The Relation Between Selected Student Characteristics and Activity Patterns in a Required High School Physical Education Class.

Karen Martha Greenockle
Louisiana State University and Agricultural & Mechanical College

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The relation between selected student characteristics and activity patterns in a required high school physical education class

Greenockle, Karen Martha, Ph.D.
The Louisiana State University and Agricultural and Mechanical Col., 1987
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THE RELATION BETWEEN SELECTED STUDENT CHARACTERISTICS
AND ACTIVITY PATTERNS IN A REQUIRED HIGH SCHOOL PHYSICAL EDUCATION CLASS

A Dissertation
Submitted to the Graduate Faculty of the Louisiana State University and Agricultural and Mechanical College in partial fulfillment of the requirements for the degree of Doctor of Philosophy

in

The School of Health, Physical Education, Recreation, and Dance

by

Karen M. Greenockle
B. S. Texas Christian University, 1972
M. S. Lamar University, 1975
August 1987
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Finally, I would especially like to dedicate this dissertation to my grandmother, Nana (Josephine Alexandra Kleeman), a true scholar, whose spirit and inspiration has guided me throughout these past four years of intense study making a dream come true.
FOREWARD

This manuscript is written in the format of the American Psychological Association. The body of the paper is presented in the format of submission for publication to scholarly journals. Additional information concerning measurement instruments and procedures, statistical procedures, tables, and studies reviewed for this research study are presented in the appendices.
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Abstract

This study described the activity patterns of students in a high school fitness class and explored the structural relations between particular student characteristics and their coded exercise behavior. Exercise behavior was systematically coded during an 8-week jogging unit in 10 high school physical education classes. Additional measures of distance covered, heart rate, perceived exertion, percent of days participated, and fitness level were also collected. Although percent of time spent jogging was low (18%), with no significant gains made in cardiovascular fitness, the amount of time spent jogging, the distance covered, and fitness level were all significantly correlated ($r > .48$, $p < .05$). A LISREL VI computer program was used to test four structural equation models representing extensions of the Fishbein Behavioral -Intention Model. Two models (1 & 3) included both direct and indirect pathways from attitude, subjective norm, and background to exercise behavior while Models 2 & 4 contained only indirect paths, mediated by intention. Model 4, in support of the Fishbein and Ajzen theory, showed the prediction of exercise behavior by attitude and subjective norm to be significantly mediated by intention. Although only approaching significance, subjective norm was found to be the stronger predictor of intention over attitude. Background variables were found to indirectly influence intention through their significant influence on attitude and subjective norm. Although not significant, but in agreement with other research findings, Model 3 indicates the direct structural relation between attitude and exercise behavior to be slightly stronger than the
direct structural relation with intention. For this sample of 9th and 10th graders, significant others, particularly peers and teachers, had a stronger impact on behavior than personal attitudes about activity.
Introduction

Research on teaching has primarily focused on teacher behavior and its effect on student achievement. Classroom research of the 1960's and early 1970's produced data indicating that certain teacher behaviors were consistently linked with student achievement gain (Brophy & Good, 1986). With the development of Academic Learning Time (ALT) and systematic observation, a shift in emphasis occurred from teacher effects to investigations of student behaviors and processes. Of the time actually spent engaged in academic activities student engagement was theorized as the crucial variable underlying the success of teaching (see Fischer et al., 1981, for a review). Engagement rates depend in part on a teacher's ability to organize and manage a class for smooth transitions and an efficient learning environment. Eventually classroom researchers extended the meaningfulness of the time measure by emphasizing the critical role of student background, perceptions, motivations, expectations, beliefs, and attitudes in student learning (Wittrock, 1986).

Following a long tradition of observational research in classroom settings, physical educators have in the last 10 years produced a considerable number of studies describing student engagement patterns in physical education (Aufderheide, Olson, & Templin, 1981; Costello & Laubach, 1978; Godbout, Burnelle, & Tousignant, 1983; Metzler, 1980; Placek, Silverman, Shute, Dodds, & Rife, 1982; Silverman, Dodds, Placek, Shute, & Rife, 1984). Noteworthy approaches to the study of relations between engagement and achievement are also ongoing in physical education (Dugas, 1984; McEwen & Graham, 1982; Pieron, 1982; Silverman,
1985), even though findings are somewhat inconsistent. The effort to correlate student process behaviors and achievement in physical education has been diverse with few replications. Thus, research-based conclusions about variables related to maximum psychomotor achievement are difficult to formulate.

With one notable exception (Silverman, 1985), physical education researchers have not studied student characteristics which may mediate engagement and, eventually, achievement in physical education. During the brief history of research on teaching in physical education the primary focus has been direct observation of students performing a movement or sport skill over short periods of time. The investigations, for the most part, have not studied the effects of vigorous exercise on adolescents in a school setting, even though physical fitness development of students has been a primary objective. As a result of the reported benefits of Corbin and Laurie's *Fitness for Life* classes with college students, the American Academy of Physical Education (1983) recommended the incorporation of this type of class into all elementary and secondary physical education programs. Some researchers have used heart rate monitors and observational techniques showing that the activity patterns of elementary school-aged children fall short of the intensity levels necessary to result in gains in cardiovascular fitness. However, these investigations occurred during periods of recess and recreation (Cumming, 1975; Gilliam, Freedson, Geenan, & Shahararay, 1981; Hovell, Bursick, Sharkey, & McClure, 1978). Other studies investigating changes in fitness levels of children within the class setting have done so in regard to comparisons of different teaching methodologies (Donath, 1977; Luebke, 1977; Masson Dailey, 1984) with only a few using actual
behavioral observation coding systems (Crowley, 1981; Lydon, 1978). Further, researchers, teachers, educators, and practitioners have a limited understanding of the critical role that student background, motivation, and attitude play in influencing student participation in a fitness class.

On the other hand, physical activity and the determinants of exercise for fitness have been studied extensively by exercise physiologists and sport psychologists. It is quite clear that regular exercise has important health effects (see Blair, Kohl, & Powell, 1986, for a review). The positive benefits of a regular exercise program are not always fully manifested because of the seemingly large number of Americans who do not participate regularly. In an effort to understand what motivates an individual to become more active, sport psychologists have studied the determinants of regular exercise (see Dishman, Sallis, & Orenstein, 1985, for a review). Recent publications in the exercise adherence literature suggest that attitudes, beliefs, background, and certain other participant characteristics may exert an influence on exercise involvement of adults during their leisure time (Dishman & Gettman, 1980; Godin, Valois, Shephard, & Desharnais, in press; Morgan, 1977; Sonstroem & Kampper, 1980).

By borrowing from research findings on exercise involvement, and drawing from what has been learned thus far from the pedagogy research, it might be possible to identify some determinants of vigorous activity patterns of high school students in a physical education class. Characteristics of the students and their background, attitudes, and knowledge may determine the amount of effort a student exerts and the seriousness of the effort. At least one research study (Godin &
Shephard, 1986) has identified psychosocial factors which influence the intention of junior high students to engage in vigorous physical activity or exercise. Past exercise experience was found to influence current exercise habits and attitude contributed significantly to intention to exercise. Although data were collected from junior high school students during a physical education class, self-report measures of activity patterns in their leisure time was used rather than activity patterns exhibited within the class itself. However, it would stand to reason that young students who engage in vigorous physical activity in their free time would also be more apt to participate in such activities within the organization of a physical education class. A significant contribution to both research on teaching and exercise behavior could be made by extending this line of inquiry in a natural setting (gymnasium and/or playing fields) to get an actual and more specific measure of student engaged time in a particular activity.

Theoretical Basis

The theoretical basis for the Godin and Shephard study of junior high students was the Fishbein Behavioral-Intention Model (Fishbein & Ajzen, 1975). Fishbein and Ajzen proposed a comprehensive theory providing a sound conceptual framework for relating beliefs, attitudes, intention, and behaviors. According to the theory intent to adopt a particular behavior is influenced by the individual's attitude toward performing the behavior along with perceptions of the social constraints placed upon that behavior. This basic model can be symbolically represented as:

\[ B \sim I = (A_{act})_{w_1} + (SN)_{w_2} \]
where \( B \) is the behavior, \( I \) is the behavioral intention, \( A_{act} \) is the attitude toward the behavior, and \( SN \) (subjective norm) is the personal perception of expectations of "significant others" regarding the performance of the behavior. The \( w_1 \) and \( w_2 \) are empirical weights denoting the relative importance of \( A_{act} \) and \( SN \). In the model, attitude is shown to be specifically influenced by the perceived consequences of the behavior in addition to the evaluation of these consequences. This can be represented as:

\[
A_{act} = \sum_{i=1}^{n} b_i \cdot e_i
\]

where \( b_i \) is the belief that a given behavior will result in a given outcome; \( e_i \) is the individual's evaluation of that outcome; and \( n \) is the total number of salient beliefs and evaluations held about the behavioral outcome. As used by this measurement model, each belief is multiplied by its corresponding evaluation, with the sum total giving a single measure of attitude toward the behavior. Similarly, perception of social constraints or, as labeled, subjective norm, is a function of normative beliefs about the behavior and motivation to comply with social expectations as represented by:

\[
SN = \sum_{i=1}^{n} NB_i \cdot MC_i
\]

In this equation \( NB_i \) is the perceived belief of the significant other; \( MC_i \) is the motivation to comply with this referent; and \( n \) is the number of relevant referents. As with attitude, each \( NB_i \) and corresponding \( MC_i \) are multiplied and then summed to give a total representing the influence of significant others. These factors are believed to predict intention to perform the behavior rather than the behavior itself. Thus, behavior in this framework, is mediated by intention. The Fishbein Model has also been successfully used with adults where
Intention has been found to be a strong predictor of subsequent exercise behavior (Bentler & Speckart, 1981; Godin et al., in press; Riddle, 1980; Valois, Desharnais, & Godin, 1984). Although a fairly comprehensive model, additional research has examined the role of other external factors on intention and behavior (Bentler & Speckart, 1979; Godin et al., in press; Godin & Shephard, 1986; Triandis, 1971, 1977; Valois et al., 1984). Past behavior or habit was found to be the most common external variable and exerted a significant influence on intention to exercise and subsequent exercise behavior. However, contrary to the Behavioral-Intention Model, Bentler and Speckart (1979) also found such variables to directly effect behavior without mediation by intention.

For continued participation in fitness activities throughout adult life, educators must be made aware of the mediating factors that influence participation at an earlier age. By understanding factors that affect student participation and thus achievement, educators may be able to have an impact on the maintenance of an active adult lifestyle. The present study investigates activity behavior by extending the Fishbein Model (1975) and incorporating some of the external mediating variables examined by Bentler and Speckart (1979) and Godin and Shephard (1986). In addition, individual activity patterns (rather than self-reports) along with measures of exercise intensity and fitness were used as indices of exercise behavior. A questionnaire developed by Godin (1983) and later revised for use with school-aged children (Godin & Shephard, 1986) was used to evaluate the Fishbein Model variables along with background variables of past activity, perception of parental activity levels, and knowledge about physical fitness.
The purposes of this study were: (a) to describe the activity patterns of students in a high school fitness class, and (b) to explore the structural relations between particular student characteristics and their coded exercise behavior in a required physical education class. Attitudes about the behavior, subjective norms, and specific background characteristics were examined as both indirect and direct influences on exercise behavior. As proposed by Fishbein and Ajzen (1975), the indirect influences of attitude and subjective norms, as mediated by intention, were examined. In keeping with the research findings of Bentler and Speckhart (1979) and Godin and Shephard (1986), additional external variables (background characteristics) were included in the proposed model. Since Bentler and Speckart also found the effects of attitude and previous behavior not to be mediated by intention, direct paths were also examined in this analysis.

Method

Subjects

The subjects for this study were students from 10 intact classes in three suburban public high schools. The schools were similar in size and racial balance. The 10 teachers (six males and four females) were certified physical education teachers ranging in age from 34 to 49 years. The teachers volunteered to teach a physical fitness unit to one ninth/tenth grade for a period of 8 weeks. This unit included the basic fitness concepts and participation in a jogging program. Initially a total of 230 students (M age = 14.7 years, SD = .96) began the fitness unit after signing informed consents and providing parental consent. Due to schedule changes, suspensions, and incomplete data from excessive absences, a total of 206 students, 119 males and 87 females completed
the study. Six students were randomly selected from each class \((n = 60)\) for systematic observation and behavior coding. Due to one suspension at mid-semester, a total of 59 students (30 males, 29 females) were coded over the 8 weeks. One student from each class was also randomly selected to take the Astrand-Astrand Cycle Ergometer pre-and posttest (Astrand & Rodahl, 1977) as a representative indicator of physical fitness attainment. Although all students were made aware that the researcher would be observing them participate at least once a week, the coded students selected were kept anonymous.

**Instrumentation and Materials**

**Knowledge Test.** A 20 question multiple choice test covering knowledge of general fitness concepts was compiled from a previously validated test in Corbin and Lindsey's (1983) fitness text. A test/retest on a sample population \((n = 30)\) of the same age exhibited a reliability coefficient of .88. Using a KR-20 analysis, questions for this exam fell within a difficulty range of .3 to .7 and discrimination range of .2 to .8.

**Questionnaire.** Items were obtained from a previously validated questionnaire (Godin, 1983) and one used by Godin and Shephard (1986) with 7th to 9th grade students. The questionnaire was constructed, with slight adaptation, to measure variables from the Fishbein Behavioral Intention Model (Fishbein & Ajzen, 1975) in addition to several external variables. The first variable, intention \((\text{Int})\), was measured on a likely-unlikely scale by answering the question: "At the present time, I intend to do active sports or vigorous activities a few times a week." Attitude-towards-the-activity \((\text{Aact})\) was assessed by summing scores from three semantic differential questions which used the end points of
good-bad, exciting-boring, and fun-unpleasant. Six behavioral beliefs (b) and their corresponding evaluations (e) of their consequences were multiplied and the products were summed to give a second composite measure of attitude (Attcomp). The belief statements required subjects to rate agreement with the proposition: "I think that doing active sports or vigorous physical activities a few times a week, would help me to be physically fit". The corresponding e statement evaluated "help me to be physically fit" on a good-bad scale. A single subjective norm (SN) rating was measured by rating the proposition: "I think that doing active sports or vigorous physical activities a few times a week, is something that people who are most important to me believe I should do". Three normative beliefs (NB) were assessed using similar wording. Corresponding motivation to comply (MC) statements were assessed by propositions such as: "I would like to do active sports or vigorous activities the way (my friends) think I should". Each NB and corresponding MC measure were multiplied and then summed ($\sum_{j} NB_j \times MC_j$) to give a second subjective norm composite measure (SNcomp). A five-point scale (+2 to -2) was used as the scoring method.

Information was also obtained regarding past activity level by asking if vigorous activity were engaged in less than once a week, 1-2 times a week, or more than 3 times a week. For the perceived parental activity level subjects were asked to evaluate the proposition: "I think that my father (mother) does vigorous physical activity during his (her) free time", on a five-point scale (+2 to -2). Information such as age, grade, sex, and race were also obtained from the questionnaire. A test/retest on a sample population (n = 30) of the same age group
yielded reliability coefficients for the various items ranging from .70 to .90.

**Fitness Tests.** In order to determine if gains in cardiovascular fitness were made an Astrand-Astrand Cycle Ergometer Test was administered to a target student in each class (Astrand & Rodahl, 1977). A 12-min run/walk test was also used to determine individual cardiovascular fitness levels of all participants (Cooper, 1977).

**Daily Logs.** Student were requested to keep daily logs regarding their intensity of activity during the fitness unit. Forms were given out and collected weekly which asked for the two heart rates that were taken during and at the conclusion of each jogging session. A rating scale of perceived exertion (RPE) was also provided to allow the subjects to circle a numerical value corresponding to how hard they thought they worked during that exercise period. Borg's (1967) scale of very, very light (6) to very, very hard (20) was used. This scale has been found to be both valid and reliable in assessing work intensity with correlations with actual heart rate ranging from .42 to .94 (Robertson, 1982). Since this study was also concerned with student attitudes as a mediating characteristic, absenteeism or nonparticipation was considered to be a reflection of a particular characteristic(s) or attitude. Therefore, space was also provided for recording information as to why the subject may not have participated on a particular day. From the log, a score which represented the percentage of time the student actually dressed out and participated in the class over the 8 weeks was calculated for each student.
Procedures

The physical education teachers were asked to teach a jogging unit which included the presentation of fitness concepts, followed by at least 20 min of jogging, 5 days a week for 8 weeks. Each of the teachers taught one of their regularly scheduled required physical education classes.

Teacher Orientation. Teachers were given an Experimental Teaching Unit (ETU) which included the benefits of cardiovascular fitness and information related to target heart rates, and related major factors such as intensity, duration, and frequency of exercise. At least one week before the study the experimenter scheduled a training session to thoroughly familiarize the teachers at each school with the procedures for the unit. Included were detailed directions for teaching a fitness unit and monitoring heart rate during exercise. Information was provided as to the type of questionnaire, fitness knowledge, and physical fitness tests that would be administered to their class.

Student orientation and testing. During the week prior to the start of the fitness unit students were given a brief introduction to the study and to basic physical fitness concepts. They were instructed in monitoring their heart rate and in recording these values and their perceived exertion ratings in a daily log. At this time the initial Astrand-Astrand Cycle Ergometer Test was administered twice to the target student on 2 consecutive days to account for testing effect.

Instructional sequence. Each day, after a brief warm-up, the class was encouraged to jog on a premarked 200 or 400 m field at each school. At approximately 10 min into the session teachers signaled for and timed student pulse counts. At the end of the session a second pulse count
was also taken after which students recorded both heart rates and their perceived exertion rating in their daily logs. At the end of the 8 weeks the Astrand-Astrand Cycle Ergometer Posttest was administered to the same target students. On a separate day the entire class was administered a 12 min run/walk test.

**Behavior coding.** Coding of four behavior categories occurred in 30 s rotational intervals for the 20 min activity period totaling approximately 3 min per subject. A 30 s continuous interval was considered to satisfactorily sample the beginning, middle, and end of the period for each student. All six students were coded on a randomly selected day, once a week for the 8 week period, totaling approximately 24 min of coded behavior for each subject. As an additional indicator of intensity of participation, the jogging area was marked off in 10 m intervals to allow recording of distances covered during the coding period. These distances were simultaneously recorded during each 30 s coding interval using pencil and paper. In addition, random interviews were conducted with those students (coded and noncoded) who chose not to participate or to walk the entire time of the activity session. Students were asked to recall why they were engaged or not engaged in the appropriate activity during the allotted activity session.

Due to the nature of the activity (jogging), requiring a large area, student behavior was coded live. A Datamyte was used allowing for both duration and event coding. The focus of this study was on student activity patterns, particularly motor engagement time. A specific coding system was devised categorizing student actions into the following exclusive, non-overlapping categories:
1. Jogging in the designated area;
2. Walking in the designated area;
3. On-Task - warming-up, cooling-down, taking pulse, recording in log, or receiving information from the teacher;
4. Off-Task - any non-content specific behavior.

All coding was performed by a single coder. An Interobserver Agreement (IOA) (Safrit, 1981) was established by simultaneous coding with a second trained coder with reliability estimates ranging from .97 to .99 for each individual behavior category. Reliability was also determined in the same manner throughout the 8 weeks for 10% of the total coding sessions. These sessions were randomly assigned throughout the fitness unit at the three different schools and yielded reliability coefficients ranging from .96 to .99 for each of the individual behavior categories. Intracoder reliabilities of .97 to .99 were also established by using a videotaped portion of a similar jogging class.

Data Analysis

Means and standard deviations were calculated for all observed variables. Correlated t-tests were used to examine changes in fitness level while Pearson r was used to formulate a correlation matrix to examine relations between the observed variables and for a subsequent LISREL analysis.

The LISREL VI (Joreskog & Sorbom, 1983) computer program was used to develop a structural equation model enabling the testing of relations between selected variables. Those unobserved variables to be explained by the model are termed as latent endogenous variables while those that are determined outside the model are termed latent exogenous variables. The measurement model specifies how the conceptual or latent variables
are measured in terms of the observed variables while the structural model indicates interrelation among these latent variables. Generally, the measurement models for the observed dependent and independent variables are represented as follows:

\[ Y = \Lambda_y \eta + \varepsilon, \]
\[ X = \Lambda_x \xi + \delta. \]

In the first equation \( Y \) is a vector of observed dependent variables that are linked by a matrix of factor loadings of \( Y \)'s (\( \Lambda_y \)) on a vector of common factors, \( \eta \) (latent endogenous variables). Likewise, the observed \( X \)-variables are linked to a vector of common factors, \( \xi \) (latent exogenous variables) by the loading matrix of \( X \)'s (\( \Lambda_x \)). Measurement error or unique factors are represented in these measurement models by epsilon (\( \varepsilon \)) and delta (\( \delta \)), respectively. The specific factor loadings of observed variables on latent variables are represented by lambda (\( \Lambda \)) in the development of structural equation models.

The following general structural equation model specifies the causal relations among latent variables:

\[ \eta = \beta \eta + \Gamma \xi + \zeta, \]

where \( \eta \) is a vector of observed dependent variables; \( \beta \) represents a matrix of the relations between latent endogenous variables; \( \Gamma \) (also symbolized as \( \Gamma \) in specific equations) represents the relations between the latent exogenous (\( \xi \)) and latent endogenous variables (\( \eta \)); and zeta, \( \zeta \), represents the equation error for each structural equation. In addition, the structural equation model also includes covariance between latent exogenous variables as represented by phi (\( \Phi \)), along with a covariance matrix for zeta, psi (\( \Psi \)); a covariance matrix for epsilon, (\( \Theta_\varepsilon \)); and a covariance matrix for delta (\( \Theta_\delta \)).
The proposed structural model was adapted from Fishbein's Behavioral-Intention Model as modified by Godin and Shephard (1986b). From this analysis four alternative models were sequentially developed in an effort to maximally and accurately explain the data.

Initially, the correlation matrix of all measured variables was entered into the LISREL VI computer program yielding maximum likelihood (ML) parameter estimates for the specified model. By adding or removing parameters, in an effort to maximize the fit of the data, several hierarchical models were generated and thus compared on the basis of chi square tests and t-values (p < .05, for each parameter estimated). One best measurement model for the four competing structural models was retained for comparison.

Results

Two cycle ergometer pretests were administered to counteract testing effect. A correlated t-test indicated there to be no significant differences between these two sets of scores, t(9) = 1.32, p > .05. The same analysis on the pre- and posttest indicated that there were no significant gains made in cardiovascular fitness from participation in this 8 week fitness unit, t(8) = 1.96, p > .05. By plotting the means of walking and jogging the activity patterns were shown to be fairly consistent over the 8 weeks (see Figure 1). Therefore, all subsequent analyses used a mean collapsed over time. In addition, an analysis of variance showed there to be no significant differences between the schools for these same behaviors, F(2,58) < 1.43, p > .05.

Insert Figure 1 about here
For the four coded behaviors mean percentage times were calculated showing the average time spent jogging to be 18%; walking, 69%; on-task, 7%; off-task, 6%. Average distance covered during coded time was 240 m. Heart rate was coded as being at an appropriate target level for gains in cardiovascular fitness (150+ bpm) or inappropriate level (< 150 bpm) for this age group. The mean percentage of time spent at target heart rate was 26%, $SD = 21$. Mean reported perceived exertion ratings equaled 11.1, $SD = 2.63$ (fairly light). In support of previous research findings, a Pearson r analysis indicated ratings of perceived exertion to be significantly correlated with heart rate, $r = .53, p < .0001$. Mean distance covered in the 12-min run/walk was .99 mi, $SD = .21$, indicating an overall fitness level in the very poor category for males and females (Cooper, 1977). However, those subjects who spent more time jogging covered more distance ($r = .86, p < .0001$). The time spent jogging was also related to the 12-min run/walk fitness posttest ($r = .50, p < .001$) and the distance covered ($r = .48, p < .001$). On the average, students participated 77% of the total days in the unit. Knowledge of fitness was found to be low with a mean score of 11.39 correct out of 20 (57%). Ranges for all behavioral variables are given in Table 1.

Insert Table 1 about here

The following LISREL VI results are reported by model. Models 1 and 3 include both direct and indirect paths to exercise behavior while Models 2 and 4 evaluate only indirect pathways. Models 3 and 4, however,
differ in structure in that background, mediated by attitude and subjective norm, indirectly influence intention to exercise.

**Model 1**

Figure 2 represents the originally proposed modified Fishbein Behavior-Intention Model (Godin & Shephard, 1986) with the addition of three direct pathways to exercise behavior. The latent variable labels for this structural model are as follows: (a) intention ($\eta_1$), (b) exercise behavior ($\eta_2$), (c) attitude ($\xi_1$), (d) subjective norm ($\xi_2$), and (e) background ($\xi_3$). The observed variable labels consist of: (a) jogging ($Y_1$), (b) fitness score ($Y_2$), (c) percent participation ($Y_3$), (d) heart rate ($Y_4$), (e) perceived exertion ($Y_5$), (f) a measure of intention ($Y_6$), (g) two measures of attitude, Aact ($X_1$) and Attcomp ($X_2$); (h) two measures of subjective norm, SN ($X_3$) and SNcomp ($X_4$); and (1) four measures of background, past activity ($X_5$), perceived father's activity level ($X_6$), perceived mother's activity level ($X_7$), and knowledge of fitness ($X_8$). The observed variables and their corresponding latent variables are shown in Table 2.

The overall goodness-of-fit for this model is exhibited by a Goodness-of-Fit Index (GFI) of .901, $\chi^2(66) = 161.05$, $p < .001$. Although the measurement model was satisfactory as indicated by the significant factor loadings of the observed variables on their particular factors (e.g., fitness loading = .392, SE = .15, $p < .05$, Table 3), intention was not shown to significantly predict exercise behavior (see Table 4). Contrary to the proposed Behavioral-Intention
Theory, the relation was negative as indicated by a structure coefficient of $-0.163$, $SE = 0.17$. In addition, none of the latent exogenous variables predicted intention or exercise behavior directly (see Table 4). For example, the structure coefficient for attitude $\rightarrow$ intention is $-2.86$, $SE = 1.5$, and for background $\rightarrow$ exercise behavior, $0.290$, $SE = 0.24$. It was therefore considered that inclusion of both direct and indirect pathways possibly weakened or detracted from each other in this particular model. The following second model was thus examined.

Model 2

As shown in Figure 3, this structural equation model is similar to that for Model 1 except for the deletion of the direct pathways leading from the latent exogenous variables attitude ($\xi_1$), subjective norm ($\xi_2$), and background ($\xi_3$) to the second latent endogenous variable exercise behavior ($\eta_2$). The GFI remained almost the same, $0.896$, $\chi^2(69) = 171.80$, $p < 0.001$. While none of the structure coefficients were significant, the intention-exercise behavior relation did become positive (see Table 4). The loadings on the background latent variable ($x_6 = -0.346$, $x_7 = 0.408$, $x_8 = -0.110$) were low (see Table 3) with high modification indices with the latent exogenous variables, attitude and subjective norm, indicating model misspecification. In addition, the structure coefficient for $\nu_{13}$ (background $\rightarrow$ intention) was still negative (see Table 4), thus, indicating a stronger relation outside the structure of this model. Therefore, Models 3 and 4 were developed
allowing the background variables to influence the two latent exogenous variables, attitude and intention.

___________________________
Insert Figure 3 about here
___________________________

Model 3

In an effort to retain the original concept of direct and indirect pathways to exercise behavior but also consider the effect of the background variables, alternative Model 3 was constructed (see Figure 4). The rearrangement of variables for this model resulted in four latent endogenous variables: Attitude ($\eta_1$), subjective norm ($\eta_2$), intention ($\eta_3$), and exercise behavior ($\eta_4$). Background became the only latent exogenous variable ($\xi_1$) influencing only two latent endogenous variables ($\eta_1$, $\eta_2$). The observed dependent variables increased to 10 by adding two measures of attitude ($Y_7$ and $Y_8$), and two measures of subjective norm ($Y_9$ and $Y_{10}$) while the observed independent variables decreased to four, past activity ($X_1$), father's and mother's activity ($X_2$ and $X_3$, respectively), and knowledge test ($X_4$).

___________________________
Insert Figure 4 about here
___________________________

The overall goodness-of-fit was only slightly improved, GFI = .903, $\chi^2 (68) = 163.70$, $p < .001$, with the relation between intention and exercise behavior strengthened somewhat, but not significant from previous models using a one-tailed $t$-test, $p = .10$. Negative factor loadings of observed independent variables from previous models ($X_2$, $X_4$) were replaced by positive values. As indicated by Table 3, direct paths
from attitude ($\beta_{41}$) and subjective norm ($\beta_{42}$) to exercise behavior were still nonsignificant with the latter one being negative ($-0.810$). The indirect paths through intention have also remained weak. Again, a combination of direct and indirect pathways still appears to detract from the strength of the model, thus leading to the final and most appropriate structural equation model, Model 4.

Model 4

Figure 5 illustrates the final and most significant structural equation model, similar to the one proposed by Godin and Shephard (1986) in their analysis of exercise behavior of junior high school students. In contrast to Model 3, all proposed influences on exercise behavior are indirect, mediated by intention.

The GFI of 0.908 is relatively good and close to those of the previous alternative models in this study, $\chi^2(70) = 152.56$, $p < 0.001$. Shown in Table 3, all observed dependent variables are significant measures of their corresponding latent endogenous variables ($p < 0.005$). Although slightly weaker measures, the observed independent variables for background are significant at least at the .10 level (e.g., loading of moth variable = .430, SE = .20, $p < .05$). The factor loading for past activity level, although set at 1.0, is relatively larger than the other observed independent variables. For instance, if this observed variable had been weaker the other observed variable factor loadings would have been greater than 1.0.
Structure coefficients indicate that background directly and significantly predicts attitude ($p < .001$) and subjective norm ($p < .01$) (see Table 4). It is also interesting to note that the background variables have a substantially greater influence on attitude ($2.512, p < .005$) than on subjective norm ($0.775, p < .005$). However, structure coefficients indicate subjective norm to be a stronger predictor of intention than attitude, with subjective norm approaching significance. Most important is the increased strength in the prediction of exercise behavior by intention (structure coefficient = $0.141$, $SE = 0.14$, $p < .025$), thus supporting the Fishbein and Ajzen Behavioral-Intention Theory.

Discussion

A major purpose of this study was to identify some of the processes and goals underlying the exercise behavior of high school students in a required physical education class. Instead of relying on self-reports and recall, actual behavior patterns along with fitness levels were recorded. However, recall was used for past activity level and perceived parental activity level. Although walking was favored over jogging, it is important to note that on-task (mainly managerial) and off-task were very low indicating 87% of class time was spent in activity. This would also coincide with the 77% average participation rate for all students over the 8 week fitness unit. It is well supported in the literature that for gains to be made in cardiovascular fitness participants must be engaged in vigorous activity for a minimum of 20 min. Therefore, it is not surprising that the results of the cycle ergometer test were nonsignificant considering the low percentage rate of jogging. Also, considering interferences such as weather, exam
week, homecoming events, an 8-week jogging unit in a school setting may not be long enough for gains to be made in cardiovascular fitness. Combining this information with the direct weekly observation of the class, it was apparent that the majority of teachers were more concerned with the students participating and being on task than with students maintaining a target heart rate. Although the teachers were knowledgable about the importance of cardiovascular fitness and required intensity necessary for gains, this was not consistently conveyed or encouraged. In observing the rapport between the teachers and the students there appeared to be, in some cases, the understanding that as long as the student seemingly participated and did not cause problems they were left alone (i.e., not sent to the office). Thus, as the fitness test and knowledge test indicated, this sample is generally in very poor cardiovascular condition with less than average knowledge about general fitness concepts.

Using the theoretical model of Fishbein, the exercise behavior of this sample was significantly mediated by intention, which is consistent with the hypothesis of Fishbein and Ajzen (1975). Also of major importance in this study was the inclusion of background variables as either direct or indirect influences on exercise behavior. After investigating four different theoretical models, background characteristics were found to have their strongest effect when allowed to influence attitude and subjective norm directly and exercise behavior indirectly (Models 3 and 4). These findings support previous studies with adults (Bagozzi, 1981; Bentler & Speckart, 1979; Godin et al., in press) and are in partial agreement with the one study using students from Grades 7 to 9 (Godin & Shephard, 1986). For example, in the
present study the direct influence of background variables on exercise behavior (Model 1) was reflected by a low structure coefficient of .290, \( (SE = .24) \), with the structure coefficient for the direct influence of attitude on intention to be \(-.268 \) \( (SE = 1.15) \). In Model 4 the indirect influence of background on intention through attitude and subjective norm, improved the prediction of intention by attitude \(.071 \) \( (SE = .37) \) and subjective norm \(1.607, \ SE = .87\). In contrast, Bentler and Speckart (1979) reported a stronger direct influence of the external variable, past behavior, on present exercise behavior, \(.36, \ SE = 5.25\). They also reported the influence of attitude on exercise behavior to be direct and not mediated by intention. Model 3 in the present study shows a similar tendency with attitude exhibiting a slightly stronger influence on exercise behavior \(.256, \ SE = .31, \ NS\) than on intention \(.130, \ SE = .42, \ NS\).

Although differences in data analysis techniques make comparisons of findings between the Godin and Shephard study and the present investigation difficult, there are several similarities. In the Godin and Shephard study, prior experience, attitude, and current physical activity contributed significantly to explaining the variance in exercise intention. Though these researchers did not measure exercise behavior, a theoretical model was designed which linked intention to behavior. With specific reference to parental influences, Godin and Shephard found father's activity level to be positively associated with student attitude while the present study indicated mother's activity level to be the stronger observed independent variable.

In opposition to the findings of both Godin and Shephard (1986) and Godin et al. (in press), subjective norm was found to be a stronger
influence on intention than attitude in Models 3 and 4 with this sample. For example, the beta weights for attitude and subjective norm in the Godin & Shephard analysis were .531 and .150, respectively, with subjective norm being deleted. In the present analysis the structure coefficient ($\beta_{31}$) for attitude $\rightarrow$ intention was .071, $SE = .37$, while 1.607, $SE = .87$, was calculated for subjective norm ($\beta_{32}$).

Fishbein and Ajzen (1975) offer some explanation suggesting that the relative weighting of attitude and subjective norm vary with type of behavior, the context in which the behavior is performed, and the characteristics of the individuals involved. Investigated behaviors have varied from smoking, alcohol/drug abuse or rehabilitation to exercise behavior. Participation may be required or voluntary. Specifically with exercise behavior, research studies have been done with adults participating in voluntary programs giving self-reports of past and current activity patterns. With these sample populations attitude was found to be a stronger influence on intention than was subjective norm. In considering the age group studied, teenagers, it seems reasonable that they are more strongly influenced by significant others, particularly their peers, in addition to having negative attitudes toward physical education. Such a notion is supported by several researchers who have found Grade 8 (13-14 years) to be a critical stage in the development of dissatisfaction with physical education programs, and that students entering the 9th grade are more likely to report a variety of annoyances with physical activity programs (e.g., discomforts of exercise, choice of sports, grading; MacIntosh & Albinson, 1982). Such was the case with the present study as revealed by the random student interviews. Complaints ranged from "it's too hot"
or "it's too cold" to run outside to "I don't want to dress-out." Other comments included not wanting to get sweaty or mess up their make-up or hair. There were also preferences voiced for playing basketball or flag football. From weekly observations it also appeared that interest and positive reinforcement from the teachers and small "cliques" of their peers encouraged more active behavior. Likewise, a peer group that didn't dress-out could easily influence a select few toward off-task behavior. These types of negative attitudes and peer influences may have also been reflected in the small amount of time spent jogging.

Even though the teachers in this study provided basic fitness concepts and somewhat encouraged all students to exercise at an appropriate level, the consequences of teaching can be understood only as a function of what stimulates the learner to participate. Thus, one goal of the current research was to provide a model which would explain attitude-behavior relations in a class situation. Model 4 represents the influence of student background characteristics on their attitude and normative beliefs and how these factors are mediated by intention to predict exercise behavior. As indicated, with this age group, significant others seems to be a critical factor indirectly influencing exercise behavior. Much of the participation and involvement of the students appeared to be influenced by the presentation, enthusiasm, and leadership provided by the individual teachers and peers. Possibly the involvement of several students in each class (perhaps in a leadership role) would encourage others to participate. For further research, a richer description of why students choose to participate in vigorous physical activity might be provided by extended interviews over longer periods of time.
References


### Table 1

**Descriptive Statistics for Behavior Variables**

<table>
<thead>
<tr>
<th>Variables</th>
<th>M (SD)</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jogging</td>
<td>18% (14)</td>
<td>0 - 59</td>
</tr>
<tr>
<td>Walking</td>
<td>69% (15)</td>
<td>32 - 94</td>
</tr>
<tr>
<td>On-Task</td>
<td>7% (03)</td>
<td>1 - 17</td>
</tr>
<tr>
<td>Off-Task</td>
<td>6% (06)</td>
<td>0 - 24</td>
</tr>
<tr>
<td>Distance</td>
<td>23.27 m (6.33)</td>
<td>14.60 - 43.43</td>
</tr>
<tr>
<td>Perceived Exertion</td>
<td>11.13 (2.63)</td>
<td>6.00 - 18.14</td>
</tr>
<tr>
<td>Past Activity</td>
<td>1.59 (1.23)</td>
<td>0 - 3</td>
</tr>
<tr>
<td>Percent Participation</td>
<td>77% (.19)</td>
<td>16% - 100%</td>
</tr>
<tr>
<td>12-min run/walk</td>
<td>.99 mi (.31)</td>
<td>.33 - 1.82</td>
</tr>
<tr>
<td>Cycle Ergometer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>pretest</td>
<td>156.33 bpm (6.36)</td>
<td>148 - 172</td>
</tr>
<tr>
<td>posttest</td>
<td>148.00 bpm (9.00)</td>
<td>132 - 164</td>
</tr>
</tbody>
</table>
Table 2

**Observed Variables and Their Corresponding Latent Variables**

<table>
<thead>
<tr>
<th>Observed Variables</th>
<th>Latent Variables</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jogging (Jog)</td>
<td>Exercise Behavior</td>
</tr>
<tr>
<td>Fitness Test Score (Fitness)</td>
<td>Exercise Behavior</td>
</tr>
<tr>
<td>Percent Participation (PcPart)</td>
<td>Exercise Behavior</td>
</tr>
<tr>
<td>Heart Rate (HR)</td>
<td>Exercise Behavior</td>
</tr>
<tr>
<td>Perceived Exertion (PEx)</td>
<td>Exercise Behavior</td>
</tr>
<tr>
<td>Intention (Int)</td>
<td>Intention</td>
</tr>
<tr>
<td>Attitude (Aact)</td>
<td>Attitude</td>
</tr>
<tr>
<td>Attitude Composite (Attcomp)</td>
<td>Attitude</td>
</tr>
<tr>
<td>Subjective Norm (SN)</td>
<td>Subjective Norm</td>
</tr>
<tr>
<td>Subjective Norm Composite (SNcomp)</td>
<td>Subjective Norm</td>
</tr>
<tr>
<td>Past Activity Level (Past)</td>
<td>Background</td>
</tr>
<tr>
<td>Perceived Father's Activity (Fath)</td>
<td>Background</td>
</tr>
<tr>
<td>Perceived Mother's Activity (Moth)</td>
<td>Background</td>
</tr>
<tr>
<td>Knowledge Test Score (Know)</td>
<td>Background</td>
</tr>
</tbody>
</table>
Table 3

Comparison of Factor Loadings and Standard Errors of Observed Variables for Four Behavioral-Intention Models

<table>
<thead>
<tr>
<th>Variable</th>
<th>Model 1 loading (SE)</th>
<th>Model 2 loading (SE)</th>
<th>Model 3 loading (SE)</th>
<th>Model 4 loading (SE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jog</td>
<td>1.000</td>
<td>1.000</td>
<td>1.000</td>
<td>1.000</td>
</tr>
<tr>
<td>Fitness</td>
<td>.392*(.15)</td>
<td>.405***(.15)</td>
<td>.376*(.13)</td>
<td>.450**(13)</td>
</tr>
<tr>
<td>PCPart</td>
<td>.614***(.18)</td>
<td>.631***(.18)</td>
<td>.550(.12)</td>
<td>.597***(.13)</td>
</tr>
<tr>
<td>HR</td>
<td>1.382***(.26)</td>
<td>1.369***(.27)</td>
<td>.302*(.11)</td>
<td>.363***(.12)</td>
</tr>
<tr>
<td>PEx</td>
<td>1.177***(.22)</td>
<td>1.235***(.24)</td>
<td>.268*(.10)</td>
<td>.327***(.11)</td>
</tr>
<tr>
<td>Int</td>
<td>1.000</td>
<td>1.000</td>
<td>1.000</td>
<td>1.000</td>
</tr>
<tr>
<td>Attcomp</td>
<td>1.000</td>
<td>1.000</td>
<td>.702(.11)</td>
<td>.707***(.11)</td>
</tr>
<tr>
<td>Aact</td>
<td>1.532***(.24)</td>
<td>1.509***(.23)</td>
<td>1.000</td>
<td>1.000</td>
</tr>
<tr>
<td>SN</td>
<td>.559***(.15)</td>
<td>.607***(.17)</td>
<td>1.000</td>
<td>1.000</td>
</tr>
<tr>
<td>SNcomp</td>
<td>1.000</td>
<td>1.000</td>
<td>1.610(.43)</td>
<td>1.643***(.45)</td>
</tr>
<tr>
<td>Past</td>
<td>1.000</td>
<td>1.000</td>
<td>1.000</td>
<td>1.000</td>
</tr>
<tr>
<td>Fath</td>
<td>-.505 (.23)</td>
<td>-.346 (.19)</td>
<td>.542*(.22)</td>
<td>.385*(.20)</td>
</tr>
<tr>
<td>Moth</td>
<td>.626* (.29)</td>
<td>.408* (.22)</td>
<td>.469* (.22)</td>
<td>.430* (.20)</td>
</tr>
<tr>
<td>Know</td>
<td>-.123 (.11)</td>
<td>-.110 (.10)</td>
<td>.109 (.20)</td>
<td>.198 (.19)</td>
</tr>
</tbody>
</table>

* p < .05  
** p < .005  
*** p < .0005

Note. Values of 1.000 are arbitrarily set as fixed points for the estimation of the other factor loadings.
Table 4

Comparison of Structure Coefficients of the Latent Variables in Four Behavioral-Intention Models

<table>
<thead>
<tr>
<th>Latent Variables</th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
<th>Model 4</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>SC (SE)</td>
<td>SC (SE)</td>
<td>SC (SE)</td>
<td>SC (SE)</td>
</tr>
<tr>
<td>Att ---&gt; Int</td>
<td>-.268 (1.5)</td>
<td>.040 (.91)</td>
<td>.130 (.42)</td>
<td>.071 (.37)</td>
</tr>
<tr>
<td>SN ---&gt; Int</td>
<td>1.326 (1.5)</td>
<td>1.058 (.91)</td>
<td>1.448 (.93)</td>
<td>1.607 (.87)</td>
</tr>
<tr>
<td>Backgd ---&gt; Int</td>
<td>-.033 (.31)</td>
<td>-.007 (.18)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Att ---&gt; ExBeh</td>
<td>.952 (.93)</td>
<td></td>
<td>.256 (.31)</td>
<td></td>
</tr>
<tr>
<td>SN ---&gt; ExBeh</td>
<td>-.714 (.77)</td>
<td></td>
<td>-.810 (.60)</td>
<td></td>
</tr>
<tr>
<td>Backgd ---&gt; ExBeh</td>
<td>.290 (.24)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Backgd ---&gt; Att</td>
<td></td>
<td></td>
<td>2.174***(.50)</td>
<td>2.512***(.73)</td>
</tr>
<tr>
<td>Backgd ---&gt; SN</td>
<td></td>
<td></td>
<td>.856**(.25)</td>
<td>.775***(.22)</td>
</tr>
<tr>
<td>Int ---&gt; ExBeh</td>
<td>-.163 (.17)</td>
<td>.012 (.04)</td>
<td>.113 (.11)</td>
<td>.141**(.14)</td>
</tr>
</tbody>
</table>

* p < .05
** p < .025
*** p < .005

Note. SC = structure coefficient.
Figure Captions

**Figure 1.** Coded walking and jogging means plotted over an 8-week fitness unit.

**Figure 2.** Structural equation Model 1 used to analyze relations among attitude, subjective norm, background, intentions, and exercise behavior.

**Figure 3.** Structural equation Model 2 used to analyze relations among attitude, subjective norm, background, intentions, and exercise behavior.

**Figure 4.** Structural equation Model 3 used to analyze relations among attitude, subjective norm, background, intentions, and exercise behavior.

**Figure 5.** Structural equation Model 4 used to analyze relations among attitude, subjective norm, background, intentions, and exercise behavior.
Appendix A

Extended Review of the Literature
Research in Exercise Behavior:
A Review

The widespread concern of our society for health and fitness has sparked an equally significant promotion of involvement in physical activity. Along with this fitness boom there has evolved a considerable amount of research investigating influences on exercise behavior. Attempts have been made toward defining theoretical models in an effort to understand both attitude towards and involvement in physical activity. Approaches have been psychological, social, physical, and in many cases a combination of two or more of these areas. The earlier conceptual models of Kenyon (1968), Sonstroem (1978), Dishman (1978), Morgan (1977), Fishbein and Ajzen (1975), and later, Nolan and Feldman (1984) indicated psychosocial variables to play a role in such behavior. Kenyon constructed a multidimensional conceptual model characterizing physical activity with specific regard to the instrumental values as perceived by the individual. Specifically, Kenyon's structural model characterizes physical activity into six univocal and independent subdomains each representing an instrumental value. These include physical activity: (a) as a social experience, (b) for health and fitness, (c) as the pursuit of vertigo, (d) as an aesthetic experience, (e) as catharsis, and (f) as an ascetic experience. As a result, the Kenyon Attitude Toward Physical Activity Inventory (ATPA) was developed to assess these attitudes toward physical activity. Later this scale was revised by Schutz, Smoll, Carre, and Moser (1985) for use with children (CATPA). Both inventories have been widely used by researchers attempting to describe the exercise behavior of a particular population.

Other researchers (e.g., Dishman, Morgan, Sonstroem) have taken more of a psychological approach in designing theoretical models. Sonstroem (1978), for one, developed a two-dimensional model using physical estimation and attraction as key variables in explaining and predicting involvement in physical activity. Originally, Sonstroem (1974) proposed that for initial participation to occur an individual must be attracted to physical activity, plus perceive themselves capable of succeeding (estimation of physical abilities) in that activity. As a result, the Physical Ability Attitude Inventory (PAAI), later named the Physical Estimation and Attraction Scale (PEAS), was developed to evaluate this proposition. Later, Sonstroem (1974) expanded the scale to include statements based on Kenyon's ATPA. From his research Sonstroem (1974, 1976, 1978) developed the presently known psychological model which is cyclical in nature. This model proposes that physical activity produces physical ability which increases one's estimation of ability. With this perceived success, self-esteem is enhanced leading to continued participation and thus, maintenance of physical ability. With this type of structure an individual can enter at any point in the cycle and still meet the theoretical criterion.

Since the PEAS was originally validated with junior and senior high boys, Morgan (1977) revised it for use with adult males and females. Results of the research has been inconsistent probably because of the variation in the type of physical ability measures used—performance based vs. physiological evaluation (Morgan & Vogel, 1976; Sonstroem, 1975; Neale, Sonstroem, & Metz, 1969). As a result, Dishman (1978)
Implied self-motivation to be a confounding factor when using a performance based (skill related) measure of physical ability. He and his colleagues (Dishman, Ickes, & Morgan, 1980) used several physiological variables along with the PEAS in an attempt to predict active participation. Self-motivation was found to be the more powerful predictor with body composition being a significant factor. It was suggested that the PEAS focused on specific skill abilities, rather than more general fitness concepts and may have accounted for its lowered predictive ability in this particular study. In concurrence, Dishman (1982a) did propose initial fitness level to be related to the willingness and the ability of an individual to exercise.

More recently, Noland and Feldman (1984) proposed an Exercise Behavior Model patterned after Becker's (1974) Health Belief Model. It contains four major predispositions influencing readiness to exercise. Previous concepts of attitude and self-concept have been used in combination with values related to exercise and exercise locus of control. In this model, readiness to exercise is also shown to be influenced by two classifications of modifying factors. One category of general factors includes demographic, social, structural (prior experience), and physical variables. The second classification, cues to action, includes health problems, health education, advice from others, exposure to exercisers, and the media. These modifying factors and readiness to exercise are directly related to the likelihood of action (perception of benefits and barriers to action). According to Noland and Feldman's model, it is this last categorization of benefits and barriers to exercise that ultimately influences exercise behavior.
Noland and Felman (1984) applied their exercise behavior model to a population of adult women specifically evaluating attitude, self-concept, values related to health and fitness, and perception of control. For the last variable, Rotter's (1966) locus of control scale was modified to be more exercise related than health related. This was justified by previous research that has indicated specific locus of control scales to be better predictors of a particular behavior (Saltzer, 1970; Wallston, Wallston, Kaplan, & Haides, 1976). From this exercise locus of control scale (EXLOC) a negative correlation was found between exercise behavior and beliefs about the environment (weather), which could be relevant to two different aspects of the theoretical model. The influence of weather was not only an indicator of externality but also a barrier to action, which theoretically, directly influences exercise behavior. Also, in keeping with previous research, this study found a positive relation between attitude toward physical activity and exercise behavior (Harris, 1970; Neale et al., 1969).

Although not a new model, but one that has appeared frequently in current research is Fishbein and Ajzen's Behavioral-Intention Model (1975). In contrast to Kenyon's and Sonstroem's scales that measure attitudes about physical activity in general, Fishbein and Ajzen's original theory states that an individual attitude toward an object doesn't necessarily predict action. Thus, for prediction, specific attitudes toward performing a behavior should be assessed. This particular framework is designed to examine more closely the relation between attitude and behavior through intention. The model itself explains social behavior in terms of individual decision-making by predicting intention rather than behavior. It is postulated that the
Intention to adopt a given behavior is influenced or determined by both personal and social factors. The personal factor, termed as "attitude toward performing the behavior," consists of an individual's evaluation of performing the behavior and belief that the resultant behavioral consequences will occur. The social factor, termed as "subjective norm," refers to the individual's perception of the social pressures by significant others for performing or not performing the behavior along with the motivation to comply with the opinions of these significant others. Both of these components can be measured directly and indirectly, of which the direct measures should have a higher correlation with behavioral intention than the indirect measures (Fishbein & Ajzen, 1975). The direct measures are two single bipolar statements pertaining specifically to the attitude toward performing the behavior and the perception of the role of significant others. The indirect measures are a composite of bipolar statements about beliefs and evaluation of the consequences (attitude), and normative beliefs and motivation to comply (subjective norm). In summary, behavioral intention correlates highly with actual behavior and, attitude and subjective norm are significant predictors of behavioral intention. In addition, these components are highly correlated to the sum of the products of their subcomponents (i.e., beliefs and evaluations; normative beliefs and motivation to comply).

Research, for the most part, has mirrored these theoretical models. However, some of the research has been more of a pragmatic approach exploring concepts and relations with little theoretical basis. Some research has combined variables from these models along with other unique factors broadening the scope of the previous literature, thus,
making categorization of the literature into these specific variable types difficult. The purpose of this review is to explore the research dealing with exercise behavior derived from one or more of these theoretical models organized according to three different age categories: Children and adolescents, young adults, and adults. Research dealing with young adults and adults have dealt primarily with adherence and drop-out behavior while investigations with children have centered around attitudes toward physical activity.

**Children and Adolescents**

Interest in the health benefits of physical activity for this age group has primarily revolved around optimal physical growth and development, psychological well-being, and the development of appropriate skills and habits as a foundation for an active adult lifestyle. Since some degenerative diseases, such as coronary heart disease (CHD), are considered to have their roots in childhood, researchers have examined influences of exercise and physiological factors related to the risks of such diseases. According to a review by Haskell, Montoye, and Orenstein (1985) results have been conflicting with little evidence indicating extremely active children to be any healthier than moderately active children. However, in general, moderate to vigorous activity appears to provide many health-related benefits (Ericksson, 1972). Thus, the fostering of active participation in sports, games, and vigorous leisure-time activities has been encouraged by researchers and physical educators.

The decline in involvement in physical activity that comes with increasing age has been well documented in the literature (McPherson, 1978; Snyder & Spreitzer, 1984; Woods & Birren, 1984). According to
Shephard, Lavalee, and Lariviere (1976) a sedentary lifestyle is already established in many elementary and middle school children, with 11-year-olds watching as much television as 30 hours per week. Associated with inactivity has been the physiological aspect of obesity in both children and adults. Conservative estimates suggest that 30-60% of school-aged children are overweight (Hastad, 1986). In addition it has been speculated that 4 out of 5 will grow into obese adults, and 28 out of 29 teenagers who are obese will become obese adults (Johnson, Burke, & Mayer, 1956). Interestingly enough, research evidence suggests that obese children are not necessarily less active than children of normal weight (Bradfield, Paulos, & Grossman, 1971; Maxfield & Konishl, 1966; Waxman & Stunkard, 1980) even though this decreased activity level does hold true for obese adults. However, Waxman and Stunkard did find obese boys to eat more and faster than nonobese boys indicating increased intake, rather than decreased output, to be a contributing factor in maintaining an obese state. Although these same children were as active at school as their counterparts of normal weight, there was evidence that they were less active at home than their siblings. It has been suggested that parental and societal norms instill negative attitudes toward obesity with more active individuals depicted as being slim and fit. As a result, obese children are more inhibited about engaging in physical activity (Worsley, Coonan, Leitch, & Crawford, 1983). In contrast, studies by Bullen, Reed, and Mayer (1964), Johnson et al. (1956), Mann (1974), and Stefanik, Herald, and Mayer (1959) have shown a relation between activity and obesity indicating physical inactivity to be a major contributor to obesity in children.
According to McPherson (1978), various psychosocial factors may be responsible for this decline in physical activity several of which are related to inadequate socialization and negative attitudes developed during childhood and adolescence. Thus, research investigating factors influencing initial and continued participation in physical activity has been encouraged. Researchers have examined various psychosocial variables, particularly, attitude, self-esteem, perceived ability, locus of control, significant others, and behavioral intention. Neale et al. (1969) encourage physical education programs to promote the reinforcement of positive attitudes toward physical activity along with the development of sport skills and physical fitness. Supporting Sonstroem's theoretical model, these researchers contend that a positive attitude leads to more active participation which increases fitness. The findings of the initial research study with middle school males using the PAAI, Rosenberg's Self-Esteem Scale, AAHPERD youth fitness test battery, and a self-report activity questionnaire tend to support this contention. Although there were no significant differences in self-esteem and participation in voluntary physical activity between high and low fit boys, high fit boys did show higher self-estimation of physical ability and attraction to physical activity. In further examinations of these variables, it appears that the influence of fitness level on participation is indirect, with perceived ability being a stronger predictor (Neale et al., 1969; Snyder & Spreitzer, 1976; Spreitzer & Snyder, 1983). According to Sonstroem (1978), physical fitness influences but does not completely explain perceived ability. In Sonstroem's (1976) validation of his Estimation Scale, the PEAS, Tennessee Self-Concept Scale, and a physical fitness test battery was
administered to junior and senior high school males. The Estimation Scale was found to be related to physical fitness and self-esteem. However, these variables failed to be significantly related in that an individual's feelings of security were shown to be more closely related to their perceived ability than to their actual capabilities.

Later Sonstroem and Kampper (1980) used the PEAS and a locus of control scale to predict athletic participation of middle-school males. Although the PEAS is capable of predicting initial involvement, it is unable to significantly predict continued participation in a sport. Locus of control was also found to be unrelated to the length of time athletes remained on a competitive team.

Research has indicated that the socialization process may indirectly influence exercise behavior by mediating attitude and adherence. Although much of this research has been done with adults using self-reports of past experience in childhood, some studies have examined the role of significant others in children's participation in sports activities (Greendorfer & Lewko, 1978; Snyder & Spreitzer, 1976). The significant others, which include parents, peers, teachers, and/or coaches have been found to be influential factors in youth sport participation. It appears that active children are encouraged by one or both parents, have friends that are also actively involved, and receive support from teachers and especially coaches.

An individual possessing a certain attitude has also been expected to possess a similar behavioral tendency (Sonstroem, 1982). In studying attitude and behavior some researchers has taken the approach of the behavioral intention theory of Ajzen and Fishbein (1975) (Bentler & Speckart, 1979; Godin and Shephard, 1986). This model has been used in
numerous research studies investigating factors related to initial and continued exercise participation of adults. Just recently the research efforts using the Fishbein model have been extended to a younger age group (Godin, 1983). In 1986 Godin and Shephard investigated psychological factors influencing intention to exercise in a junior high school. In addition to the original model's variables (i.e., attitude, beliefs, evaluations, social perceptions, and motivation) several possible external mediators were also considered. These included education, socioeconomic status, prior exercise experience, and parental activity level. In disagreement with the basic Fishbein model, external variables were found to have a direct influence on the subject's intentions. Attitudes and exercise habits contributed significantly to the prediction of exercise intentions. Although mother's intention, father's current physical activity habits, and socioeconomic status were positively associated with the student's intent to exercise, none of the parental variables offered any additional explanation of intention. In general, high intenders had strong beliefs about the consequences of exercise and made a positive evaluation of beneficial consequences while low intenders held more neutral beliefs about the consequences and were less convinced about the benefits. Thus, the authors also support the promotion of early life experiences in physical activity to further encourage continued participation throughout adulthood.

**Young Adults**

Health benefits from physical activity and/or training for young adults has been well researched. According to much of the physical fitness literature, active young adults exhibit more optimal growth and development patterns, tend to be emotionally adjusted, and have better
academic records (Haskell et al., 1986). However, the majority of research conducted with college students has primarily investigated exercise characteristics needed to produce health-related fitness changes, reduced CHD risk factors as well as related psychosocial variables.

Much of the health-related fitness research has used physiological assessments, particularly for aerobic capacity, in examining cardiovascular fitness. In these instances, young males (approximately 20-years-old) have been used most often because they are able to work longer at high intensities with less risk from chronic diseases and confounding variations in hormonal levels. Findings from such investigations support the contention that selected CHD risk factors are lower in more active individuals (Haskell, 1984; Haskell et al., 1986; Leon, Conrad, Hunninghake, & Serfass, 1979). Research conducted by Bain (1985) used females enrolled in a fitness and weight control class, who were evaluated on a psychosocial questionnaire, on percent body fat, and a timed mile run. In support of Dishman's Model of Adherence, she found the more successful students in the class to be leaner, more physically fit, and self-motivated. Although body composition is an important factor to consider in this type of research, most of the studies have been conducted with children and adults. Therefore, discussion of physical characteristics will be limited in this section.

Declining involvement in physically activity with increased age has been documented in a number of descriptive studies (McPherson, 1978, 1984; Snyder & Spreitzer, 1984; Woods & Birren, 1984). As a result investigations in this area have also included psychosocial variables such as attitude, perceived ability, perceived consequences, motivation,
LOC, and goal attainment. The purpose of such investigations has been to gain information to assist individuals in developing interest and skills for active lifestyles as an adult (Haskell et al., 1986). Sonstroem and Walker (1973) examined attitudes toward physical activity and locus of control using the ATPA and the Health LOC scales finding internals with a positive attitude obtained significantly higher fitness scores and reported significantly greater amounts of voluntary physical exercise. Recently, Fox, Corbin, and Coudry (1985) used the PEAS along with a self-report of physical activity, Rosenberg's Self-Esteem Scale, and a composite score from a health-related fitness test battery with college females. Results indicated self-estimation to be an important mediator between fitness and self-esteem and a key factor related to activity patterns.

In a previously mentioned naturalistic study conducted by Bain (1985) it was also found that individuals with varying body composition differed in their goals while enrolled in a fitness and weight control class. Students with acceptable amounts of body fat emphasized fitness goals while the majority of obese females only expected the class to provide structured exercise. Only one of the five obese females expected to lose weight. Moderately overweight students with a positive body image expected the class to be fun and relaxing. However, those with a less positive body image related their goals to weight loss.

Some investigations of attitude and behavior outcomes with this age group used the Fishbein Behavioral-Intention Model (Fishbein & Ajzen, 1975). However, Bentler and Speckhart (1979) found attitude and previous behavior to directly influence subsequent behavior without mediation by intention. Thus, these researchers revised the Fishbein
Model to include a reciprocal relation between previous behavior and subjective norm. In support, Borgida and Campbell (1982) also found personal experience to influence attitude-behavior consistency. More extensive research in this area has been conducted with adults and will be covered more thoroughly in that section.

Perceived gain or as termed in the behavioral-intention model, perceived consequences, has been found to be related to commitment to physical activity. Gruger (1977) found that individuals were more likely to report commitment to an activity if fitness benefits were perceived as possible even though they may not have performed the activity at an adequate level for actual fitness gains. Later, the Perrier Study (Harris, 1978) noted that those individuals who were highly committed to physical activity were also active over longer periods of time, spent more time exercising, and participated in sports to a greater extent. These active individuals also reported greater positive benefits from involvement.

Research with Adults

Both the physiological and psychological benefits of regular exercise, particularly in the prevention of CHD, have been well established. Despite the support in the literature, two-thirds of American adults do not exercise regularly (Harris, 1978), with 45% not exercising at all (National Center for Health Statistics, 1980). Specifically, the Harris (1978) survey on Fitness in America found 90% of the 1,510 subjects polled to believe in the value of regular exercise. However, 45% of this population reported not to exercise regularly. More recently Stephens, Jacobs, and White (1985) reported that only about 20% of the U.S. population exercised at an intensity and
frequency that would elicit beneficial cardiovascular effects. In addition it was reported that at least 40% of the present population may be considered sedentary.

The lack of participation in regular physical activity has been a major concern of researchers with more recent investigations focusing on the high drop-out rate (e.g., Dishman, 1982b; Oldridge, 1984; Steinhart, 1985). Even though 85% of exercisers report that they "feel better" (Morgan, 1981), 50% of those who begin an exercise program usually drop out within 6 mos. (Carmody, Senner, Malinow, & Matarazzo, 1980; Dishman, 1981b; Martin et al., 1984; Wanzel & Danielson, 1977). Exercise adherence research with adults has focused primarily on psychological factors such as attitudes and values, estimation of physical abilities, goals and goal attainment, self-motivation, behavioral commitment, and intention. In some studies these factors have been combined with various psychosocial (e.g., locus of control, significant others, past activity, aspects of the exercise setting) and physical factors (e.g., percent body fat, total body weight, athletic ability, fitness level).

Investigations by Dishman (1982b), Dishman and Gettman (1980), and Sonstroem and Walker (1973) found individuals with positive attitudes toward physical activity accompanied by feelings of responsibility for the behavioral consequences tend to exercise longer and more frequently than individuals with less positive feelings toward the activity and who feel they have less control over behavioral outcomes. In health behavior research investigations found perceived value of general health behavior to significantly influence the occurrence of an individual's health practices (Becker et al., 1977; Larson, Olsen, & Shortell, 1979). However, in exercise behavior research influential factors seem to be
more specific. Such is the case with Laffery and Isenberg (1983) who found perceived importance of physical activity to be more strongly related than health value to leisure activity patterns of middle-aged women. However, other researchers have reported ATPA, health value, and perceived ability to be unrelated to initial involvement in exercise programs (Long & Haney, 1986; McCready & Long, 1985; Steinhart, 1985; Valois, Shephard, & Godin, 1986).

Compliance to positive health behaviors, a major component of the Health Belief Model (Becker, 1974), was revised to include the influence of health motivation termed as the perceived concern of the importance of health factors. The role of self-motivation in medical compliance has been implicated as a possible influence by Baekland and Lundwall (1975), Haynes, Taylor, & Sackett, (1979), and Zax (1962). In exercise behavior research self-motivation, conceptualized as a persistence in habitual behavior regardless of extrinsic reinforcement, has emerged as a more significant factor in predicting exercise behavior than attitude and perceived value (Dishman & Ickes, 1981). As mentioned previously, Dishman (1978) implicated self-motivation as a confounding factor when relating perceived ability to a measure of physical ability. Dishman and Gettman (1980), in a study with adult males enrolled in a cardiovascular and muscle endurance program examined possible psychobiologic influences of self-motivation, attraction and estimation, health locus of control, attitude, plus a measure of percent body fat. Self-motivation and percent body fat were the only two significant factors that discriminated between exercise adherers and drop-outs. However, adherers did score higher on the attraction and estimation scale (PEAS) and on the attitude scale (ATPA), and exhibited more
internal characteristics than nonadherers. Results also indicated that individuals who were self-referred or volunteer participants were more likely to adhere to an exercise program, thus, implying a self-motivated sample. Wankel, Yardley, and Graham (1985) examined the effects of self-motivation along with a decision balance-sheet (listing of anticipated gains and losses) and social support materials finding only the latter two to significantly effect attendance.

A commonly investigated factor closely related to health value has been locus of control. The assumption is that internally controlled individuals will engage in health promoting activities to a greater extent than externally controlled individuals. Earlier investigations used the Health Locus of Control Scale (HLOC) (Wallston, Wallston, Kaplan, & Mardes, 1976) examining both health-related and nonhealth-related behavior (Lynn & Kiker, 1969; Wallston & Walston, 1978). However, the HLOC scale did not provide significant results, particularly when investigating exercise behavior. According to Rotter (1975) LOC scales needed to be constructed specific to the behavior that is being measured. Researchers such as Nolan and Feldman (1984), McCready and Long (1985), and Saltzer (1981) have developed specific locus of control scales. The Noland and Feldman and McCready and Long scales are specifically related to exercise behavior while Saltzer's scale is specific to weight loss (WLOC). Whether using health LOC scales or specific LOC scales, findings have still been inconsistent. Bonds (1980) found internality and self-confidence to be related to a greater number of hours spent in recreational exercise and Saltzer (1981) found WLOC internals with high values placed on physical appearance or health to be more likely to display persistence in
fulfilling their behavioral goals than the external WLOC individuals. There have also been numerous research studies that have found only weak relations between LOC and participation in habitual exercise (Laffery & Isenberg, 1983; Long & Haney, 1985; McCready & Long, 1985; Slenker, Price, Roberts, & Jurs, 1984). However, in agreement with Noland and Feldman's theoretical model, Slenker et al. (1984) did find barriers to action to be the strongest discriminator between joggers and nonexercisers. The Canadian Fitness Survey (1983) found the main perceived reason for inactivity were barriers such as lack of time, lack of willpower, fatigue, and inadequate facilities. More than the barriers themselves, Godin, Shephard, and Colantino (1986) point out the problem of non-participation to be due to lack of self-regulatory skills necessary to overcome barriers to action.

These barriers to action plus weather, distance from the facility, time pressures, organization of the program, and quality of instruction have been categorized as environmental factors. The last two factors, organization and quality instruction, have been found to offer encouragement and reinforcement which positively influences adherence to exercise programs (Martin et al., 1984; Stalonas, Johnson, & Christ, 1978; Wankel, 1984). In addition, investigations by Martin et al. (1984) indicated elicited support for instructor feedback and praise during exercise, flexible goal setting, and social support for improving adherence to exercise programs. Convenience of the facility and time of the program have also been consistent predictors of continued participation in exercise programs (Dishman, in press; Oldridge, 1982; Steinhardt, 1985; Teraslinna et al., 1969).
Other barriers may be linked more closely to the personal physical demands made by an exercise regime itself. Physical demands associated with exercise may be particularly stressful for overweight individuals, and thus contributing to both metabolic and perceptual stress (Mlhevic, 1981). As a result, unrealistic goals are usually set that are most often not met (Danielson & Wankel, 1977). A combination of frustration and discouragement from not reaching set goals, plus the uncomfortable physical stress, greatly enhances the possibility of discontinuance of an exercise program. Interestingly enough, Ingjer and Dahl (1979) found adherers and drop-outs not to differ in aerobic fitness at the outset of a 9-week endurance training period. After 7 weeks adherers had significantly increased in aerobic power and decreased in body weight while the eventual drop-outs, who had complained of discomfort had made no change. Adherers were also found to have a higher percentage of aerobic (Type I) muscles fibers and were able to run at a faster maximal pace than their counterparts. Hence, it was suggested that the drop-outs were less biologically equipped to adapt to and handle the stressful exercise regime. On the other hand, stimulus control and self-reinforcement were reported as being effective in helping overweight males in implementing and maintaining an aerobic exercise program (Keefe & Blumenthal, 1980).

Specific physical factors, particularly percent body fat, combined with psychosocial factors has been shown to improve the prediction of adherence (Dishman & Ickes, 1981; Ward & Morgan, 1984). At least five independent studies have shown percent of body fat to be a fairly consistent discriminator between adherers and drop-outs (Dishman, 1981a, 1981b; Massie & Shephard, 1971; Ward & Morgan, 1984; Young & Ishmail,
1977). Although a self-report study using Montoye's (1975) Leisure Time Physical Activity questionnaire (LTPA), Blair, Jacobs, & Powell, (1981) found leaner individuals to report more vigorous LTPA than their heavier counterparts. It has also been documented that obese adults are less active than individuals of normal weight (Bloom & Eldex, 1967; Brownell & Stunkard, 1980), and less likely to continue in an exercise program (Dishman, Sallis, & Orenstein, 1985).

Past activity experience and habit fall into the psychosocial category of research variables along with childhood socialization into sport activity. Development of an active lifestyle has been shown to be influenced by childhood recreation activities (Sofranko & Nolan, 1972; Yoestring & Burkhead, 1973) and youth participation (Clarke, 1973), parental influence (Spreitzer & Snyder, 1976), and spouse or peer involvement and/or encouragement in physical activity (Roth, 1974). Other researchers have also stressed the importance of early experiences in physical activity with regard to adult exercise behavior (Engstrom, 1979; Harris, 1970; Sofranko & Noland, 1972; Schreyer, Lime, & Williams, 1984; Yoestring & Burkhead, 1973). It has also been found that sport participation in youth seems to be related to adult sport activities but not necessarily adult leisure or fitness activity (Dishman, in press; Loy, McPherson, & Kenyon, 1978; Harris, 1979). Findings by Loy, McPherson, and Kenyon (1978) suggest that middle-aged former college athletes tend to be less active than their nonathletic counterparts. Research by Oldridge (1981), Godin, et al. (in press), and Steinhardt (1985) have also documented the influence of more recent habits upon exercise behavior.
Bagozzi (1981), Godin, Cox, and Shephard (1983), and Valois et al. (1986) also found habit to be a significant predictor of participation in physical activity. Valois, et al. (1986) combined habit and perceived ability in their investigations finding only habit to be a strong predictor of exercise behavior. Other research with supervised programs, have indicated past participation in the program to be the most reliable correlate of current participation (Dishman, 1982; Morgan, 1977; Oldridge, 1982).

Research in the areas of attitude, intention, and behavior has shown past behavior to be an intervening variable when predicting behavioral intention and actual behavior by having a direct impact on current intentions and future behavior (Bentler & Speckhart, 1979; Saltzer, 1981). Bagozzi (1981) found past behavior to reduce the influence of attitude on current behavior after Triandis (1977) proposed past behavior reduces the impact of intention on behavior. Accordingly, it seems that as habit increases, performance of a behavior becomes less of a rational response to its consequences and more of a learned one (Bagozzi, 1981). Both researchers did suggest habit to have a significant influence on both present and future behavior.

Fishbein's Behavioral-Intention Model has been used in numerous research studies investigating factors related to initial and continued exercise participation of adults. The model basically examines the psychosocial factors included in Kenyon's and Sonstroem's attitude scales. However, according to Godin and Shephard (1986), the behavioral and attitudinal dimensions in these scales are examined in a general context yielding inconsistent findings. In addition, habitual activity has not been significantly predicted. The Fishbein model examines
attitude with regard to the "action", the "target", the "context", and the "time" at which the action occurs. The action refers to the specific behavior (exercise) engaged in which is directed toward a specific (jogging) or general (activity) target. Context and time refer to the place and time of day in which the exercise behavior occurs. Results of such research have been a bit more positive. Riddle (1980), for one, showed a high correlation between intention to jog and actual jogging behavior ($r = .82$) with behavioral intention being predicted by both attitudinal and normative components ($R^2 = .551$). Such results have been further supported by Bagozzi (1981), Bentler and Speckhart (1981), and Godin et al., (in press).

Other mediating factors such as LOC and outcome values have also been examined by Saltzer (1981). In general, he found that internal WLOC individuals who believe that certain behaviors lead to highly valued outcomes are more likely to perform those behaviors than externals with high outcome values. Further, such control of the outcomes and value placed on the outcome appears to directly influence behavioral intention. This is contrary to Fishbein and Ajzen's (1975) proposal that external mediators only influence behavioral intention indirectly through their subcomponents of normative beliefs and perceived consequences (Saltzer, 1981).

This perception of positive outcomes has also been related to commitment, termed as personal investment (Snyder, 1983). According to Snyder and Spreitzer (1984), if an individual places a high value on physical fitness and has made it an important part of one's identity, the individual will be more committed to adhering to an exercise regime. Earlier research by Harris (1979) found positive feelings of well-being
and self-esteem to also be predictors of commitment to physical activity. In examining attitudes and behaviors of runners Carmack and Martins (1979) found perceived addiction, state of mind, and length of the run to be positive predictors of commitment to running.

Summary

In summary, research has examined a wide variety of factors thought to influence participation in physical activity. Factors from the social, physical, and psychological dimensions have been investigated with inconsistent findings. Past reviews of the literature have cited a variety of limitations and possible suggestions to improve the consistency of the research findings in this area. A major problem noted has been the lack of a sound theoretical base with studies being conducted across a variety of age groups, of participants and non-participants, in supervised and unsupervised activity programs. Even with testing various hypotheses generalization of human behaviors is still difficult. Measurement tools also lend particular problems in that self-report questionnaires, necessary for dealing with large populations, tend to have low reliabilities. In addition, definitions of fitness and levels of participation (i.e., intensity, duration, frequency) greatly vary making comparison of findings questionable. Physiological measures also widely vary both in format, reliability, and validity. Sophisticated equipment is not only expensive but not always feasible for use with large numbers of subjects.

Suggestions for future research include:

1. Development of a sound theoretical framework;
2. Refine measurement tools, particularly with characterizing individual activity patterns to strengthen the association with other behaviors;

3. Standardize definitions insuring specific understandings of intensity, duration, and frequency of exercise;

4. Use large populations to reduce selection bias;

5. Add more research with school age population and determine what and how to motivate this population to exercise in later life;

6. Continue to examine reasons for decreased activity levels with age and the large percentage rate of dropouts from activity programs.
Additional References


Appendix B

The Knowledge Test
Fitness Knowledge Test

Twenty-seven multiple choice questions pertaining to basic fitness concepts were obtained from Corbin and Lindsey's (1983) fitness text written for the secondary schools. Questions in this text were compiled by a committee consisting of university and secondary school physical education teachers. The text materials were tested by these committee members using public school physical education classes yielding valid results. For this study, a test/retest reliability was done on a sample population of 30 junior high students ranging in age from 13 to 16. A reliability coefficient of .80 was obtained. A KR-20 analysis yielded a range of difficulty from .18 to .75 and a discrimination range from -.36 to .57. Those questions not falling within an acceptable difficulty range of .30 to .70 and a discrimination range of .21 to .80 were eliminated (Ebel, 1965). The specific values for the index of difficulty and index of discrimination are presented in Table 5. The resulting 20 question knowledge test exhibited a test/retest reliability coefficient of .89. This test was administered to each of 10 classes by their physical education teacher one week prior to the start of the fitness unit.
## Table 5

**Index of Difficulty and Index of Discrimination for the Knowledge Test**

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<th>Item</th>
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Cheryl was interested in starting an exercise program. She has never been very good at sports and games, but she was healthy and she could run long distances.

1. On which part of physical fitness would Cheryl score high?
   a. balance   c. cardiovascular fitness
   b. agility   d. power

2. Which of the following would be good for Cheryl to do after she finished running?
   a. cool down after exercising
   b. begin exercise with several short, fast sprints
   c. sit down immediately after hard exercise
   d. think about starting a new kind of exercise program

3. Which is a good time for Cheryl to do her exercising?
   a. when she has a few spare moments
   b. when the humidity is lower
   c. after she has just eaten
   d. on a hot day to perspire a lot

Frank wanted to know "how to exercise to get fit." He took several physical fitness tests to find out how fit he was. Next, he tried to determine the amount of exercise he needed to improve his physical fitness.

4. What should Frank know about frequency of exercise?
   a. exercise at least 3 times a week
   b. exercise at least 5 times a week
   c. exercise at least 6 times a week
   d. exercise vigorously once a week

5. How much time should Frank plan to spend each time he exercises?
   a. at least 5 minutes
   b. at least 5 to 15 minutes
   c. at least 15 to 30 minutes
   d. at least 30 to 60 minutes

Larry thought that cardiovascular fitness was the most important part of fitness to him. To develop his cardiovascular fitness he started jogging.

6. What would be a good test for Larry to find out how good his cardiovascular fitness was?
   a. body measurements
   b. sit-ups
   c. 12 minute run/walk
   d. bend and reach test
7. How could Larry know if he were jogging vigorously enough to
improve his fitness?
   a. if he started sweating
   b. if his heart rate increased
   c. if he started breathing hard
   d. if he started breathing hard

8. Before jogging what should Larry do?
   a. warm-up
   b. sit down and rest
   c. slow jog
   d. do several short, fast sprints

9. What kind of exercise did Larry do to improve his cardiovascular
fitness?
   a. anaerobic exercise
   b. isotonic exercise
   c. passive exercise
   d. aerobic exercise

You have a close friend who needs to lose weight. The friend wants to
lose 20 pounds.

10. Exercise can help your friend lose weight by:
   a. burning up more calories
   b. increasing your appetite
   c. keeping you too busy to eat
   d. making you too tired to eat

11. How would you define strength?
   a. amount of strain a muscle bears
   b. amount of exercise done regularly
   c. amount of force a muscle can exert
   d. amount of activities done in a week

12. If you want to develop strength which kind of exercise would be
best?
   a. stretching exercises
   b. lifting weights
   c. jogging
   d. leg exercises only

13. Flexibility is defined as:
   a. ability to exercise for long periods of time without being out
   of breath
   b. amount of force you can exert with your muscles
   c. ability to repeat exercises many times without getting tired
   d. ability to move your muscles and joints freely
14. To overload a muscle for the flexibility part of fitness you must:
   a. circle the track one extra time
   b. lift as heavy weight as you can each time you lift
   c. stretch the muscle farther than it is normally stretched
   d. stretch less that you normally should

15. If your neighbor had hypertension, which illness would your neighbor have?
   a. high blood pressure
   b. cancer
   c. heart disease
   d. back problems

16. You might have health problems if you do not exercise. Which of the following is NOT one of the health problems caused by lack of exercise?
   a. cancer
   b. heart disease
   c. obesity
   d. high blood pressure

17. Sweating during exercise:
   a. helps the body cool off
   b. keeps the body warm
   c. means you are losing fat
   d. means you are out of shape

18. Which is a good excuse for not exercising?
   a. "I do not have the time."
   b. "I am in good shape already."
   c. "I was never good at sports."
   d. "My doctor told me I should not."

19. To get into shape after not exercising for a long time, it is important to:
   a. exercise fast and long
   b. exercise once a week at maximum load
   c. start exercising gradually
   d. go on a diet and forget about exercising

20. If you want to be fit, healthy, look good and feel good all your life, you need to do some kind of physical activity
   a. regularly
   b. when you can spare the time
   c. at least one day a week
   d. only with a friend
Appendix C

The Questionnaire
The purpose of this questionnaire was to acquire information from the students regarding their attitudes and beliefs about physical activity. Included in the questionnaire were other questions regarding age, grade, sex, race, past activity level, and perceived activity levels of both father and mother. Items were obtained from a previously validated questionnaire (Godin, 1983) which was used by Godin and Shephard (1986) with 7th to 9th grade students. The questionnaire was constructed to measure variables from the Fishbein Behavioral-Intention Model (Fishbein & Ajzen, 1975) along with other previously mentioned variables. Specifically, the variables measured were: a) Intention, b) attitude toward activity, c) beliefs and evaluation of the consequences of activity, d) subjective norm, e) normative beliefs of significant referents, and f) motivation to comply with these referents. The results of a test-retest reliability procedure are presented in Table 6. Descriptive statistics for each of the items are presented in Table 7.
Table 6

Calculations of Reliability Estimates for Questionnaire Items

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<tr>
<th>Item</th>
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Table 7

**Descriptive Statistics for Observed Variables**

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School of Health, Physical Education, Recreation and Dance
Louisiana State University

DO NOT WRITE YOUR NAME
STRICTLY CONFIDENTIAL

This questionnaire is about your attitudes towards exercise, and about your past and present patterns of physical activity. We know that not everyone is interested in physical activity to the same extent, but we are very interested in your answers to the following questions whether you are physically active or not.

How to complete the questionnaire

Each question makes use of rating scales with five (5) choices; you are to darken in the corresponding lettered circle on your answer sheet that best describes your opinion.

Example 1:
The weather in Baton Rouge is hot in July
a. very likely; b. fairly likely; c. neither; d. fairly unlikely; e. very unlikely

Example 2:
The weather in Louisiana is:
a. very good; b. fairly good; c. neither; d. fairly bad; d. very bad

THE FOLLOWING QUESTIONS ARE ABOUT YOUR OPINIONS AND ATTITUDES TOWARDS REGULAR PHYSICAL ACTIVITY.

1. At the present time, I plan to do active sports or vigorous activities (i.e. exercise) long enough to get sweaty a few times a week.
   a. very likely; b. fairly likely; c. neither; d. fairly unlikely; e. very unlikely

I think that doing active sports or vigorous physical activities (i.e. exercise) to get sweaty a few times a week is:

2. a. very good; b. fairly good; c. neither; d. fairly bad; e. very bad

3. a. very exciting; b. fairly exciting; c. neither; d. fairly boring; e. very boring
4. a. very fun;  b. fairly fun;  c. neither;  d. fairly unpleasant;  e. very unpleasant
Generally speaking, how would you describe something that:

5. is healthy for you...
   a. very good;  b. fairly good;  c. neither;  d. fairly bad;  e. very bad

6. makes your body look better...
   a. very good;  b. fairly good;  c. neither;  d. fairly bad;  e. very bad

7. is tiring...
   a. very good;  b. fairly good;  c. neither;  d. fairly bad;  e. very bad

8. helps you feel better...
   a. very good;  b. fairly good;  c. neither;  d. fairly bad;  e. very bad

10. is fun...
    a. very good;  b. fairly good;  c. neither;  d. fairly bad;  e. very bad

11. helps you to be physically fit...
    a. very good;  b. fairly good;  c. neither;  d. fairly bad;  e. very bad

I think that doing active sports or vigorous physical activities (i.e. exercise) long enough to get sweaty a few times a week:

12. would be healthy...
    a. agree strongly;  b. agree somewhat;  c. neither;  d. disagree somewhat;  e. disagree strongly

13. would make my body look better...
    a. agree strongly;  b. agree somewhat;  c. neither;  d. disagree somewhat;  e. disagree strongly

14. would be tiring...
    a. agree strongly;  b. agree somewhat;  c. neither;  d. disagree somewhat;  e. disagree strongly

15. would help me feel better...
    a. agree strongly;  b. agree somewhat;  c. neither;  d. disagree somewhat;  e. disagree strongly

17. would be fun...
    a. agree strongly;  b. agree somewhat;  c. neither;  d. disagree somewhat;  e. disagree strongly

18. would help me to be physically fit...
    a. agree strongly;  b. agree somewhat;  c. neither;  d. disagree somewhat;  e. disagree strongly
I think that doing active sports or vigorous physical activities (i.e. exercise) long enough to get sweaty a few times a week, is something that:

19. PEOPLE WHO ARE MOST IMPORTANT TO ME believe I should do...
   a. agree strongly;  b. agree somewhat;  c. neither;
   d. disagree somewhat;  e. disagree strongly

20. MY PARENTS believe I should do...
   a. agree strongly;  b. agree somewhat;  c. neither;
   d. disagree somewhat;  e. disagree strongly

21. MY TEACHERS believe I should do...
   a. agree strongly;  b. agree somewhat;  c. neither;
   d. disagree somewhat;  e. disagree strongly

22. MY FRIENDS believe I should do...
   a. agree strongly;  b. agree somewhat;  c. neither;
   d. disagree somewhat;  e. disagree strongly

I would like to do active sports or vigorous physical activities (i.e. exercise):

23. the way my PARENTS think I should...
   a. agree strongly;  b. agree somewhat;  c. neither;
   d. disagree somewhat;  e. disagree strongly

24. the way my TEACHERS think I should...
   a. agree strongly;  b. agree somewhat;  c. neither;
   d. disagree somewhat;  e. disagree strongly

25. the way my FRIENDS think I should...
   a. agree strongly;  b. agree somewhat;  c. neither;
   d. disagree somewhat;  e. disagree strongly

I think that my father does vigorous physical activity during his free time.

26. a. agree strongly;  b. agree somewhat;  c. neither;
    d. disagree somewhat;  e. disagree strongly

I think that my mother does vigorous physical activity during his free time.

27. a. agree strongly;  b. agree somewhat;  c. neither;
    d. disagree somewhat;  e. disagree strongly

THESE NEXT QUESTIONS ARE TO TELL US A LITTLE ABOUT YOU.

28. Are you...  a. male;  b. female

29. How old are you?  a. 13 yrs.;  b. 14 yrs.;  c. 15 yrs.;  d. 16 yrs.
30. What grade are you in at school?  a. 9th;  b. 10th;  c. 11th;  d. 12th

THE NEXT TWO QUESTIONS BELOW ARE ABOUT YOUR PAST EXPERIENCE WITH EXERCISE.

31. During the period of your childhood (ages 6 to 11) did you do any sport or physical activity during your free time?
   a. Yes. If yes, continue with question 32.
   b. No. If you answered no stop.

32. Considering the sport or physical activity you did most often during the period of your childhood (ages 6 to 11), did you do it:
   a. A LOT (at least 3 times per week)
   b. A FAIR AMOUNT (1 to 2 times per week)
   c. HARDLY EVER (less than 1 time per week)
Appendix D

The Physical Fitness Tests
Physical Fitness Tests

The Astrand-Astrand Cycle Ergometer Test was used as a pre and posttest to assess gains in physical fitness. The initial test was administered twice to each student on 2 consecutive days to account for testing effect. A t-test showed no significant differences between these test scores. After adjustment of the bicycle seat to ensure proper leg extension, the subject pedalled for one minute at a work load of 60 rpm at a beginning resistance of .5 kp as a warm-up. A metronome set at 100 was used to synchronize a steady pedaling pace. Every 2 min the resistance was incremented by .5 kp until a steady state heart rate of 150 bpm was reached. Heart rate was taken by palpation of the carotid artery 15 s before each increment in resistance. These heart rates and work loads were recorded on a prepared coding sheet. Upon reaching steady state, the subject pedalled for an additional 5 min or until exhaustion at the established workload with heart rates taken every minute. A posttest was administered in the same manner to the same students at the conclusion of the fitness unit.

A 12-min run/walk fitness test was administered to all subjects to establish their fitness level. The test was conducted by the researcher on the premarked jogging area. After being instructed to run as much as possible, walking only if necessary, the class was signalled to begin at a designated starting point. Upon completion of each lap, subjects picked up a numbered lap card as they passed the starting point, indicating the number of laps completed. This allowed for a more accurate account of distance covered. At the end of 12 min the class was signaled to stop on the spot and wait for their completed distance.
to be calculated. A footage marker wheel was then pushed from the starting point to each individual subject. Laps and additional footage was recorded for each subject. This was later computed into miles to the nearest tenth for data analysis.
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Appendix E

The Daily Log
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**How hard do you feel you worked today?**

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**I did not participate on**

**Because:**
Appendix F

Experimental Teaching Unit
INTRODUCTION TO PHYSICAL FITNESS

DID YOU KNOW:

More than 50% of all teenagers cannot do 1 chin-up.

Only 55% of adult Americans do any kind of regular exercise.

Studies have shown that fitness declines with age.

Lack of fitness is a result of an inactive lifestyle (T.V., cars, other machines).

Regular physical activity is necessary to keep the body functioning properly.

7 out of 8 children become fat adults

28 out of 29 fat teen-agers become fat adults.

Strong muscles take up less room than fat and give the body its nice shape.

Heart disease is the leading killer in the U.S.

People who exercise regularly have less chance of getting and dying from heart disease.

Exercising while you are young on a regular basis can reduce the chance of illness when you are older.

Exercise makes the heart stronger by:

- decreasing heart rate so it won't have to work as hard
- pushing more blood out with each beat
- therefore, circulating more blood per minute
- better use of oxygen

BENEFITS OF EXERCISING REGULARLY:

- look good
- feel good (have more energy)
- be healthy
- enjoy life
FITNESS UNIT

I. INTRODUCTION - Filling Out Your DAILY LOGS

A. Fill out the following information on your cards:
   1. your I.D. number = _____
   2. age = _____
   3. predicted maximum Heart Rate = 220 - age = _____

B. While sitting quietly, practice finding pulse at the neck and/or wrist (do not use the thumb)
   1. Ask for a show of hands of those who are unable to find it.
   2. "Ready - Count" (time students for 30 seconds)
   3. "Stop" - double the number you counted to get an approximate heart rate for one minute.
   4. Record this number in your log where it says resting HR =
   5. Practice taking pulse again but instead, time students for 6 seconds. Add a "0" to the number counted to get an approximate heart rate for one minute.
   6. Example:
      count = 7, add "0" = 70 beats per minute

C. Jog in place for one minute.
   1. "Stop" - find pulse
   2. Time class for 6 seconds
   3. "Stop", add "0" =_____ This will give your exercise heart rate.

D. Record this heart rate in your log where it says: HR2 = _____

E. Perceived Exertion
   1. This is a personal estimate of how hard you think you worked.
   2. Circle the correct number that best tells how hard you worked today:

      6
      VERY, VERY LIGHT
      7
      VERY LIGHT
      8
      FAIRLY LIGHT
      9
      SOMEWHAT HARD
      10
      HARD
      11
      VERY HARD
      12
      13
      14
      15
      16
      17
      18
F. NONPARTICIPATION
1. If you did not participate in class today, in a few words explain why.
2. This should be written in the appropriate area on their card.

II. INTRODUCTION TO FITNESS COMPONENTS

A. Why is fitness important? Allow class to give their ideas.

DEFINITION: Physical fitness of the whole body, including the muscles, skeleton, heart, and all other body parts to work together efficiently, which means able to do the most work with the least amount of effort.
If you are physically fit, health will allow you to participate enthusiastically in school and recreational activities.

BENEFITS: look good 
feel good 
be healthy 
enjoy life 

B. SOME FACTS:

a. more than 50% of all teenagers cannot do 1 chin-up.
b. Only 55% of adult Americans do any kind of regular exercise.
c. Studies have shown that fitness declines with age.
d. Lack of fitness is a result of an inactive lifestyle (T.V., cars, other machines).
e. Regular physical activity is necessary to keep the body functioning properly.
f. 7 out of 8 children become fat adults
   28 out of 29 fat teen-agers become fat adults.
g. Strong muscles take up less room than fat and give the body its nice shape.
h. Heart disease is the leading killer in the U.S.
   People who exercise regularly have less chance of getting and dying from heart disease.
   Exercising while you are young on a regular basis can reduce the chance of illness when you are older.

i. Exercise makes the heart stronger by:
   - decreasing heart rate so it won't have to work as hard
   - pushing more blood out with each beat
   - therefore, circulating more blood per minute
   - better use of oxygen
C. Cover the following definitions:

1. CARDIOVASCULAR FITNESS - efficient working of the heart and blood vessels to deliver blood to the working parts of the body.

2. MUSCULAR STRENGTH - being able to exert force against a resistance.

3. ENDURANCE - (muscular and/or cardiovascular) - being able to continue or last over a long period of time without becoming very tired.

4. FLEXIBILITY - stretching or lengthening the muscles and ligaments to allow bending and twisting.

D. Fitness tests to evaluate some of the components mentioned:

1. Push-ups for one minute to test arm and shoulder strength.
2. Bent knee sit-ups for one minute to test abdominal strength and endurance.
3. Sitting toe touch to test flexibility of low back, hips and thighs.
4. 12 minute run/walk to test cardiovascular endurance.

III. TYPES OF EXERCISE

A. AEROBIC EXERCISE (define)

1. aerobic - taking in enough oxygen while exercising to continue over a long period of time.
2. examples - distance running, swimming, cycling

B. ANAEROBIC EXERCISE (define)

1. anaerobic - the amount of oxygen taken in is not enough to continue an activity.
2. examples - 50 yard dash, basketball, weight lifting

IV. ESSENTIAL COMPONENTS OF ANY EXERCISE PROGRAM

A. In order to physically benefit from exercise it must be done at a proper intensity for a certain number of minutes a day and for so many days a week.

B. These factors are known as intensity, duration and frequency:

1. INTENSITY - how hard you work; this is determined by your exercise heart rate and should be within your target zone.
2. DURATION - length of time you exercise
   a. minimum of 20 minutes
   b. at your target heart rate
3. FREQUENCY - number of times per week
   a. minimum of 3 days spaced out during the week
   b. can get better and faster results exercising 4-5 days a week
   c. usually 1-2 days of rest are needed for your body to recover from previous exercise.

C. OVERLOAD - pushing yourself to do more than you could do the previous time you exercised.
   1. This should be done gradually by adding only a few more minutes or repetitions at a time.
   2. Doing too much too soon can result in injury or severe fatigue.

V. WARMING UP
   A. Exercises done before engaging in vigorous physical activity.
   B. Types of exercises:
      1. STATIC STRETCHING - slow, easy bending holding the stretched position for at least 10 seconds.
         Examples - toe touching, side bends, lunges
      2. Other exercises - large arm circles, knee bends, twisting, heel lifts
   C. Helps maximize performance by:
      1. Loosening muscles and joints
      2. Increasing blood flow to and from the heart and muscles to help them get ready for exercise.
   D. Helps decrease the chance of injury (pulled muscles).

VI. COOLING DOWN
   A. Can be walking after vigorous exercise followed by static stretching.
   B. Keeps blood flowing back to heart at a slower rate; decrease heartrate slowly.
   C. Static stretching exercises to prevent muscle cramping and possible injury.
      1. Standing and sitting stretches (toe touches, straddles, hurdle)
      2. Lunges
      3. Heel stretches

VII. WEIGHT CONTROL AND EXERCISE
   A. Types of weight
      1. LEAN BODY WEIGHT = muscles, bones, internal organs
      2. FAT WEIGHT = fat tissue
         a. number of fat cells increase up to ages 16-18 yrs.
         b. thereafter they just fill up (gain weight) or empty out
c. obese people have more fat cells than nonobese
d. exercising when you are young can help control the number of fat cells your body makes decreasing the chance of being obese.

B. Exercise can help control obesity by burning up calories.

1. If you are eating more calories than you are using (activity) then you will gain weight.
2. Your weight may not change with exercise but fat content can still decrease (building muscle can add some weight).
3. To reduce body fat you must exercise:
   a. at least 3 times a week
   b. at 20 minutes or longer
   c. hard enough (sufficient intensity = target heart rate) to use up at least 300 kcalories each session

C. Exercise helps increase lean body weight (muscle development gives your body its shape).

1. Muscle development depends upon exercise (especially weight training and upon hormones therefore
2. Girls don't develop the big bulky muscles like boys do.
3. Muscles can give girls a prettier shape.

D. Diet without exercise can cause loss of lean tissue (muscle) and protein as well as fat.

E. Weight loss by exercise causes nearly all weight loss to come from fat.

F. Weight loss will occur from all areas of the body. Exercise for specific areas of the body (stomach) do not decrease fat in this one area.

III. THE HEART AS A PUMP

A. The heart is a muscle and therefore can be strengthened by making it work harder (beat faster with exercise)

B. AEROBIC CAPACITY - taking in a maximum amount of oxygen and using it efficiently when exercising.

1. Muscles need oxygen to produce energy to work
2. Oxygen is delivered in the blood to the working muscles.

C. HEART RATE - number of beats (contractions of the heart muscle) to pump blood through the blood vessels. HR increases when exercising to get more blood and oxygen to the muscles.

D. STROKE VOLUME - amount of blood that the heart pumps out each time it beats (contracts). (The more blood pumped out each time the better)
time the better)

E. CARDIAC OUTPUT - amount of blood the heart pumps out into circulation in one minute.

F. BLOOD PRESSURE - amount of pressure (force) that blood exerts (pushes) against the blood vessel walls (arteries).
   1. This helps the blood move through the arteries.
   2. It goes up with each beat of the heart.

G. Exercise improves all these occurrences by making the heart stronger:
   1. The heart doesn't have to beat as fast (HR decreases)
   2. More blood gets pushed out with each heart beat (stroke volume)
   3. Therefore more blood is circulated per minute to keep muscles working (increases cardiac output).
   4. Aerobic Capacity improved which means more oxygen is taken in and used.
   5. Less increases in blood pressure also means less stress on the blood vessels.

IX. Exercising in different climates

A. Exercise increases body temperature. As a result:
   1. More blood flows to the skin surface.
   2. You sweat.

B. Sweating cools your skin and blood off so you don't overheat before it goes back to heart and internal organs.

C. Exercising in hot weather can increase your body temperature even more. Humidity can decrease evaporation of sweat not allowing you to cool-off. If skin and blood stay hot, body temperature increases. (heat exhaustion or stroke)

D. Excess fluid loss from heat and sweat loss can cause dehydration -> dizzy, rapid pulse, chills. Drink plenty of fluids.

E. Need to wear loose fitting and cool clothing to allow for sweat evaporation.

F. Cold weather - heavier clothing helps keep the body warmer. (by preventing heat loss). Exercise also produces heat to keep body warm.

X. Cardiovascular Disease

A. Sometimes known as coronary heart disease (CHD) -> disease
affecting the heart and blood vessels.

B. Major causes:

1. Build up of fatty substances on inside walls of arteries (some of which is called cholesterol; triglycerides) this narrows the arteries = called atherosclerosis.
   a. decrease amount of blood transported throughout the body
   b. which also means less oxygen going to muscles and heart

C. Risk factors:

1. High blood pressure - cause damage to narrowed blood vessels.
2. Obesity or excess weight.
   a. increase work load in heart
   b. associated with increase blood pressure
   c. usually have increased cholesterol and tryglycerides in blood and fat.
3. Lack of physical activity.
   a. exercise keeps weight down
   b. decrease blood fat
   c. decrease blood pressure
   d. keeps heart and blood vessels stronger
   e. increase number of blood vessels to carry blood and oxygen
Appendix G

The Jogging Area
Jogging Area

Each school had a grassy field that was marked off either in 200 m or 400 m depending upon the available space. Two schools used a 400 m and one used a 200 m track-like marked area. Traffic cones were also placed around the oval every 10 m to allow for calculating distance covered by the coded target students. These cones also aided in a clear delineation of the jogging area. Distances were calculated by multiplying the number of cones passed by 10 m.
Appendix H

Behavior Coding
Behavior Coding

Using a random numbers table and the teachers class roll, six students per class were randomly selected. Eleven and 12th graders were omitted. Two Datamytes were used to code these selected target subjects. This hand-held calculator-type machine consists of four columns and five rows of numbered buttons ranging from 1 to 20. For this study, the four numbers across the top represented the behaviors to be coded: Jogging, walking, on-task, and off-task. Each row (5) was used to represent one subject on a single Datamyte. The second Datamyte was used in the same fashion to code the sixth subject. For the 30 s rotations, a pretaped voice recording of observe/record cues was used. Specifically, the tape instructed: "Find one, (5 s pause), observe one (30 s interval), stop; find two (5 s), observe two (30 s), stop; ...", etc. At the conclusion of the 20 min session, both duration and frequency counts for all behaviors for each subject were extracted from the Datamyte. This information was recorded on a prepared coding sheet. Total participation times were then calculated for each subject. For a more exact comparison in the data analysis a percent of total time for each behavior category was used for the data analysis. While observing the cued subject, 10 m distance markers were also counted and recorded in the appropriate space (Dist) on the coding sheet.

Intracoder reliability was obtained with a videotaped portion of a jogging class. Pearson r coefficients by category were calculated. Intercoder reliability was calculated before the study and for 10% of the total days observed. The latter resulted in three randomly selected days, one at each school, throughout the 8 weeks. A Subject X Coder
randomized block ANOVA with repeated measures (2) on the last variable for each of four behavior categories was used. A mean square within was obtained to calculate the \( r \) for each category (MS\(_{\text{subject}}\) - MS\(_{\text{within}}\)/MS\(_{\text{subject}}\); Safrit, 1981). Pearson \( r \) coefficients for both intra- and intercoder reliability are shown in Table 8 with the individual ANOVA tables presented in Table 9.
Table 6

Calculations of Intracoder and Intercoder Reliability Estimates for Behavior Categories of the Observational Instrument at Three Schools

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Table 9

ANOVA Tables Used to Calculate Reliability Estimates for the Behavior Categories of the Observational Instrument

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**Prestudy Jogging Behavior**

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**On-task Behavior - School 1**

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**Off-task Behavior - School 1**

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**Walking Behavior - School 2**

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Table 9 con't

### Jogging Behavior - School 2

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### On-task Behavior - School 2

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MSwithin = 1.13
Table 9 con't

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$MS_{within} = 5.87$

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#### On-task Behavior - School 3

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$MS_{within} = 1.53$
Table 9 con't

**Off-task Behavior - School 3**

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$MS_{within} = 2.87$

* $p < .05$

** $p < .01$

*** $p < .001$
Observational Coding Sheet

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Appendix I

Additional Tables
Table 10

Descriptive Data for Three Schools

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</table>

* P < .05
** P < .01
*** P < .001
### Table 12

**Comparison of Variances and Covariances of Observed and Latent Variables for Four Behavioral-Intention Models**

<table>
<thead>
<tr>
<th>Unique</th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
<th>Model 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jog</td>
<td>.723 (.09)</td>
<td>.730 (.09)</td>
<td>-.276 (.39)</td>
<td>-.047 (.28)</td>
</tr>
<tr>
<td>Fitness</td>
<td>.959 (.10)</td>
<td>.958 (.10)</td>
<td>.820 (.10)</td>
<td>.788 (.10)</td>
</tr>
<tr>
<td>PcPart</td>
<td>.895 (.09)</td>
<td>.892 (.09)</td>
<td>.614 (.20)</td>
<td>.627 (.15)</td>
</tr>
<tr>
<td>HR</td>
<td>.471 (.10)</td>
<td>.494 (.10)</td>
<td>.884 (.09)</td>
<td>.862 (.09)</td>
</tr>
<tr>
<td>PEx</td>
<td>.616 (.09)</td>
<td>.588 (.09)</td>
<td>.908 (.09)</td>
<td>.888 (.09)</td>
</tr>
<tr>
<td>Int</td>
<td>.000</td>
<td>.000</td>
<td>.000</td>
<td>.000</td>
</tr>
<tr>
<td>Attcomp</td>
<td>.745 (.08)</td>
<td>.741 (.08)</td>
<td>.720 (.08)</td>
<td>.724 (.08)</td>
</tr>
<tr>
<td>Aact</td>
<td>.401 (.09)</td>
<td>.401 (.08)</td>
<td>.432 (.08)</td>
<td>.447 (.08)</td>
</tr>
<tr>
<td>SN</td>
<td>.931 (.10)</td>
<td>.931 (.10)</td>
<td>.937 (.10)</td>
<td>.933 (.10)</td>
</tr>
<tr>
<td>SNcomp</td>
<td>.780 (.13)</td>
<td>.814 (.13)</td>
<td>.838 (.12)</td>
<td>.818 (.11)</td>
</tr>
<tr>
<td>Past</td>
<td>1.332 (.28)</td>
<td>1.490 (.36)</td>
<td>.855 (.09)</td>
<td>.863 (.09)</td>
</tr>
<tr>
<td>Fath</td>
<td>1.085 (.12)</td>
<td>1.059 (.12)</td>
<td>.957 (.10)</td>
<td>.980 (.10)</td>
</tr>
<tr>
<td>Moth</td>
<td>1.130 (.13)</td>
<td>1.082 (.25)</td>
<td>.968 (.10)</td>
<td>.975 (.10)</td>
</tr>
<tr>
<td>Know</td>
<td>1.005 (.10)</td>
<td>1.006 (.10)</td>
<td>.998 (.10)</td>
<td>.995 (.10)</td>
</tr>
</tbody>
</table>
Table 12 con't

<table>
<thead>
<tr>
<th>Unique Covariance</th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
<th>Model 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fitness/Jog</td>
<td>0.376*** (.07)</td>
<td>0.375*** (.07)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PcPart/Fitn</td>
<td>0.200** (.06)</td>
<td>0.197** (.05)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PcPart/Jog</td>
<td></td>
<td></td>
<td>-0.540 (.23)</td>
<td>-0.463 (.18)</td>
</tr>
<tr>
<td>PEx/HR</td>
<td></td>
<td></td>
<td>0.354*** (.07)</td>
<td>0.333*** (.07)</td>
</tr>
<tr>
<td>Moth/Fath</td>
<td></td>
<td></td>
<td></td>
<td>0.291*** (.07)</td>
</tr>
<tr>
<td>SN/Att</td>
<td>0.293*** (.06)</td>
<td>0.293*** (.06)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Backgd/Att</td>
<td>0.134** (.04)</td>
<td>0.168*** (.05)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Backgd/SN</td>
<td>0.081* (.05)</td>
<td>0.097* (.05)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>** Common Variance**</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Attitude</td>
<td>0.255*** (.07)</td>
<td>0.259*** (.08)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subj Norm</td>
<td>0.220* (.12)</td>
<td>0.186 (.12)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Background</td>
<td>-0.332 (.18)</td>
<td>-0.490 (.42)</td>
<td>0.456** (.06)</td>
<td>0.137** (.06)</td>
</tr>
</tbody>
</table>

* p < .05
** p < .005
*** p < .0005

Note. All unique variances of all observed variables in all four models are significant at least at p < .005 except Jog in Model 3 & 4 which are non-significant.
Vita

Karen Martha Greenockle was born on June 27, 1950 in Seaford, New York where she grew up attending elementary, junior, and senior high school. She graduated as a member of the 1968 graduating class of Seaford Senior High School. Karen attended Nassau Community College for her freshman year, after which she transferred to Texas Christian University to earn her B. S. in Health and Physical Education in 1972.

In December 1975 she earned her Master of Science in Health and Physical Education from Lamar University, Beaumont, Texas. She continued at the university as an instructor in Physical Education teaching and coaching women's gymnastics and track and field. During this time Karen also became a certified Aerobics Instructor.

In the Fall of 1983 she entered the doctoral program at Louisiana State University in exercise physiology. After one year she changed her major to teacher behavior with a minor in nutrition. While completing the requirements for the doctoral degree she was a teaching and research assistant for 3 years in the School of Health, Physical Education, Recreation, and Dance. Her final year she worked as Assistant-to-the-Editor-in-Chief of the Research Quarterly for Exercise and Sport, Dr. Jerry R. Thomas.

After completing the requirements for the doctor of philosophy degree, Karen will serve as an assistant professor in Physical Education and coordinator of the Wellness Program at the University of Tennessee at Martin.
DOCTORAL EXAMINATION AND DISSERTATION REPORT

Candidate: Karen M. Greenockle

Major Field: HPERD (Physical Education/Teacher Behavior)

Title of Dissertation: The Relation Between Selected Student Characteristics and Activity Patterns in a Required High School Physical Education Class

Approved:

[Signature]
Major Professor and Chairman

[Signature]
Dean of the Graduate School

EXAMINING COMMITTEE:

[Signature]

[Signature]

[Signature]

[Signature]

[Signature]

Date of Examination:

July 17, 1987