opposite the predicted direction. In the hypothesized model for Week 10 only physical fitness was a signifiant predictor of performance.

Again, the hypothesized model received only partial support. The results failed to support the assumption of this study that physical fitness would directly, as well as through other paths, predict exercise performance. The results failed to support several theoretical links that the present study sought to test. Self-motivation did not predict performance thus failing to support Bandura's (1977) assumption that motivation mediates between self-efficacy

and performance. Bandura's theory that self-efficacy directly predicts performance was not supported. (Both self-efficacy for performanace and self-efficacy for adherence failed to reach positive significance.) Garland's (1985) contention that negative anticipated satisfaction with performance predicts performance was supported.

That this study's construct, anticipated satisfaction with adherence, did predict performance while anticipated satisfaction with performance had no strong effect, provides support for the separation of these constructs. The positive direction of the influence is counter to what Garland found. Other studies, however, have found anticipated satisfaction with performance to predict performance in a positive direction (Bandura, 1977). Perceived fitness and physical self-concept directly affected performance, counter to Bandura's theory that states such information affects performance through its effect on self-efficacy. That goals directly predicted performance also counters Bandura's theory that self-efficacy mediates goals and performance, but lends support to Garland's and Tu and Rothstein's (1979) findings that goals also directly predict performance.

Hypothesis 10 stated that self-motivation, self-efficacy for performance, self-efficacy for adherence, anticipated satisfaction with performance, anticipated satisfaction with adherence, perceived fitness, and physical fitness directly predict adherence. Hypothesis 10 is

illustrated in Figure 13. Adherence was not measured in Week 1. The full equations for Week 10 included self-concept, social support, empathy, and goals as additional predictors of adherence. The resulting F-test (see Table G-5) indicated a significant difference between the full and hypothesized equations for the Week 10 model. In the hypothesized model, self-efficacy for adherence was the only predictor of adherence. The hypothesis was only partially supported. The results failed to support Dishman and Gettman's (1980) and Dishman's (1981) direct connection of self-motivation and adherence. This study's test of anticipated satisfaction with performance, anticipated satisfaction with adherence, perceived fitness, and physical fitness as direct predictors of adherence also failed to achieve support.

Support for Bandura and Schunk's (1981) findings that self-efficacy predicts adherence was found in the results. That self-efficacy for adherence and not self-efficacy for performance was a significant predictor again supports the separation of adherence and performance elements of measures. Goals was a direct predictor of adherence (as well as of performance) supporting Tu and Rothstein's (1979) and Riddles' (1980) findings that goals predict exercise adherence.

Further Comparisons

As a furthur comparison of the hypothesized and full models, squared multiple correlation coefficients (R^2s)

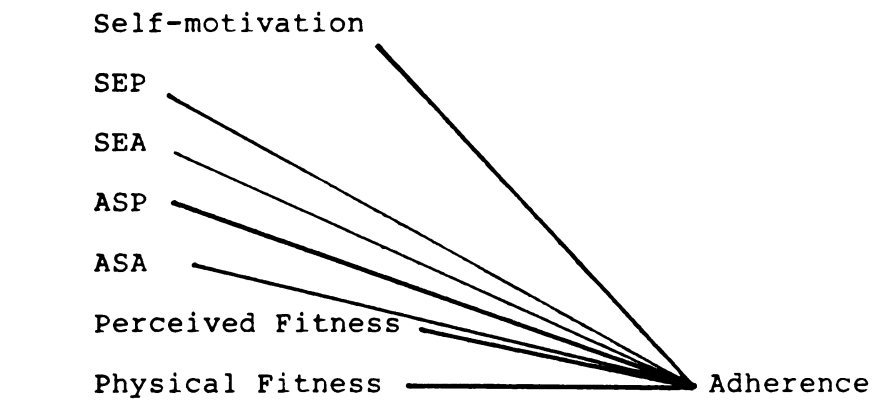


FIGURE 13. HYPOTHESIS 10 ILLUSTRATED.

("explained variance") were calculated for equations that differentially predicted performance and adherence. As can be seen from Table 6, neither the Week 1 nor the Week 10 hypothesized models accounted for exercise performance as well as the corresponding full models. As indicated in Table 10, the hypothesized model did not account for exercise adherence as well as the corresponding full model.

Summary of Path Analysis Results

The hypothesized accounted for the performance and adherence data very pooryl compared to the full model (see Figure 14). Figures 15 and 16 illustrate the significant positive paths from both the hypothesized and full models. In Week 1 (see Figure 15), performance was influenced by physical fitness, self-concept, perceived fitness, and anticipated satisfaction with adherence, but not by self-motivation, self-efficacy for performance, self-efficacy for adherence, anticipated satisfaction with performance, empathy, or goals. Adherence was not measured in Week 1. Self-motivation, self-efficacy for performance, anticipated satisfaction for adherence, goals, and self-concept had no significant predictors. Self-efficacy for adherence was significantly predicted by goals, anticipated satisfaction with adherence, and social support. Anticipated satisfaction with performance was significantly influenced by perceived fitness. Perceived fitness was significantly predicted by physical fitness.

Table 6. Comparison of the R^2_s for Performance and Adherence Between the Hypothesized Model and the Full Model.

Week	Hypothesized Model	Hypothesized Model Adherence	Full Model	Full Model Adherence	Difference Performance	Difference Adherence
1	.491		.639		.148	
10	.437	.292	.570	.589	.133	.297

Hypothesis	S	R	PS
Hypothesis 1. Self-concept is directly influenced by social support, empathy, and physical fitness.		X	
Hypothesis 2. Physical fitness is the only direct predictor of perceived fitness.			X
Hypothesis 3. Goals are directly influenced by self-concept, perceived fitness, and physical fitness		X	
Hypothesis 4. Goals is the only predictor of anticipated satisfaction with performance.		X	
Hypothesis 5. Goals is the only predictor of anticipated satisfaction with adherence.		X	
Hypothesis 6. Self-efficacy for performance is directly influenced by self-concept, perceived fitness, goals, anticipated satisfaction with performance, and anticipated satisfaction with adherence.			X
Hypothesis 7. Self-efficacy for adherence is directly influenced by self-concept, perceived fitness goals, anticipated satisfaction with performance, and anticipated satisfaction with adherence.			X
Hypothesis 8. Self-motivation is directly predicted by self-efficacy for performance, self-efficacy for adherence, anticipated satisfaction with performance, and anticipated satisfaction with adherence			X
Hypothesis 9. Performance is directly influenced by self-motivation, self-efficacy for adherence, anticipated satisfaction with performance, anticipated satisfaction with adherence, perceived fitness, and physical fitness.			X
Hypothesis 10. Adherence is directly predicted by self-motivation, self-efficacy for performance, self-efficacy for adherence, anticipated satisfaction with performance, anticipated satisfaction with adherence, perceived fitness, and physical fitness.			X

S = Supported
R = Refuted
PS = Partially Supported

Figure 14. Status of the Path Hypotheses.

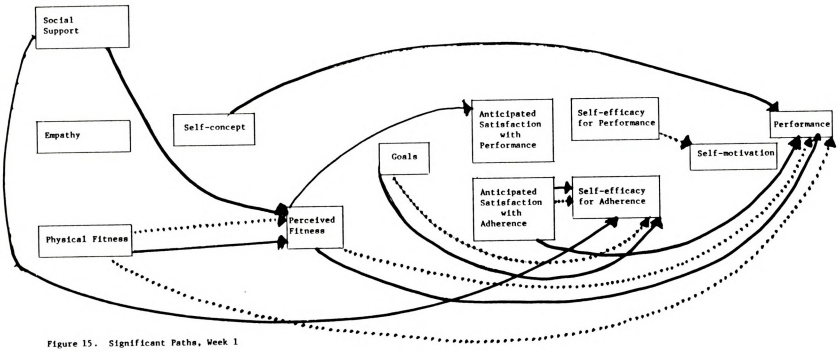


Figure 15. Significant Paths, Week 1

Key: ——— Significant in full model.
•••••• Significant in hypothesized model.

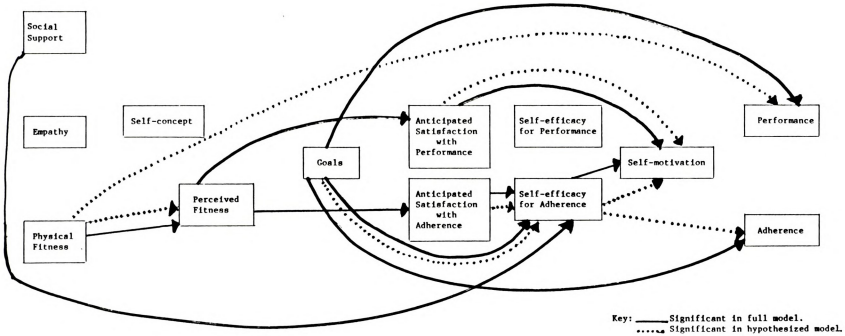


Figure 16. Significant Paths, Week 10.

In Week 10 (see Figure 16), performance was influenced by physical fitness and goals, but not by self-motivation, self-efficacy for performance, self-efficacy for adherence, anticipated satisfaction with performance, anticipated satisfaction with adherence, perceived fitness, physical fitness, self-concept, social support, or empathy. Adherence was significantly predicted by goals and self-efficacy for adherence. Self-motivation was only an effect and not a causal influence of anything. Self-motivation was significantly predicted by self-efficacy for adherence and anticipated satisfaction with performance. Both anticipated satisfaction with performance and anticipated satisfaction with adherence were significantly predicted by perceived fitness. Self-efficacy for adherence was significantly predicted by goals, anticipated satisfaction with adherence and social support. Self-efficacy for performance, goals, and self-concept had no significant predictors among those tested in this study. Perceived fitness was significantly predicted by physical fitness.

Limitations of Path Analysis

Although causal modeling and path analysis are becoming increasingly popular and important to the advancement of social science research (Kenny, 1979), several limitations of this nonexperimental research method must be considered. Discretion must be exercised in making inferences. Inferences made in the present study are justified for two reasons. First, the theoretical model and its proposed

linkages were formulated a priori from established theory and the careful observation of previous research. The strength of interpreting results from path analysis is derived from explicit a priori model construction (Cook & Campbell, 1979; Duncan, 1975; Hunter & Gerbing, 1982; Hunter & Levine, 1983; Kenny, 1979). In order to make strong conclusions in causal modeling, the researcher must begin with strong assumptions (Kenny).

Secondly, an implicit weakness in path analysis is causes due to variables left out of the model. The model of the present study considered several variables. Cook and Campbell (1979) stated that if other probable causal variables can be tested and excluded, the basis for causal inference is strengthened.

Cook and Campbell (1979) suggested that the researcher is in a stronger position to establish complex and realistic path models when there are 3 or more points of measurement. Unfortunately, the planned remeasurement points were not carried out due to the follow-up failure.

As mentioned above, path analysis is not a method for discovering causal directions, but for testing directions of causation already specified by a model. Therefore, the researcher must make the theoretical framework with which the model was built explicit (Hunter & Levine, 1982; Pedhazur, 1982). The present study reviewed the theoretical and research background of each of the variables utilized in

the model and presented a rationale for the model based on that theoretical framework.

The data may fit competing models equally well. Therefore path analysis is more effective as a method for rejecting untenable models than for supporting one of several competing models (Kerlinger & Pedhzur, 1973).

Finally, the present study includes all the limitations which are characteristic of passive observational studies such as sampling problems (Hunter & Levine, 1982) and extraneous variable control problems.

A Proposed Respecified Model

In the early stages of model or theory development it is sometimes useful to delete the nonsignificant path coefficients and examine the resulting respecified model against the full model with another sample population. This approach is referred to as theory trimming (Kerlinger & Pedhazur, 1973). Kerlinger and Pedhazur also suggested the meaningfulness of paths should be considered. Therefore the respecified models contain only the significant paths that eventually influence performance or adherence (see Figures 16 and 17).

Week 1 In Week 1, performance is directly predicted by self-concept, perceived fitness, and anticipated satisfaction with adherence (see Figure 17). Social support and physical fitness indirectly influence performance through their significant influence on perceived fitness.

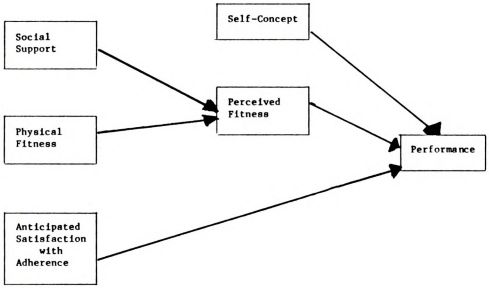


Figure 17. Proposed Respecified Model, Week 1.

Week 10 In Week 10, performance is directly predicted by goals and physical fitness (see Figure 18). Adherence is directly predicted by goals and self-efficacy for adherence. Social support and goals also influence adherence through their influence on self-efficacy for adherence. Anticipated satisfaction with adherence directly affects self-efficacy for adherence. Perceived fitness affects adherence through anticipated satisfaction with adherence and physical fitness has its influence through perceived fitness. A future step in the research would be the examination of these proposed respecified models with a new sample population.

Other Hypotheses and Analyses

The other hypotheses and analyses beyond the path analyses were:

1. Subjects who initially set goals and were high in self-efficacy and perceived fitness and low in anticipated self-satisfaction with performance in the pretest would experience greater increases in their distance on the 12 minute run than subjects who initially did not set goals and were low in self-efficacy and perceived fitness and high in anticipated satisfaction.

2. Subjects with greater distance increases would experience increases in self-efficacy for performance and perceived fitness over the 10 weeks and still experience low anticipated satisfaction with performance. Subjects with smaller distance increases would experience little or no

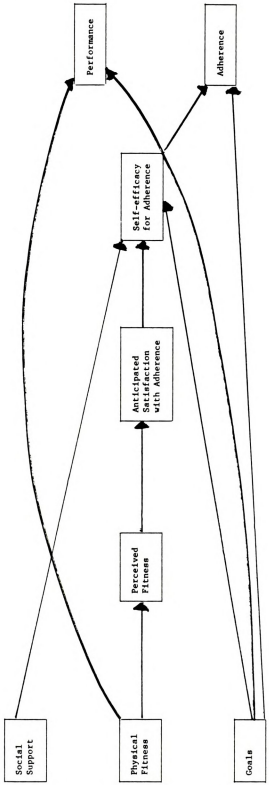


Figure 18. Proposed Respecified Model, Week 10.

change in self-efficacy, perceived fitness, or anticipated satisfaction with performance.

3. Physical fitness measures would not change significantly from Week 1 to Week 10 (due to the short period of time since exercise was begun).

4. A MANOVA was planned to test the data for significant change in the 9 variables suggested by the hypotheses above.

To examine the first hypothesis an attempt was made to form two groups at each data collection point based on whether or not subjects had set goals and by median split of the data for perceived fitness, self-efficacy for performance, and anticipated satisfaction with performance. A t-test to examine the difference between the two groups in improvement in performance (increased distance on the 12 minute run) was planned. The groups fitting the required parameters were extremely small ($N = 6$, $N = 2$). There was a nonsignificant negative association of the groups with distance change, $t(6) = -.65$. (The criterion level for this and all other analyses was $p \leq .05$.) In a further attempt to gain information on the relationship of these variables to performance, four unplanned t-tests were calculated. First, two groups were formed based on whether the subject had set goals in Week 1. A t-test to examine the difference between the two groups in improvement in performance (increased distance on the 12 minute run) was calculated. There was a nonsignificant negative association $t(45) = -.14$, of the two

groups with distance change. Next, two groups were formed from the top 25% and the low 25% of the scores of the Week 1 data for perceived fitness. A *t*-test to examine the difference betweeen the high and lowest perceived fitness groups in improvement in performance was calculated. There was a nonsignificant negative association, $t(30) = -.17$. Two groups were then formed from the top 25% and the lowest 25% of the Week 1 data for self-efficacy for performance. A *t*-test to examine the difference between the high and low self-efficacy for performance groups in improvement in performance was calculated. There was a nonsignificant negative association, $t(33) = -.55$. Finally, two groups were formed from the top 25% and the lowest 25% of the Week 1 data for anticipated satisfaction with performance. A *t*-test to examine the difference between the high and low anticipated satisfaction with performance groups in improvement in performance was calculated. There was a nonsignificant association, $t(39) = .46$.

These *t*-tests indicated that there was not a significant difference in improvement between groups high or low in perceived fitness, groups high or low in self-efficacy, groups high or low in anticipated satisfaction with performance, or groups which did or did not set goals. The hypothesis remained unsupported in this second set of tests.

Four *t*-tests were conducted to test the second hypothesis. A median split of the distance scores formed

groups high and low in performance change. A *t*-test examined the difference in the two groups in changes in self-efficacy for performance, perceived fitness, and anticipated satisfaction with performance. Results indicated that no significant differences existed between the high and performance groups on changes in self-efficacy for performance, $t(52) = 1.25$, perceived fitness, $t(56) = -.44$, or anticipated satisfaction with performance, $t(63) = -.96$.

A paired *t*-test was calculated to examine the difference in physical fitness in Week 1 and Week 10. Results indicated physical fitness did not change significantly from Week 1 to Week 10, $t(56) = -1.68$.

A MANOVA was conducted to test the variables involved in these 3 hypotheses for significance of change for Week 1 to Week 10. The results indicated significant changes occurred. The multivariate $F(9,37) = 7.14$. Significant changes occurred in the following variables in the univariate *F*-tests: self-efficacy for performance, performance, perceived fitness, and empathy (see Table 7).

Table 7. Univariate F-tests of MANOVA Test for Significance of Change.

Variable	Week 1 Mean	Week 10 Mean	F
ASP[1]	76.52	75.87	.06
ASA[2]	79.13	73.91	3.25
SEP[3]	43.44	26.96	34.73*
SEA[4]	66.34	62.83	1.8
Performance	12.42	12.96	28.37*
Perceived Fitness	3.21	3.49	4.55*
Social Support	2.58	2.61	.18
Empathy	3.43	3.94	6.18*
Self-Motivation	24.35	24.02	.18

[1]Anticipated Satisfaction With Performance.
[2]Anticipated Satisfaction With Adherence.
[3]Self-efficacy for Performance.
[4]Self-efficacy for Adherence.

Chapter VI

Discussion

This study examined the predictive power of a model of the posited relationships of several biopsychosocial variables to exercise performance and adherence. Utilizing causal modeling and path analysis, its purpose was to contribute to theory building in the exercise adherence and health compliance area. The model was recursive, testing only one-way causal direction hypotheses. This does not deny the two-way flow of causal direction that could be tested with a more complex, nonrecursive model. It is simply a reflection of the choice to study a limited portion of a growing set of assumptions and theories. The variables are also not exhaustive, but reflect the most viable research and theory in the area. The number of variables is limited to retain the power of the path analyses. Path analysis is reduced in power by the use of a large number of variables and a small sample.

A major caution regarding the interpretation of the results of this study is offered. The final sample of data that could be accepted for path analysis is relatively small for this type of analysis and the number of variables utilized (N = 54 in Week 1 and N = 44 in Week 10). The reader is advised to interpret the results with caution.

Major Findings

The overall results provide only weak support for the hypothesized model as formulated in the path diagram. The model was constructed from several theories and studies regarding performance and adherence. Some of the theories are consistently supported by the results, and others are partially supported.

Sonstroem's (1974, 1978, 1984) exercise adherence theory suggested that perceived athletic ability gained by athletic or exercise participation enhances self-esteem or self-concept which makes further physical activity attractive and insures continued involvement. People who feel good about themselves will be attracted to and continue exercise. The significant paths which lead to performance and adherence (see Figures 17 and 18) support Sonstroem's proposal. Perceived fitness, a specific aspect of self-concept is predicted by physical fitness and directly affects performance in Week 1. (That the subjects were primarily former high school athletes probably had an important effect on perceived fitness in Week 1.) By Week 10, additional information on physical fitness gained through performance and physical fitness tests influenced perceived fitness, adherence, and performance. The effect on adherence was mediated by both attitude toward continued activity (anticipated satisfaction with adherence and self-efficacy for adherence). This path of influence closely follows Sonstroem's theory.

Bandura's (1977) theory of self-efficacy was partially supported by the results. Bandura's theory suggests that self-efficacy mediates the effect of perceived fitness, goals, and social support on performance and adherence (persistence of effort in his words). Self-efficacy for adherence (but not self-efficacy for performance) was predicted by goals and social support and influenced indirectly by perceived fitness. Also consistent with Bandura's findings, self-efficacy for adherence (but not for performance) directly predicted adherence.

Several aspects of Bandura's theory were not supported. Cognitions about physical states are an important source of self-efficacy information in Bandura's theory. This element of Bandura's theory was only partially supported by the present study. Perceived fitness did indirectly influence self-efficacy for adherence. Perceived fitness negatively predicted self-efficacy for performance. This may reflect several factors. The students were not all practicing running. Some of the effect may have been from students whose conditioning did not involve running. Perhaps they viewed their fitness as enabling them to perform another task. It may reflect the real difficulty im improving performance a third time in a ten week period. It is highly likely that it reflects the belief they would not do well because they were forced to run on a differenct track when University officials set up a commercial event on the track the students had planned to run on. The new track was

bigger, and was outdoors, as opposed to the shaded indoor track. It was a hot windy day during exam week. (The laps were converted mathematically for the data analyses.) Even runners may perceive their conditioning and fitness as preparation unrelated to an all-out run lasting 12 minutes. To test these hypotheses, future researchers may wish to replicate the study and solidly assure same-track testing of performance. They should add an outcome expectancy measure to the replication which asks the subjects how certain they are that thier physical fitness will be important to their performance on the 12-minute run.

Secondly, self-efficacy for performance did not predict performance as one would expect following Bandura's theory. Goals and self-concept were not mediated by self-efficacy as one would also expect, but had direct effects on performance.

Finally, Bandura also suggests self-motivation mediates the effect of self-efficacy on performance and adherence. The results of the present study do not support this aspect of Bandura's theory. While self-efficacy for performance did predict self-motivation, self-motivation had no effect on performance or adherence.

Dishman's (1981, 1982a, 1982c) adherence studies reported that self-motivation and physical states were the only significant predictors of exercise adherence. The results of this study only partially support Dishman's findings. Self-motivation never achieved significance as a

predictor of adherence or performance. Physical fitness did directly predict performance in Week 1 and Week 10 but its effect on adherence was mediated by several other path variables. The complexity of the model tested may have contributed to the difference in results of the present study. The biopsychosocial model tested additional relevant variables that were not included in Dishman's study. Another contributing factor may be that the Self-Motivation Inventory measures a general disposition to persevere, which is not specific to exercise adherence as were the other measures in the present study.

Garland (1985) postulated that self-efficacy (his performance valence) and anticipated satisfaction (his performance expectancy) mediated between goals and performance. The results of the present study partially support Garland's theory. Garland's construct of performance expectancy or anticipated satisfaction with performance was the source of this study's construct, anticipated satisfaction with adherence. Anticipated satisfaction with adherence did have significant paths in both Week 1 and Week 10. It directly predicted performance in Week 1 and mediated between perceived fitness and self-efficacy for adherence which significantly predicted adherence. However, the remainder of Garland's proposition was not borne out in the results. Goals did not influence anticipated satisfaction with performance, anticipated satisfaction with adherence, or self-efficacy for

performance. The way the goals variable was operationalized certainly contributed to the difference in results. Goals, in the present study, was the number of times per week the student planned to train. Garland's (1985) goal was defined as the level of performance that an individual wishes to achieve. The present study measure quantity of adherence, while Garland was speaking of standards of performance goals.

These were the major findings with regard to the theories utilized in the present research. Another premise of this study, that adherence and performance aspects of measures should be separated wherever possible to clarify constructs and effects, was well supported by the results. The variables which predicted anticipated satisfaction with performance versus anticipated satisfaction with adherence, self-efficacy for performance versus self-efficacy for adherence, and performance versus adherence differed. The predictive power of anticipated satisfaction with performance versus anticipated satisfaction with adherence and self-efficacy for performance versus self-efficacy for adherence also differed. It appears that the subjects had distinctly different efficacy and expectancy beliefs with regard to performance and adherence. Other measures which may have given different results or more information had they been separated into their performance and adherence aspects are goals and self-motivation. Goals measured only number of planned training sessions per week. A measure of

the standards for performance would give information needed to measure the separate effect of adherence goals and performance goals as predictors, as well as the effect of other predictors on them. Future researchers may wish to attempt that separation.

Other Analyses

The results of the nonpath analyses (t-tests) indicated that the groups formulated according to Bandura's self-efficacy theory and Garland's cognitive mediation theory (goal setters high in self-efficacy for performance and perceived fitness and low in anticipated satisfaction with performance) did not have greater increases in performance as expected. These results are consistent with the path analysis.

Another t-test indicated no significant change in physical fitness over the term. This test confirmed the assumption of the study that physical states would not change significantly in that time.

Finally, the MANOVA indicated significant increases in performance, perceived fitness, and empathy and a significant decrease in self-efficacy. According to Bandura's theory, performance is one of the best sources of efficacy information. By Week 10 the subjects had 2-3 performance scores that could contribute to self-efficacy. Bandura's theory is not supported by this result. However, as mentioned above the decrease in self-efficacy may have been due in large part to the unplanned use of a different

track. It may be due to some students' beliefs that (a) their conditioning was not related to an all-out run, and (b) therefore they couldn't improve further. It may be due to the belief that additional improvement in ten weeks was not reasonable. The increase in perceived fitness which probably utilizes the same information lends support to Sonstroem's adherence theory. Performance increases were most likely due to the effect of training. Empathy increases are most certainly due the instructor's friendliness which was perceived by the students as empathy as well as social support.

Uncontrolled Factors and Measurement Problems

Several uncontrolled factors that may have contributed to the present results are now mentioned. The students became friendly and supportive to each other in their exercise effort inside and outside the class. The instructor was very friendly and supportive of the students' exercise during class. This additional support may help account for the switch in the role of social support from predicting perceived fitness in Week 1 to predicting self-efficacy for adherence in Week 10. As mentioned above, it may also have influenced the increase in perceived empathy.

The students' status as former athletes means the group was not a representative sample of college students and tends to confound the results. For example, the fact that many of the students were former athletes may account for the early effect of physical fitness and perceived fitness

on performance. These students did not need several weeks of training to know they were in good condition.

This study did not examine male and female differences. Whether the variables have greater saliency for men's or women's adherence or performance is an interesting and perhaps vital question. Godin and Shepherd (1985) found some male-female differences in adherence related to response to social support. Future researchers may wish to include further study of male-female differences in adherence and variables related to adherence.

As mentioned above, the present study had a very small sample for path analysis. Path analysis should have a greater sample to achieve reliable results.

Yet another problem was the failure of the collection procedure on proposed follow-up studies which was discussed in the Methods section. Because the study began in spring term, the follow-up reports were due in August and October. Most students had changed addresses at least twice during this time period making adequate mail and telephone follow up impossible. The much needed information on the longer term effect of the variables on adherence this part of the study was designed to gain was not collected.

Several measurement problems that created interpretation problems and results that were inconsistent with the literature require discussion and revision before any replication takes place. The decision to measure self-concept only at the beginning of the study became a

problem. It would have provided a better test of Sonstroem's theory of self-concept and adherence had a posttest also been done. In addition, a broader measure of self-concept or self-esteem appears to have been needed. The physical self variable, while broader than perceived fitness, probably did not capture the self-valuing (beyond the physical self-valuing) that Sonstroem posits is enhanced with increases in perceived athletic ability. Yet it was enough broader than the perceived fitness variable that it could not be used as that variable. Its intermediate status may have been the reason self-concept paths did not achieve significance where it was expected. The low reliability of the measure in this study would caution against its use without revision in any replication study.

As discussed above, several questions surround the significant drop in the self-efficacy for performance scores and the unexpected negative influence of physical fitness on self-efficacy for performance. The self-efficacy for performance scale should ask the subject to estimate their actual performance rather than improvement in performance. An outcome expectancy question that asks the subject to state how certain they are that their physical fitness will affect their performance is also recommended. Together, these changes may resolve the questions regarding the unexpected results.

Definition, operationalization, and separation of the goals measure into its adherence and performance aspects

could similarly resolve the question of unexpected results and interpretation problems encountered with the results related to goals. This change could also give more information about the differential effects of performance goals and adherence goals.

Similarly, the Self-motivation Inventory appears too general a measure for the present study. Motivation measures specific to adherence and performance could provide more specific information. Perhaps self-motivation would also have greater predictive power with the use of these separate measures.

The change of the performance measurement device, the running track, also affected the reliability of the data. Running on the bigger, warmer, windier track certainly affected the subjects' performance. Anticipating the different run problably also affected their self-efficacy for performance scores. Future researchers are cautioned to secure agreements from buildings officials that would prevent such problems.

Finally, the large number of theories and variables included in the design presented a problem in analyses. Besides the reduction of explanatory power with the small sample and large number of variables, the results were often difficult to conceptualize at once. Comparison of models from two concise theories rather than from a collection of theories may provide a more manageable research design in the future.

Conclusions

Although the hypothesized model did not fare well, the results were informative:

1. Sontroem's exercise adherence theory was consistently supported. Fitness did affect perceived fitness which did in turn predict attitudes toward exercise performance and adherence, and did predict adherence and performance.

2. Bandura's self-efficacy theory was partially supported. Self-efficacy (for adherence) mediated the effect of goals, perceived fitness, and social support on adherence. Self-efficacy did not mediate the effects of perceived fitness, goals, and self-concept on performance. Self-efficacy never had a positive influence on performance.

3. Garland's cognitive mediation of goals and tasks theory was partially supported. Anticipated satisfaction with adherence, a construct built on Garland's thinking, mediated between goals and performance. However, anticipated satisfaction with performance, self-efficacy for performance, and self-efficacy for adherence did not influence performance as one would expect from Garland's theory.

4. Dishman's exercise adherence theory was partially supported. Physical states did have an important influence on performance and adherence as well as other variables affecting adherence. Self-motivation, however, never significantly influenced either performance or adherence.

5. The present study was not designed to compare theories but to examine the relationships of variables to each other and to adherence. However, the results provide the beginnings of such comparisons for a few theories and emphasize the need for such comparisons.

6. The present study's suggestion that adherence and performance aspects of all measures require separation was consistently supported. Wherever such separation took place it allowed the observation of separate predictors for those variables as well as the observation of their differing predictive powers.

7. Studies that require follow up and utilize college students should be started in the beginning of the academic year to assure data collection.

Implications for Exercise Programs

While the challenge to learn more about exercise adherence continues, findings of the present study along with the related literature, suggest the following recommendations for exercise programs or individual exercise prescriptions. Exercise leaders (or prescribers of individual exercise prescriptions) should:

1. Encourage the exerciser to enlist the support of the spouse or close friend. Suggest they discuss goals, progress, and feelings about the exercise activity.

2. Assist the exercise participant in setting adherence and performance goals. Emphasize reasonable goals so that improvement and favorable assessment of fitness and

performance are perceived. Recognize and reinforce progress the participant makes in reaching goals.

3. Schedule periodic fitness and performance tests to provide feedback and reinforcement of actual and perceived fitness levels.

4. Emphasize improvements the exerciser makes in fitness, performance, self-esteem, and general mental health.

5. Provide and encourage close associates to support and reinforce the exerciser's ability to adhere as well as their actual adherence.

Implications for Future Research

1. Path analysis apppears a valuable model for the multivariate study of exercise adherence.

2. Replication of this study and examination of the proposed respecified models with a new sample population appears to be a next step in future research.

3. The direct comparison of the explanatory power of theories such as those of Sonstroem and Bandura appears to be another next step. Such theory comparison would contribute to identifying of viable theory to guide exercise adherence efforts as recommended by Dishman et al. (1985).

4. Self-concept ought to be measured pre and post study to provide a more complete test of Sonstroem's theory. A broader measure of self-concept/self-esteem appears required.

5. The self-efficacy for performance scale should ask the subjects to estimate their actual performance rather than their performance improvement.

6. An outcome expectancy scale should ask the subjects to state how certain they are that their physical fitness will be important to their performance.

7. The use of standardized definitions of variables among exercise researchers is needed.

8. Follow-up and longitudinal studies are still needed to provide information about adherence over time. I echo Dishman (1982c) and Sonstroem (1984) in saying that a ten week study is just a beginning in any study of adherence.

Footnotes

[1] In the present study exercise adherence refers to continued involvement or persistence in exercise behavior. Exercise behavior refers to involvement in exercise activity such as jogging, aerobic dancing, weight training, calisthenics, or swimming.

[2] In this study performance refers to the quality of an exercise behavior. How well one performed on a timed run was the measure of one's performance.

[3] In the present study compliance refers to persistence in following a medical treatment plan.

APPENDICES

APPENDIX A

Questionnaires

Name:_____

Date:_____

Exercise Data Collection

Instructor's Measures On Exerciser

Part I - Physiological States

1. Resting Heart Rate pre _____ post_____

2. Harvard Step Test pre_____ post_____

Part II - Performance Measure

12 Minute Run pre_____ Week 5_____

post_____

Name:_____

Date:_____

Exerciser's Self-report Questionnaire

Part III - Perceived Fitness

1. I believe I am in good physical condition.

1	2	3	4	5
somewhat		moderately		strongly believe

2. I believe I am a physically fit person.

1	2	3	4	5
somewhat		moderately		strongly believe

Part IV - Social Support

Please write the name of a few of your close friends or family who give you support or encouragement for your feelings, thoughts, or activities.

---

1. Do people close to you let you know they believe your thoughts about exercising are okay.

0	1	2	3	4	5
never	very seldom	seldom	moderately	often	very often

2. Do people close to you help you think about your exercise plans or strategies?

0	1	2	3	4	5
never	very seldom	seldom	moderately	often	very often

3. Do people close to you do things like drive you to exercise class or buy exercise shorts or shoes to encourage your exercise.

0	1	2	3	4	5
never	very seldom	seldom	moderately	often	very often

4. Do people close to you do things like exercise with you or call you so you can remember to exercise?

0	1	2	3	4	5
never	very seldom	seldom	moderately	often	very often

5. Do people close to you share your joy when you've met a new exercise goal?

0	1	2	3	4	5
never	very seldom	seldom	moderately	often	very often

6. Do people close to you help you with your anger, guilt, or sadness when you aren't meeting your exercise goals?

0	1	2	3	4	5
never	very seldom	seldom	moderately	often	very often

Part V - Empathy

1. Does the instructor understand your attitudes and feelings about exercise?

0	1	2	3	4	5
never	very seldom	seldom	moderately	often	very often

2. Does the instructor appear to care if you exercise?

0	1	2	3	4	5
never	very seldom	seldom	moderately	often	very often

3. Does the instructor encourage you to exercise?

0	1	2	3	4	5
never	very seldom	seldom	moderately	often	very often

Part VI - Tennessee Self-Concept Scale

Items 1-18 make up the Physical Self subscale. The TSCS is copyrighted. Copies are available from Western Psychological Services, 12031 Wilshire Blvd., Los Angeles, CA 90025.

Part VII - Goals Inventory

1. Do there seem to be specific exercise goals for this class? (Some target or level of exercise to work for)

   _____Yes _____No

2. If there are class goals are they set for the term?

   _____Yes _____No

3. If there are class goals are they set for each week?

   _____Yes _____No

4. If there are class goals, are they about "sticking to it" or persistence?

   _____Yes _____No

5. If there are class goals, are they about quality of your exercise performance?

   _____Yes _____No

6. Do you set specific exercise goals yourself?

   _____Yes _____No

7. If you set your own goals, are they set for the term?

   _____Yes _____No

8. If you set your own goals, are they set each week?

   _____Yes _____No

9. If you set your own goals, are they about "sticking to it" or persistence?

   _____Yes _____No

10. If you set your own goals, are they about the quality of your exercise performance?

    _____Yes _____No

Part VIII - Self-Efficacy for Performance

Instructions: Self-efficacy is the belief that you can perform a particular task. It is self-confidence in a particular or specific situation. Rate how strongly you believe (have self-efficacy or self-confidence) that you can improve your performance on the 12 Minute Run by each of the amounts listed:

% OF CERTAINTY

	0	10	20	30	40	50	60	70	80	90	100
1/2 lap											
1 lap											
1-1/2 laps											
2 laps											
2-1/2 laps											
3 laps											
3-1/2 laps											
4 laps											
4-1/2 laps											
5 laps											
5-1/2 laps											
6 laps											
6-1/2 laps											
7 laps											
7-1/2 laps											
8 laps											

Part IX - Self-Efficacy for Adherence

Instructions: Rate how strongly you believe that you will continue to do your exercise program during the next 6 months. (The specific task here is persisting at an exercise program.) Rate how strongly you believe (have self-efficacy or self-confidence) that you can continue to exercise the number of times per week listed:

% OF CERTAINTY

	0	10	20	30	40	50	60	70	80	90	100%
every day											
6 times a week											
5 times a week											
4 times a week											
3 times a week											
2 times a week											
1 time a week											

Part X - Anticipated Satisfaction With Performance

Instructions: How satisfied or pleased or accepting of your exercise performance in this class do you expect to be? Rate how satisfied you think you will be:

extremely dissatisfied — extremely satisfied

__0% __10% __20% __30% __40% __50% __60% __70% __80% __90% __100%

Part XI - Anticipated Satisfaction With Adherence

Instructions: How satisfied or pleased or accepting of your exercise adherence in this class do you expect to be? Rate how satisfied you think you will be:

extremely dissatisfied — extremely satisfied

__0% __10% __20% __30% __40% __50% __60% __70% __80% __90% __100%

Part XII - Dishman's Self-motivation Scale

Instructions: Read each of the statements below, and circle the number beneath the letter corresponding to the alternative that best describes how characteristic the statement is when applied to you. The alternatives are:

A. extremely uncharacteristic of me.
B. somewhat uncharacteristic of me.
C. neither characteristic nor uncharacteristic of me.
D. somewhat characteristic of me.
E. extremely characteristic of me.

A	B	C	D	E	
5	4	3	2	1	1. I get discouraged easily.
5	4	3	2	1	2. I don't work any harder than I have to.
1	2	3	4	5	3. I seldom if ever let myself down.
5	4	3	2	1	4. I'm just not the goal-setting type.
1	2	3	4	5	5. I'm good at keeping promises, especially the ones I make to myself.
5	4	3	2	1	6. I don't impose much structure on my activities.
1	2	3	4	5	7. I have a very hard-driving, aggressive personality.

APPENDIX B

Informed Consent and Information Release

MICHIGAN STATE UNIVERSITY
Department of Health and Physical Education
Department of Psychology

RESEARCH CONSENT FORM

1. I have freely consented to take part in a scientific study being conducted by Mary Clearing Sky a graduate student in Michigan State University's Clinical Psychology Department, as part of her doctoral dissertation research and as an authorized part of the research and evaluation program in the Department of Health and Physical Education under the supervision of Robert Caldwell, Ph.D., Assistant Professor of Psychology and Deborah Feltz, Ph.D., Associate Professor of Physical Education.

2. The study has been explained to me and I understand the explanation that has been given and what my participation will involve. I understand that information about my attitudes and physical preparation for exercise and my exercise performance will be collected. I understand that the questionnaire contains some personal questions. The information will be used to learn more about people who exercise and will be helpful to educators and health-care providers.

3. I understand that I will complete a 30 minute questionnaire in the first and tenth weeks of class, brief questionnaires in the fifth week of class and at 10 and 20 weeks after class. I understand that as part of the follow-up I will also complete a summary log of my weekly exercise.

4. I understand that my name will be removed from the questionnaire as soon as the forms are stapled together.

5. I understand that I am free to discontinue my participation in the study at any time without penalty.

6. I understand that the results of the study will be treated in strict confidence and that I will remain anonymous. Within these restrictions, results of the study will be made available to me at my request.

7. I understand that my participation in the study does not guarantee any beneficial results to me.

8. I understand that, at my request, I can receive additional explanation of the study after my participation is completed.

Signed:_____

Title of Exper: An Analysis of the Predictors of Exercise Performance and Adherence Date:_____

MICHIGAN STATE UNIVERSITY
Department of Psychology
Department of Health and Physical Education

Exercise Adherence Study

Dear _____,
verifying person

The student who signed below is a volunteer in a study of exercise behaviors. He/she has given you permission to report his/her exercise behavior. Please complete the attached form and return it to us in the enclosed self-addressed, stamped envelope as quickly as possible. Thank you for your assistance in our study.

Students name:_____

I, _____, grant permission to
student's signature

_____, to report my exercise
person who will verify your exercise

behavior to Mary Clearing Sky for use in an exercise adherence study.

This information is to be strictly confidential and for use only

in this study.

Date: _____

Student's summer address:_____

City, State, Zip:_____

Phone Number: ( )_____

Name of person verifying your exercise:_____

Address:_____

City, State, Zip:_____

Phone Number: ( )_____

APPENDIX C

Course Outline

Course: General Conditioning

Instructor: Jeanne Foley

Office: IM Circle, Ex. Phys. Lab Office E

Phone: 5-4734

Suggested References:

1. Physiology of Fitness - Brian J. Sharkey
   (Human Kinetics Publishers, Inc.) $12.95

2. Fit or FAT - Covert Bailey
   (Houghton-Mifflin Co.) $ 4.95

Course Outline:

- 10 Weeks, 2 classes per week

- Week One: Monday - Intro, paperwork
  Wednesday - Fitness Test, intro to stretching/ warmup routine

- Week Two: Monday - Work out individual conditioning programs, then warmup and first workout
  Wednesday - First 15:00 warmup (in gym) then follow workout program

- Week Three-Ten: Warmup/workout as on Wed. of Week 2

Note: On Monday or last week of class, we will do the Fitness Test again - mandatory

Grading:

Your course grade will be determined in two parts:

1) Attendance (70% of grade)
   0 or 1 absence: 4.0, grade drops by 0.5 for every absence over 1. (Note: more than 10 minutes late to class = absence)

2) Conditioning Log (30% of grade)
   Daily log of workouts, record of fitness tests, etc.
   (Log sheets and further details on this will be given in next class period.)

Final Grade = .7 x (attendance grade) + .3 x (log grade) rounded to next lower half grade point

Example: 3 absences, A on notebook (3 absences = 4.0 - 1.0)

Grade: .7 (3.0) + .3 (4.0) = 2.1 + 1.2 = 3.3 Final Grade: 3.0

APPENDIX D

Testing Schedule

Testing Schedule

Week 1 and Week 10

Harvard Step Test
Resting Heart Rate
Body Weight
Perceived Social Support
Perceived Empathy
Tennessee Self-Concept Scale
Perceived Fitness
Goals Inventory
Anticipated Satisfaction With Performance
Anticipated Satisfaction With Adherence
Self-efficacy for Performance
Self-efficacy for Adherence
Dishman's Self-Motivation Inventory
Twelve Minute Run

Week 10 only

Adherence Computation

APPENDIX E

Pearson Correlations

Table E-1. Correlations Among Variables, Week 1.

	Social Support	Empathy	Physical Fitness	Physical Self-concept	Perceived Fitness	Goals	ASP	ASA	SEP	SEA	Self-motivation	Performance
Social Support	1.00	.33*	.20*	.23*	.36*	.13	.13	.26*	-.19	.53*	.10	- .00
Empathy		1.00	-.07	.00	.08	.09	-.27*	-.17	-.18	.02	-.10	- .03
Physical Fitness			1.00	.21*	.54*	.08	.10	.21*	.03	.30*	.10	.55*
Physical Self-concept				1.00	.09	-.07	.03	-.17	.04	.04	.17	.13
Perceived Fitness					1.00	.12	.27*	.25*	-.01	.28*	.20*	.57*
Goals						1.00	.00	.07	.05	.44	.00	.06
ASP							1.00	.59*	.24*	.09	.38*	.30*
ASA								1.00	.16	.36*	.37*	.38*
SEP									1.00	.18	.35*	.02
SEA										1.00	.14	.11
Self-motivation											1.00	.07
Performance												1.00

Table E-2. Correlations Among Variables, Week 10

	Social Support	Empathy	Physical Fitness	Physical Self-concept	Perceived Fitness	Goals	ASP	ASA	SEP	SEA	Self-motivation	Performance	Adherence
Social Support	1.00	.62*	.14	.12	.34*	.00	.23*	.20	.04	-.12	.44*	-.02	-.05
Empathy		1.00	-.16	-.08	.15	.16	.02	.09	-.12	-.33*	.35*	-.09	.11
Physical Fitness			1.00	.15	.36*	.07	.19	.21	-.07	.12	.20	.51*	.23*
Physical Self-concept				1.00	.27*	-.07	.21*	.28*	-.02	.02	.13	.21*	-.07
Perceived Fitness					1.00	-.01	.56*	.60*	-.08	.36*	.52*	.55*	-.10
Goals						1.00	-.02	.00	.09	.48*	.10	.06	.63*
ASP							1.00	.81*	.14	.28*	.49*	.34*	-.06
ASA								1.00	.07	.38*	.45*	.33*	.02
SEP									1.00	.12	.08	-.32*	.02
SEA										1.00	.25*	.25*	.34*
Self-motivation											1.00	.34*	.18
Performance												1.00	.05
Adherence													1.00

APPENDIX F

Statistical Formulae

Formula for F-test

The computational formula for testing a full model against a reduced model[1] is:

$$F\ (k-g, df_{MS_{e\ full}}) = \frac{(SS_{e\ reduced} - SS_{e\ full})\ \ k-g}{MS_{e\ full}}$$

Where SS_e = sum of squares error and K = the number of independent variables in the full regression equation and g = the number of independent variables in the reduced regression equation.

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[1] L. Ott (1977). An introduction to statistical methods and data analysis. North Scituate, MA: Duxburg Press.

Formula for "Q" Coefficient[1]

Full Model

$$R_m^2 = 1 - (1 - R_1^2)(1 - R_2^2) \ldots (1 - R_p^2)$$

Reduced Model

$$M = 1 \ (1 - R_1^2) \ (1 - R_2^2) \ \ldots (1 - R_p^2)$$

$$W = - \ (n - d) \ \log_e Q = - \ (N - d) \ \log_e \left(\frac{1 - R_m^2}{1 - M}\right)$$

where as:

W = measure of goodness of fit

N = sample size

d = number of path coefficients hypothesized to be equal to zero (number; overidentifying restriction)

$\log_e$ = natural logarithm

W = approximate X^2 distribution w/df = d

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[1] E. S. Pedhazur (1982). Multiple regression in behavioral research: Explanation and prediction. New York: Holt, Rinehart, and Winston.

APPENDIX G

F-tests

Table G-5. *F*-tests Testing Full Models Against Hypothesized Models.

Variables	Week 1	Week 10
Self-concept	F (0, 51) = 0	F (0, 41) = 0
Perceived Fitness	F (3, 50) = 3.05*	F (3, 40) = .56
Goals	F (2, 49) = .07	F (2, 39) = 1.19
Anticipated Satisfaction with Performance	F (5, 48) = 2.92*	F (5, 38) = 3.66**
Anticipated Satisfaction with Adherence	F (5, 48) = 2.34	F (5, 38) = 4.73**
Self-efficacy for Performance	F (3, 46) = 1.14	F (3, 36) = .47
Self-efficacy for Adherence	F (3, 46) = 3.49*	F (3, 36) = 2.83
Self-motivation	F (6, 44) = .47	F (6, 34) = .53
Performance	F (7, 43) = 2.51*	F (4, 33) = 2.54
Adherence		F (4, 33) = 5.96***

* $p < .05$

** $p < .01$

*** $p < .001$

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