

ABSTRACT

Title of dissertation: DIFFERENCES IN PERCEIVED STRESS, AFFECT, ANXIETY, AND COPING ABILITY AMONG COLLEGE STUDENTS IN PHYSICAL EDUCATION COURSES

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Because college students are a unique group with distinct environmental, situational, and interpersonal stressors, they are an important population for studying potential stress management techniques. Since physical activity is a renowned means of stress reduction, a logical area for exploration is whether college students' engagement in various forms of physical activity courses is related to improvements in individual perceptions of health-related constructs from the start of a course until its end. The purpose of this research was to understand whether college students who were enrolled in various physical education courses differentially self-report perceived stress, anxiety, coping ability, and affect after the conclusion of their courses. Specifically, this study examined whether these differences existed between students enrolled in yoga classes and those who were enrolled in other Kinesiology courses such as weight lifting, aerobics, and golf.

This cross-sectional exploratory study involved a self-administered questionnaire that was administered at the end of Summer 2006 semester. 108 students met inclusion criteria. Survey sections addressed each of the independent and dependent variables

identified for the study and included the following reliable and valid survey instruments: Perceived Stress Scale, Brief COPE, Inventory of College Students Recent Life Experiences, Positive and Negative Affect Scales and State Trait Anxiety Inventory. The final section of the survey collected student characteristic and attitudinal information. Contrary to the main hypothesis that students enrolled in yoga classes would report less perceived stress, they actually reported significantly more perceived stress than their counterparts ($p < .002$). However, yoga students reported using more positive coping strategies over the past month than nonpractitioners ($p < .008$). More research needs to be conducted with pre-and post-tests between students or other population groups who practice yoga in order to understand whether yoga practice may be a factor in reducing stress over time. The observations from this study suggest that yoga may be a unique type of physical activity that may be 'sought out' by high-stressed persons or those wishing to learn strategies to cope with their stress.

DIFFERENCES IN PERCEIVED STRESS, AFFECT, ANXIETY, AND COPING
ABILITY AMONG COLLEGE STUDENTS IN PHYSICAL EDUCATION COURSES

by

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DEDICATION

This dissertation is dedicated to the loving memory of my grandparents: Gertrude and Manual Permuth and Helene and Joseph Uditsky. What a shame that we could not have known one another longer, but the memories I have of all of you are fond ones. You created wonderful parents for Jenny, Matt, and me. I will not forget you for that and I treasure the time we shared. You have two gorgeous great grandkids, by the way. Joey and Nate are creating mischief everywhere. Two little diablos. What characteristics did they inherit from all of you?

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Chapter One

The purpose of this dissertation was to investigate whether college students who were enrolled in a semester session of yoga experienced lower levels of perceived stress and anxiety and higher levels of positive affect when surveyed at the conclusion of their semester than students who participated in other forms of physical activity classes. Additionally, this study examined whether students who were in yoga classes used a greater number of positive coping strategies than nonpractitioners. This is a timely and important topic with potential implications for public health practice given the increase in morbidity and mortality in the United States due to stress-related diseases (McEwen, 1998; McEwen, 2005).

Because the study of the role of yoga in stress management is still in its relative infancy, this research is essential to understanding whether practitioners of yoga actually perceive themselves to have less stress and anxiety in their lives. Additionally, while many studies show that physical activity improves mood (Fox, 1999; Netz & Lidor, 2003), the evidence base is still growing that shows that yoga practice can also accomplish this goal (Sageman, 2004; Bower, Woolery, Sternlieb, & Garet, 2005).

Scientists have been studying the role of psychological factors in human disease for at least the past half-century. Prior to World War II, infectious disease was the leading cause of illness (Guyer, Freedman, Strobino, & Sondik, 2000). Since that time, however, many of those diseases have been eradicated or controlled (Garrett, 1996; Dowdle, 1998). The advent of new technology, decreases in leisure time, and an effort to increase human productivity brought upon a new set of 'lifestyle' diseases that now mostly comprise the top ten leading causes of death in the United States (Mokdad, Marks, Stroup, & Gerberding, 2004). A disease that is attributable to lifestyle implies that there are certain

behaviors or environmental influences that contribute to its onset and clinical course.

Conversely, altering behaviors can prevent these diseases.

The National Center of Health Statistics (NCHS) indicated that cardiovascular disease, cancer, and cerebrovascular disease were the top three causes of death in the United States (National Center for Health Statistics [NCHS], 2002). These three disease classifications are frequently linked to lifestyle behaviors such as inadequate physical activity, poor diet, and smoking (Department of Health and Human Services [DHHS], 2002; World Health Organization [WHO], 2003). Yet new evidence has shown that stress can also contribute to the etiology of heart disease (Cohen, Schwartz, Epel, Kirshbaum, Sidney, & Seeman, 2006; O'Keefe, Poston, Moe, Haddock, & Harris, 2004), various cancers (Reiche, Morimoto, & Nunes, 2005; Kruk & Aboul-Enein, 2004) and cerebrovascular diseases (Waldstein, Siegel, Lefkowitz, Maier, Pelletie, Obuchowski, & Katzel, 2004; Schneck, 1997).

Stress has been studied as a factor in such a large number of diseases that it can become difficult to establish causation (Lerner, 1996; Eysenck, 1995). This is particularly the case if the concept of stress is not well defined and if studies do not demonstrate stress as a precursor to the onset of disease (Cohen, Kessler, & Gordon, 1995; Macleod & Davey-Smith, 2002). Because stress has been implicated in the onset and maintenance of so many acute and chronic diseases, scientific priorities have shifted to focus on primary and secondary prevention strategies by way of stress reduction and stress management techniques in order to reduce the burden of disease on the population (Ebrahim & Davey Smith, 1998; Schneiderman, Antoni, Saab, & Ironson, 2001; Kromhout, Menotti, Kesteloot, & Sans, 2002).

Definitions of what constitutes ‘stress’ have been elucidated over the past few decades so that researchers can conceptualize how to measure the psychological, physiological, and environmental pathways by which stress could influence disease (Cohen, Kessler, & Gordon, 1995). Despite these conceptualizations of stress, scientists continue to disagree as to the definition of this term. This paper used the definition of psychological stress. Lazarus and Folkman (1984) provided the following definition: “Psychological stress involves a particular relationship between the person and the environment that is appraised by the person as taxing or exceeding his or her resources and endangering his or her well being” (p. 19).

These conceptualizations of stress allow three separate means of assessing the role of stress in disease risk (Cohen, Kessler, & Gordon, 1995; Seaward, 2002; Lazarus, 1999). The psychological tradition focuses on a person’s subjective evaluation of his or her ability to cope with external demands. The environmental perspective looks at experiences that are normatively perceived to lead to adaptive demands. Biological perspectives deal with the role of physiological activation that is a result of psychological or physical demands (Seaward, 2002; Lazarus, 1999). This research focused primarily on the psychological perspective for its theoretical framework and measurement perspective, though environmental assessments of stress were also used.

Though stress is a universal construct that affects all humans, studies show that different populations are known to have different stressors (Crandall, Preisler, & Aussprung, 1992; Sarafino & Ewing, 1999; Morrison & O’Connor, 2005). College students are a unique group of individuals who face certain intrapersonal, interpersonal, environmental, and academic stressors (Ross, Niebling, & Heckert, 1999). Many of these

stressors are not necessarily relevant to other population groups (Ross, Niebling, & Heckert, 1999; Misra & McKean, 2000; Camatta & Nagoshi, 1995; Kadison & DiGeronimo, 2004). For instance, students often need to adjust to a new social environment, being away from home, dealing with living away from certain parental authority, and heightened academic challenges (Towbes & Cohen, 1996). If college students do not learn appropriate coping strategies to deal with these new stressors, they may suffer from physical and psychological ailments and distress (Sarafino & Ewing, 1999). Problems affecting college students in particular are loneliness, nervousness, sleeplessness, and excessive anxiety (Wright, 1967).

Because of the cost of psychological and physical stress on the body, many adults are trying complementary and alternative methods (CAM) of ameliorating their health and coping with disease ([Oldendick](#), Coker, Wieland, Raymond, Probst, Schell, & Stoskopf, 2000; Grzywacz, Lang, Suerken, Quandt, & Bell, 2005). College and university students are starting to take this path as well, as they are becoming accepting of and satisfied with CAM modalities (Lamarine, Fisher, & Sbarbaro, 2003).

Yoga is one form of CAM that has been tested to determine its efficacy in improving or preventing mental and physical illness in college students (Birkel & Edgren, 2000; Woolery, Myers, Sternlieb, & Zeltzer, 2004; West, Otte, Geher, Johnson, & Mohr, 2004; Berger & Owen, 1992). Typically, yoga is viewed as a holistic stress management technique that yields a physiologic response in the body that reduces one's stress response (Parshad, 2004). In fact, yoga practitioners and those who have never practiced have perceived yoga as beneficial to reduce stress (Atkinson & Permuth-Levine, submitted).

Research Questions

Three research questions were explored in this dissertation. All questions were explored in the context of a cross-sectional survey given to students enrolled in one-credit physical education courses in the summer 2006 semester. In addition to the multivariate analyses, post-hoc tests were conducted when necessary.

For the first two questions, two groupings of students were compared: those who practiced yoga (that is, they were enrolled in one of the two yoga classes offered), and those who were enrolled in the other physical education courses. The other participating courses were as follows: bowling, beginning and intermediate golf, beginning and intermediate weight lifting, and step aerobics. The third research question compared groupings of students by the number of metabolic equivalents (MET) that are typically used during each type of physical intensity per hour (Centers for Disease Control [CDC], 2006). The research questions are presented below.

1. Was there a relationship between perceived stress, affect, coping strategies, and trait anxiety among students who practice yoga versus those who did not?

The first research question explored the notion that the outcome measures of interest were related to one another -- and that taken together, they differed between students who practiced yoga and those who were enrolled in the other courses. Since this question used statistical techniques that can not differentiate where specific relationships between the independent and dependent variables lie, there were four additional research questions proposed to elucidate between which variables were of significance.

1a. Did students enrolled in a yoga course perceive lower levels of stress than those students who were enrolled in other physical activity courses?

The primary outcome of interest for this study was perceived stress. Thus this research question explored whether students enrolled in the summer yoga courses perceived less stress at the end of the semester than those students who were enrolled in other physical activity courses. Specifically, the research examined whether yoga students have lower levels of perceived stress at the semester's end by comparing total scores on a survey of this measure. Perceived stress was defined as the score received on the Perceived Stress Scale (PSS) by Cohen, Kamarck, and Mermelstein (1983), which measures self-reported perceptions of stress. Items were designed to assess how unpredictable, uncontrollable, and overloaded respondents find their lives. In addition, the scale asked about current levels of experienced stress. Lower scores on the PSS are associated with lower levels of perceived stress.

1b. Did students enrolled in yoga courses use a greater number of positive coping strategies than students enrolled in other types of physical activity courses?

Because perceived stress can be reduced by the use of positive coping strategies (Lazarus, 1984), another research question was whether students enrolled in yoga courses used a greater number of positive coping strategies at the end of the semester than those students enrolled in other types of physical activity courses. Positive coping strategies were indicated by specific numerical responses to ten subscales of the Brief COPE by Carver (1997). The Brief COPE is an abbreviated form of a larger instrument (the COPE), which measures an array of individual coping responses and their frequency.

1c. Did students enrolled in yoga courses experience higher levels of positive affect and lower levels of negative affect than students enrolled in other types of physical activity courses?

This research question examined whether yoga participants experienced higher levels of positive and lower levels of negative affect than their non-yoga peers at the end of the semester. These constructs were measured by scores on the Positive and Negative Affect Scale (PANAS). Higher scores on the Positive and Negative Affect subscales indicate higher levels of these constructs (Watson, Clark, & Tellegen, 1988). The PANAS measures 10 positive affects and 10 negative affects that respondents were asked to rate on the extent to which they have felt that way over a certain time frame.

1d. Did students enrolled in yoga courses experience less trait anxiety than students enrolled in other types of physical education/activity courses?

The last question stemming from the overall query explored whether yoga participants experienced less trait anxiety at the end of the semester compared to non-yoga peers. A subscale on the State Trait Anxiety Inventory (STAI) measured trait anxiety. Lower scores on this subscale of the STAI indicated less trait anxiety (Spielberger, Gorsuch, Lushere, Vagg, & Jacobs, 1983). The STAI evaluates how respondents felt at a particular time in the recent past and how they anticipate they will feel either in a specific situation that is likely to be encountered in the future or in a variety of hypothetical situations. The “trait” scale measures general feelings.

Because the types of college students who engage in physical in different physical activity classes might differ based on sex, race, or other variables that need to be understood in light of the main research question, the **second research question examined:**

2. Was there a relationship between perceived stress, affect, coping strategies, and trait anxiety among students who practice yoga and those who do not – when

controlling for potential covariates such as number of reported stressors, gender, race, courseload, amount of hours worked outside of school, and others? Other potential covariates are detailed in chapter three.

Finally, since persons may also choose to be enrolled in a particular physical activity class due to its level of physical exertion required, it may be that certain types of activities elicit more of a relaxation response than others. Thus the final research question explored:

3. Was there a difference in perceived stress, affect, coping strategies, or trait anxiety among persons enrolled in low, moderate, and high intensity physical activity courses? For this question, three groups of students were compared. Low intensity courses were defined as bowling, golf, and beginning yoga. Moderate intensity courses were beginning weight lifting and yoga for fitness. High intensity courses were step aerobics and intermediate weight lifting.

Problem Rationale

Stress as Related to Adverse Health Outcomes

As mentioned previously, the U.S. population has been experiencing a higher number of deaths and illnesses related to stress than in the past. Over the past decade, adults have self-reported higher levels of frequent mental distress than before (CDC, 2004). Additionally, a recent CDC (2005) report indicated that self-reported health-related quality of life (HRQOL) was lower than in the past, as defined partially by an increase in the mean number of physically and unhealthy days and activity limitations. All of the aforementioned symptoms have been linked to stress (Landry, Quick, & Kasl, 1994; CDC, 1998; Moriarty, Zach, & Kobau, 2003).

Among college students, stress has been linked to substance abuse, lower self-esteem, academic problems, depression, and many other ailments (Broman, 2005; Ross, Niebling, & Heckert, 1999; Hudd, Dumlao, Erdmann-Sager, Murray, & Pham, 2000). As a result of the harmful consequences of stress in this population, student wellness offices and counseling centers have had to form more innovative stress management programs and services to aid their students. In fact, there are several efforts to increase and improve college mental health services because of growing demand (Kitzrow, 2003). Particularly, mental health services have increased at universities in order to serve different minority groups (Kearney, Draper, & Baron, 2005; De Melo & Farber, 2005), international students (Mori, 2000), and the increase of students with psychological problems (Schwartz, 2006a; Schwartz, 2006b; Mowbray, Megivern, Mandiberg, Strauss, Stein, Collins, Kopels, Curlin, & Lett, 2006).

Physical activity is a commonly used technique used to ameliorate stress across all age groups (Fleshner, 2000; Dunn, Trevedi, & O'Neal, 2001; Sothern, Loftin, Suskind, Udall, & Blecker, 1999). Hatha yoga, a form of physical activity, has been explored in other populations and has been found to be a means to reduce stress (Michalsen, Grossman, Acil, Langhorst, Ludtke, Esch, Stefano, & Dobos, 2005; Smith, Richardson, Joffman, & Pilkington, 2005; Gura, 2002). Whether yoga could decrease levels of stress and anxiety and improve coping and mood in this population was not known at present. Given that college students are likely to explore CAM techniques (Feldman & Laura, 2004), it was appropriate to test out the promise of this modality for college students.

Increasing use of CAM for Health Reasons

There has been a substantial increase in the use of Complementary and Alternative Medicine (CAM) use among American adults since 1990 (Tindle, Davis, Phillips, & Eisenberg, 2005). The National Center for Complementary and Alternative Medicine (NCCAM) defined CAM as “a group of diverse medical and health care systems, practices, and products that are not presently considered to be part of conventional medicine” (NCCAM, 2007). Complementary and alternative medicine differ based on whether they are used in conjunction with or in place of conventional medical treatment. Complementary therapies are used as adjuvant to traditional medicine, and alternative therapies are substitutes for established methods.

While the list of CAM therapies varies over time, there are five main categories or domains of CAM that have been agreed upon by NCCAM. These categories are designated as 1) alternative medical systems, 2) mind-body interventions, 3) biologically based therapies, 4) manipulative body-based methods, and 5) energy therapies. Mind-body interventions use techniques to enhance the mind’s ability to affect bodily function. Some examples of mind-body techniques are meditation, prayer, dance, music, art, and others that have already become mainstream such as support groups and cognitive-behavioral therapy (NCCAM, 2007). Hatha Yoga, or the branch of yoga that focuses on physical postures and a way to integrate the mind and body, typically falls under the second category (Coker, 1999; Miller, Fletcher, & Kabat-Zinn, 1995; Astin, Shapiro, Eisenberg, & Forsys, 2003).

A few large-scale studies have validated this trend which is of critical importance when attempting to understand yoga’s concurrent growth, since yoga is viewed as a CAM

therapy in both of these national surveys. Eisenberg, Kessler, Foster, Norlock, Calkins, and Delbanco (1993) performed the first nationally representative survey of CAM use in this country. The study included 16 CAM therapies, yoga being one of them. This research found that 34 percent of adults had used at least one CAM therapy during the past year. When researchers conducted a follow-up survey, the 1997 results indicated that CAM use increased by 25 percent from the initial figures.

The most recent study by Tindle and colleagues (2005) used trend data from the 2002 National Health Interview Survey (NHIS) to examine changes in CAM therapy usage between 1997 and 2002 using comparable definitions of CAM to those in the Eisenberg study mentioned above. While general CAM usage remained steady, there was an increase in yoga usage, from 3.7 percent in 1997 to 5.1 percent of adults in 2002.

CAM acceptance and usage has risen among college-aged students as well, though the research on this population is in its infancy. Lamarine, Fisher, and Sbarbaro (2003) surveyed over 500 undergraduate and graduate students at a large university and found that the majority of college students favor the use of alternative medicine, and those who used it reported satisfaction with these methods. The most commonly used alternative therapies were herbs, dietary supplements, and chiropractic care.

The scientific study of yoga as an intervention for either stress/anxiety reduction or mood and coping ability improvement among college students is almost non-existent, except in the form of dissertation abstracts. Published papers, however, have found promising results in terms of improved mood after a yoga session and reductions in perceived stress (Netz & Lidor, 2003; Berger & Owen, 1992; West, Otte, Geher, Johnson, & Mohr, 2004). Therefore this study is a critical addition to the literature base

on the efficacy of using yoga to improve coping ability and reduce stress in this special population.

Definition of Variables and/or other Terms

(Conceptual and Operational Definitions)

Affect is defined as the emotional tone a person expresses (MedicineNet.com, 2006).

Positive Affect (PA) is state of high energy, pleasurable engagement, and alertness.

Moroseness and lethargy characterize low PA. **Negative Affect** (NA) is the dimension with aversive mood states and subjective distress. Calmness characterizes a lack of NA (Watson, Clark, & Tellegen, 1988). *Positive and Negative Affect were measured by the Positive and Negative Affect Scales.*

Anxiety is a state of apprehension, uncertainty, and fear resulting from the anticipation of a realistic or fantasized threatening event or situation, often impairing physical and psychological functioning. **Trait anxiety** reflects the existence of stable individual differences in the tendency to respond with state anxiety in the anticipation of threatening situations (Spielberger, 1983). *Scores on the State Trait Anxiety Inventory measured trait anxiety.*

Cognitive Appraisal is the process through which the person evaluates whether a particular encounter with the environment is relevant to his or her well-being, and if so, in what ways. **Primary appraisal** is when the person evaluates whether he or she has anything at stake in this encounter. **Secondary appraisal** occurs when the individual evaluates what (if anything) can be done to overcome or prevent harm or to improve the prospects for benefit (Folkman, Lazarus, Dunkel-Schetter, DeLongis, & Gruen, 1986).

Coping is defined as individuals' efforts in thought and action to manage specific demands (Lazarus, 1993). Distinctions are made in the coping literature between active and avoidant coping strategies. Active coping strategies are either behavioral or

psychological responses designed to change the nature of the stressor itself or how one thinks about it, whereas avoidant coping strategies lead people into activities (such as alcohol use) or mental states (such as withdrawal) that keep them from directly addressing stressful events. For the purposes of this paper, active coping strategies are referred to as **positive** and avoidant strategies as **negative**. Positive coping strategies are proposed to be the best ways to deal with stressful events, while negative coping strategies appear to be a psychological risk factor or marker for adverse responses to stressful life events (Holahan & Moos, 1987). *The Brief COPE measured positive and negative coping strategies.*

Hatha Yoga is one of the branches of yoga that focuses specifically on the physical postures, called ‘*asanas*’ that are integrated with a special form of breathing control, called ‘*pranayama*’. In most cases, a hatha yoga class begins with a brief meditation period. Typically, meditation is followed by a warm-up to prepare the body for the *asanas*. This warm-up period often begins with sun-salutations, or ‘*namaskar*’, which is a series of movements or postures that seek to integrate the mind and body. A hatha yoga practice concludes with a resting period, termed ‘*savasana*.’ For the purposes of this paper, when we use the word ‘yoga’, we will be referring to a **hatha yoga** practice, where the emphasis is on meditation, physical postures, and relaxation techniques (Coulter, 2001).

Metabolic Equivalent or MET, level, estimates the amount of oxygen used by the body during physical activity. For the purposes of this research, we define activities that burn less than 3.5kcal/min as low intensity, those that burn 3.5-7kcal/min as moderate

intensity, and activities that burn more than 7kcal/min as vigorous intensity. (Ainsworth, Haskell, Leon, Jacobs, Montoye, Sallis, & Paffenbarger, 1993).

Physical Activity consists of athletic, recreational or occupational activities that require physical skills and utilize strength, power, endurance, speed, flexibility, range of motion or agility (National Athletic Trainers Association, 2006).

Psychological Stress refers to a relationship with the environment that the person appraises as significant for his or her well-being and in which the demands tax or exceed available coping resources (Lazarus and Folkman, 1986).

Psychological Stress Theory identifies two processes: cognitive appraisal and coping, as critical mediators of stressful person-environment relations and their immediate and long-range outcomes (Folkman, Lazarus, Dunkel-Schetter, DeLongis, & Gruen, 1986).

Stress will be defined according to a definition by Lazarus and Folkman (1984), as a condition or feeling experienced when a person perceives that “demands exceed the personal and social resources the individual is able to mobilize.” Lazarus developed psychological stress theory which views stress as a relationship, or transaction, between individuals and their environment. *Self-reported perceived stress was measured by the Perceived Stress Scale.*

Yoga is a word originating from the Sanskrit word *yuj* meaning “to yoke, to harness.” Its initial meaning applied to spiritual endeavors, as were particularly used to control the senses. In the 3rd or 4th century BCE, the word yoga evolved to mean the “Hindu tradition of spiritual discipline, comprising of different approaches to self-realization or enlightenment.” (Feuerstein, 2000)

Chapter Two: Literature Review

Overview

This chapter serves as a literature review of the research on the burden of stress on health and its consequences for a unique population group: college-aged students. The dissertation first explored physical and psychological problems due to stress and how these issues may manifest among the target population. Since the general notion of “stress management” is one overarching solution to the correlates and consequences of stress, there is a targeted literature review on interventions and techniques used to assist in managing and reducing stress for adults and college-aged students in particular.

The literature review then explores the definition and epidemiology of yoga practice followed by an overview of the efficacy of yoga in the scientific literature for improving physical and psychological problems in adults. Additionally, yoga is explored in the context of its use as a stress management technique as well as a tool for improving other psychological indicators, such as affect, anxiety, and perceived stress.

Because this dissertation examined the effects of different forms of physical activity, (with an emphasis on hatha yoga) on perceived stress, trait anxiety, coping ability, and affect in college students, this literature review also provides a brief overview of physical activity interventions for these and other outcomes among this population. When possible, the literature review provides the methodology used in these studies, as well as potential gaps and limitations associated with current research.

This review concludes with a synopsis of the theoretical framework for this study: psychological stress theory. Constructs will be defined and additional studies will be presented that examined stress from the critical lens of this theory. The relationship

between stress, emotion, and coping will also be noted in its theoretical context, since affect is also an area of interest in this study.

Definition and Conceptualization of Stress

This literature review and this study view the concept of stress as having negative implications, or causing distress. This notion of stress is the opposite of the notion of ‘eustress’, which is a positive, desirable form of stress. Though both forms of stress can be damaging to the body, particularly over the long-term, the research reviewed in this chapter was based on the assumption that stress is negative (Seaward, 2002).

For the purposes of this paper, stress was defined in the context of a transactional model that acknowledges the interactions between individuals and their environment. Lazarus (1984) defined stress as “a condition or feeling experienced when a person perceives that demands exceed the personal and social resources the individual is able to mobilize.” Lazarus developed psychological stress theory which views stress as a relationship, or transaction, between individuals and their environment. This definition itself encompasses the traditional notion that stress originates from some external demand that exceeds one’s coping resources. Often stress manifests in pathology or some type of alteration of the environment.

Stress has been linked to chronic disease for years, but the underlying role of stress or how stress manifests in disease has been unclear until fairly recently (Lazarus, 1999). McEwen and Stellar (1993) conducted a literature review in the early 1990s and found that the typical view of stress was that if stress accumulated in the human body over time, it could lead to disease. Additionally, the authors found that individual

differences in susceptibility to stress were connected to behavioral responses to environmental stressors and were subsequently linked to physiologic response.

The word 'stress' is often paired with the term 'allostasis,' or the body's ability to adapt to meet external demands (McEwen & Seeman, 1999). Allostatic load is thus the cost of long-term exposure to fluctuating demands and the resultant neuroendocrine response when an individual reacts to those demands. McEwen (1998) and several others (Ward, Jones, & Phillips, 2003) agreed that viewing stress as a lifecourse process assists us in understanding how individual differences in predispositions, susceptibility, and perceptions of stress may or may not manifest in disease.

The interrelationship between stress and physical or psychological disease is complex. The study of stress and illness cuts across a wide-range of scientific domains such as behavioral, emotional, physiological, cognitive, and biochemical areas of inquiry. In fact, it is because "stress" is such a nebulous concept that the scientific procedures to measure it are not yet coherent and are essentially divided among endocrinological and psychological perspectives (Ward, Jones, & Phillips, 2003).

The evidence for the relationship between stress and physical disease has had a solid foundation for over the past half-century. The work of Selye (1976) and his General Adaptation Syndrome provided strong evidence to suggest that external stressors are related to autonomic stress responses, which in turn raise blood glucose and lipids, raise blood pressure, and contribute to metabolic problems.

In today's society, psychological factors account for many of the stressors for humans, which is a shift from the predominant animal and biological model that was born with Selye and concurrent research of his time (Feldman & Christensen, 1997). The

difficulty with epidemiological studies that only examine psychological factors is that they rely on self-report data, which is often found to be biased in favor of higher reporting for persons who already have symptoms of a disease (MacLeod & Davey-Smith, 2002). Furthermore, another difficulty in stress research is that stressors are perceived differently by different individuals. This issue reinforces the need to study stress from a lifecourse perspective in order to understand how early environmental and genetic influences impact psychological and biological responses in individuals (Ward, Jones, & Phillips; 2003).

The Public Health Burden of Stress & Stress-Related Outcomes

Because the field of stress research is so broad, an inclusive perspective enables us to quantify the ‘burden’ of stress on society and on the individual. The cost of stress in the United States needs to consider the research that links stress and disease and subsequently quantifies the *outcomes* that are related to stress instead of simply measuring ‘stress’ itself in a population.

For instance, various illness outcomes of stress include biomedical disease that is manifested in certain organ systems, such as neurological disorders, cardiovascular disease, and immune disorders. Stress also exhibits itself through emotional and cognitive disorders such as depression and anxiety and is evidenced through behavioral disorders such as impaired performance in life areas, aberrant anti-social behaviors, or overuse of medical resources (Hemmingway & Marmot, 1999; MacLeod & Davey Smith, 2002; Brunner, 2002). In fact, Boone and Christensen (1997) estimated that up to 70 percent of visits to clinicians were related to either stress or lifestyle, giving us an idea of the high economic cost of diseases associated with stress.

For psychological disorders related to stress, the economic burden is quite high (Greenberg, Kessler, Birnbaum, Leong, Lowe, Berglund, & Corey-Lisle, 2003). Using a human capital approach, researchers devised a new prevalence-based estimate of depression using three major cost categories associated with depression: direct costs, mortality costs arising from depression-related suicides, and costs associated with depression in the workplace. Results indicated that depression cost \$83.1 billion to the United States in 2000, the majority of which was represented by workplace costs.

Depression imposes significant costs on sufferers, their families and care-givers, employers, and insurance payers. Greenberg and Birnbaum (2005) provided an overview of the economic burden of depression in the U.S. giving societal and patient perspectives. This illness was often measured in terms of societal cost-of-illness studies and could also be viewed from the perspective of patient-level results, which underscored the magnitude of the direct and indirect economic burden of depression. For instance, using a multi-employer claims database for the six largest employers in the United States, Goetzel (2003) found that the most costly mental health condition was bipolar disorder, with major depression ranking second.

Additionally, Stewart, Ricci, Chee, Hahn and Morgenstein (2003) analyzed the workplace costs of depression among adults who participated in a national audit of productivity. The authors estimated the costs of lost work time among employees with depression at \$31 billion, of which \$27 billion (81%) were associated with presenteeism and only \$4 billion (19%) were attributed to absenteeism. These findings indicated that persons prone to stress and perhaps subsequent depression at work were not as productive as other coworkers.

According to the National Institute of Mental Health (2006), anxiety disorders affect approximately 19 million people each year and are often due to various types of stressors. While mild anxiety is typically provoked by some stressful event, anxiety disorders are chronic and can become worse if they are not treated (Kjernisted & Bleau, 2004). There are a handful of types of anxiety disorders, including social anxiety, post-traumatic stress syndrome, phobias, and panic disorders, but for the purposes of this paper, we will focus only on generalized anxiety disorder (GAD).

GAD is a chronic disease that involves constant and excessive worry, and the source of the worry is often difficult to define for the patient (National Library of Medicine, 2004). Worrying is often accompanied by physical symptoms such as fatigue, muscle tension and aches, and irritability. Persons with GAD characteristically have difficulty relaxing and may have difficulty carrying out ordinary daily activities (National Library of Medicine, 2004). There is some argument as to the prevalence of GAD in the United States (Narrow, Rae, Robins, & Regier, 2002); however, most estimates show a current point prevalence of 1.5% to 3.0%. Additionally, high rates of comorbid conditions accompany GAD, such as other mood disorders and other anxiety disorders (Kessler, Keller, & Wittchen, 2001). Anxiety disorders have shown a similar burden pattern to society as depressive disorders (Stewart, Ricci, Chee, Hahn, & Morganstein, 2003). Since stress is a major contributing factor to the development of anxiety disorders, we must include these issues as part of the burden of stress on society.

Finally, the burden of chronic diseases on the United States population is overwhelming and goes beyond the scope of this paper. However, since cardiovascular disease, diabetes, and other lifestyle diseases are often linked with stress, it is logical that

we would attempt to quantify cost-estimates of these health problems in order to find an indirect measure of the burden of stress that is related to these diseases. Thorpe (2005) argued that much of the growth in health care spending over the past two decades was linked to modifiable population risk factors such as obesity and stress. Additionally, he indicated that rising disease prevalence and new medical treatments were the main cause for the majority of this increase.

Stress and College Populations

In terms of college students, the burden of depression, anxiety, and related disorders has not been well documented. For instance, there are estimates of prevalence of risk behaviors in this population (CDC, 1997), but the outcomes of those behaviors merit more study. Depression has been shown to affect academic performance and work life among college students (Hysenbegasi, Hass, & Rowland, 2005). Depression and anxiety have also been found to co-exist with drug use, sleep disturbances, and aggression in this population (Ridner, 2005; Moo-Estrella, Perez-Benitez, Solis-Rodriguez, & Arankowsky-Sandoval, 2005; Storch, Bagner, Geffken, & Baumeister, 2004).

The amelioration of health and the management of stress are two priorities that are related to national goals set by Healthy People 2010 (DHHS, 2000). HP 2010 set health objectives designed to identify the most significant preventable threats to health and to establish national goals to reduce these threats. One offshoot of HP 2010 is 'Healthy Campus 2010,' which establishes national health objectives and acts as a model for developing college health programs (American College Health Association, 2006).

Many objectives in the Healthy Campus plan are related directly or indirectly to the management of stress. For instance, this document identified “coping with stress in competitive academic environments” as a high priority issue. Preliminary data that led to the development of this national plan also indicated that levels of stress among college students were worse than national averages of persons in the same age group. Mental health problems and “stress” were found at higher rates in campuses, with 30 percent of students reporting poor grades and dropping out due to “stress.” Finally, the document suggested making a key priority out of “reducing the proportion of students with the impediment of learning with co-existing negative stress” (American College Health Association, 2004).

Most of the research quantifying the burden of stress looks at either clinical populations, occupational groups, or at the public as a whole. The study of stress on college populations is not new; however, it has gained more attention in the past two decades, as this group has experienced a rise in morbidity and mortality that is associated with many risk behaviors unique to this group. Additionally, college and university students have unique daily experiences that act as stressors and may impact health (Garret, 2001). The impact of stress on college students had been shown to hinder academic success as well (Murff, 2005).

As a way of assessing the impact of stress on college populations, the American College Health Association (2004) conducted a recent national survey of 13,500 college students. They found that almost half (45%) reported being so depressed that they had difficulty functioning, and almost all (94%) reported feeling overwhelmed by the variety and number of tasks they had to do. Students use harmful health behaviors as a means to

manage stress, such as binge drinking, substance abuse, and risky sexual activity (Weschler, Lee, Kuo, Nelson, & Lee, 2002; Kelly, Rollings, & Harmon, 2005).

Kadison (2005) estimated that between one-fourth to one-half of all U.S. college students who are seen in college health and counseling centers were taking antidepressants as a result of stressors that were unique to the college environment. He further postulated that many students were abusing these drugs either by taking them in excess or by not using the drugs for the purpose for which they were intended. His research suggested that, since college students often feel stress from being “over-extended” due to academic, social, and financial pressures, they may turn to substance abuse to alleviate the stress.

Many other risk behaviors are endemic to college-aged students. Results from the 1995 National College Health Risk Behavior Survey indicated that risky behaviors among 18-24 year olds increased their likelihood of deleterious health outcomes. Approximately one-third of students reported binge drinking or driving a vehicle under the influence of alcohol during the 30 days preceding the survey, and nearly half of the students reported ever trying marijuana (Douglas, Collins, Warren, Kann, Gold, Clayton, Ross, & Kolbe, 1997). Drug and alcohol use are important in the study of stress because studies have shown that college smokers have higher levels of perceived stress than nonsmokers and have higher levels of avoidant coping strategies (Naquin & Gilbert, 1996).

In a subsequent national study of college students, The National College Health Assessment Survey (NCHA) measured depression, suicidal ideation, and suicide attempts among approximately 16,000 college students in the academic year 1999–2000

(American College Health Association, 2006). Results indicated that almost ten percent of students reported that they had seriously considered attempting suicide, and a small minority (1.5%) of students reported that they had attempted suicide within the last school year. The study also found that depressed mood, relationship problems, and issues with sexual identity contributed to increased likelihood of suicidal behavior (Kisch, Leino, & Silverman, 2005).

Sources of Stress among College Students

Stress among college students and adolescents can be detrimental and have unintended side effects such as suicidal ideation, substance abuse, poor academic performance, and other physical and mental consequences (Kadison, 2005; Hirsch & Ellis, 1995; Naquin & Gilbert, 1996; Broman, 2005). Ross (1999) reviewed the major sources of stress reported by college students by administering the Student Stress Survey (SSS) to 100 students at a mid-sized university. The major sources of stress on the scale ranged from daily hassles to major life events. Overall, results showed that daily hassles were reported with greater frequency than major life events and that interpersonal relationships were often the greatest stressors. The top five sources of stress reported by this sample were changes in sleeping habits, vacations and breaks, changes in eating habits, increased work load, and new responsibilities.

Perceived stress and stressors are not necessarily consistent across all college students. For example, these constructs have been found to differ between traditional and nontraditional students (Morris, Brooks, & May, 2003). Traditional students are often younger, unmarried, and are not employed full-time. Their main 'occupation' is going to

school full-time. Conversely, nontraditional students may be married and have children, are older, and go to school in the evenings.

Dill and Henley (1998) conducted a survey which found that these groups differed in concerns about various areas, including academic concerns, social relations, family and network, autonomy and responsibility, and intimacy. Traditional students worried more about academic performance and were less likely to enjoy going to classes than nontraditional students. Despite these differences, both groups rated many aspects of college life as being stressful, which could manifest in tension and anxiety despite their traditional or nontraditional status.

Similarly, there are differences in stress, active coping, and academic performance among persisting and nonpersisting college students. Persisters are defined as those students who remained in courses through an academic year, versus nonpersisters who left after the fall semester. Shields (2001) found that reported stress had a negative effect on grade point average (GPA) among persisters, but there was an indirect positive effect on grades when these students used positive coping skills. Additionally, active coping strategies were strongly related to retention rates among persisters.

This study was unique from the others presented because it took the view that stress did not have to be a negative experience. In other words, the individual can perceive stress as either challenging or threatening. Events that were perceived as challenging led to positive coping responses (trying harder in school) while threatening events were often met with avoidant and negative coping responses such as dropping out, or in this case, nonpersisting in college. This study has important ramifications for understanding better

adjustment to college for students who use active coping methods (Aspinwall & Taylor, 1992).

Research has also shown that students and faculty at colleges and universities can perceive stress in different ways (Gmelch, Wilke, Lovrich, 1986; Misra, 2000). Misra (2000) examined the academic stress of college students by comparing student and faculty perceptions noted that these two sets of individuals differed significantly in their perceptions of students' stressors and reactions to those stressors. This research found that faculty members perceived that their students experienced higher amounts of stress than students actually reported. However, both students and faculty agreed that main sources of student stress related to competition, meeting deadlines, and interpersonal relationships. Students also reported their reactions to stress in terms of emotional (i.e., fear, anxiety, worry) and cognitive themes (i.e., appraisal of situations and the use of strategies). The study also confirmed other articles' findings that suggested that students may perceive stress differently by year of school, with the freshman year often being rated as the most stressful (Allen & Hiebert, 1991; Rawson, Bloomer, & Kendall, 1994).

In another study on stress at college, Hudd and colleagues (2000) examined the effects of self-reported stress on health habits, health status, and self-esteem among 225 undergraduate students in randomly selected dorm rooms on-campus. The outcome measures of interest were demographic data, health status and habit data, self-esteem, and frequency of feeling stressed. Over half of the students indicated high levels of stress during a typical semester, as indicated by feeling stressed 'all, most, or a good bit of the time.'

Females were most likely to be stressed and athletes were reportedly less stressed than nonathletes. Stress responses were related to the practice of other health behaviors. Those who experienced high levels of stress were more likely to have had alcohol within the past twenty-four hours and were more likely to eat junk food than lower stressed groups. These findings were confirmed in another study on perceived stress among adults, with higher ratings of stress being associated with negative health behaviors (Ng & Jeffrey, 2003)

Perceived stress may also play a role on one's reactions to beneficial health messages. Millar (2005) hypothesized that increases in perceived stress would hamper college students' ability to process messages that encouraged disease detection behaviors. This study used the Perceived Stress Scale to measure current stress experienced in the past month, and other self-report measures that were taken on perceived health status. After students completed the measures, they were asked to read one of six persuasive health messages that encouraged either the performance of a health promotion or disease detection behavior.

After reading the health messages, students were asked to rate their amount of agreement with the message, and they were asked to recall as much of the message as possible by typing what they remembered into a computer. The results indicated that increases in perceived stress were associated with shorter reading times of the health messages and poorer message recall. The implication here, as discussed by the author, is that persons with high stress levels may be prone to avoid health detection behaviors. In college populations in particular this could have serious ramifications for those with

sexually transmitted infections, mental health problems, and other health issues that would benefit from early detection and treatment.

There were several limitations across these studies. The research by Hudd, Dumlao, Erdmann-Sager, Murray, Phan, Soukas, and Yokozura (2000) had the limitation of a low-response rate (approximately 60%), and most of the respondents were seniors and white. Additionally, the researchers required the students to post the completed questionnaires outside of the students' dorm rooms for pick up, suggesting a potential selection bias among individuals who may have felt freer to disclose certain opinions. The study also did not have a standard index assessing stress, but simply one question measuring this construct. However, this research did show an existing relationship between perceived stress and unhealthy behaviors, which therefore helped in quantifying the burden of stress among this group.

Other studies suffered from methodological concerns in addition to low response rates such as small study samples and lack of statistical power, non-randomized designs, self-section biases, and short or no follow-up periods. Additionally, some studies measured perceived stress only and did not make any attempts to control for the number of actual or perceived stressful events that were currently in the students' lives or that had occurred previously (Shields, 2001; Dill & Henley, 1998; Lochbaum, Lutz, Sell, Ready & Carson, 2004).

Stress Interventions through Arousal Reduction

Clinicians and health practitioners have several potential foci for stress management techniques as means to illness prevention (Greenberg, 2002). Strategies are typically tailored to specific psychosocial, behavioral, and pharmacological interventions.

For instance, psychological counseling may assist patients about perception and coping with stressful situations. Arousal reduction techniques have also been recommended in recent years and are gaining popularity. Examples of such approaches are meditation, hypnosis, relaxation exercises, massage, tai chi, yoga, and music therapy (Birnbaum & Christensen, 1997; Sandlund & Norlander, 2000).

This part of the literature review will focus on one particular type of arousal reduction intervention and briefly on physical activity studies to assess their effects on stress responses. Arousal reduction is often referred to as ‘stress management’ (Parshad, 2004). Several components of arousal reduction are utilized in stress management interventions, including: breathing techniques, visualization, thought distraction, muscle relaxation, and meditation. For the purposes of this paper, we will focus on the physical practice of *yoga*, which is widely used for stress management because it incorporates many of the arousal reduction components mentioned above (Gura, 2002; Feuerstein, 2002).

Definition of Yoga

Before continuing to explore the efficacy of yoga interventions on specific population groups, having a common working definition of this term is helpful, since “yoga” can be interpreted in many different ways. The word yoga has a wide range of meanings from its origin in the Sanskrit language. However, early in yoga’s development, this term became applied to spiritual endeavors that were specifically used to control the mind and the senses (Feuerstein, 2001). While this meaning dates back to the second millennium BCE, the current meaning of ‘yoga’ does not stray far from this early interpretation. As time progressed, the word yoga was used in the Bhagavad Gita, a

sacred Indian text, to mean “the Hindu tradition of spiritual discipline, comprising different approaches to Self-realization, or enlightenment” (Feuerstein, 2000; Feuerstein, 2001).

Yoga in modern society takes many different forms but still retains its central purpose as that of quieting the mind and the sensory system as a means to enlightenment (Feuerstein, 2001). While a common perception of yoga practice may be that it is a simply a series of physical positions to enhance flexibility, this is only one interpretation and variant of what yoga practice is. Yoga is an overarching term for a philosophical discipline that evolved over several centuries with the ultimate goal of transcending the human condition of *dukkha*, or suffering, due to self-seeking behaviors (Feuerstein, 2001; Feuerstein, 2000).

Within Hinduism, there are six major forms of yoga practiced globally, each of which has its own branches, guidelines, and tenets (Whicher, 1998). These six types are *raja yoga*, *jhana yoga*, *bhakti yoga*, *karma yoga*, *mantra yoga*, and *hatha yoga*. For the purposes of this paper, we will focus on *hatha yoga*. All other forms of yoga mentioned above place extra emphasis on one of the following: prayer, renunciation, self-surrendered action, and higher intuitive knowledge. While *hatha yoga* has the same fundamental objective of any other form of yoga, it focuses on developing the physical body’s potential so that the body can withstand demands from the outside world (Iyengar, 1995).

Hatha yoga is a non-religious system that emerged from Indian culture approximately 4000 years ago. It differs from other forms of yoga because of its focus on three elements: postures, or *asanas*; breathing exercises, or *pranayama*; and meditation.

All of these components are integrated in the practice of Hatha yoga and are complementary. Yoga postures are designed to strengthen and stretch the body. The controlled breathwork is said to improve mental focus and relaxation, and the meditational component, called *dhyana*, focuses as well as calms the mind (Coulter, 2001; Feuerstein, 2001).

Western medicine offers several overarching physiological explanations as to why yoga might be effective in disease prevention and the treatment of illness (Riley, 2004). The first explanation is the modulation of the autonomic nervous system that leads to a relaxation response (Parshad, 2004). The second explanation centers on muscular flexion and extension as a means to enhance the relaxation response in the neuromuscular system. Meditation is also purported to stimulate the limbic system, which regulates emotion.

Epidemiology of Yoga Practice in the United States

Yoga practice has grown substantially in the United States in the past two decades and has accompanied the general rising trend of Complementary and Alternative Medicine (CAM) usage by Americans. Data from a 1990 survey of CAM use that suggested unconventional medical use was on the rise in the United States (Eisenberg, Kessler, & Foster, 1993). Eisenberg, Davis, Ettner, Appel, Van Rampay, and Kessler (1998) followed up on this study with a survey that documented trends in CAM use from 1990-1997.

This nationally representative random household telephone survey studied the prevalence, estimated costs, and disclosure of alternative therapies to physicians. This study reported that from 1990 to 1997, there was a 47.3 percent increase in total visits to Alternative Medicine practitioners (approx. 629 million visits) and a significant

increase in the usage of such therapies as herbal medicine, massage, vitamins, homeopathy, and energy healing. While this study did not include yoga, it was one of the first to document that persons were using CAM for specific health problems and that the patterns of use of CAM varied demographically. For instance, CAM users were typically women, younger, college-educated, and had higher incomes.

In a more recent study, Tindle, Davis, Phillips, and Eisenberg (2005) used the Alternative Health/Complementary and Alternative Medicine supplement to the 2002 National Health Interview Survey to document trends in CAM use from 1997-2002. Their main outcome measures were prevalence, sociodemographic correlates, and insurance coverage of CAM use by U.S. adults. This survey found that the greatest relative increase in CAM use for this time-frame was seen for herbal medicine usage and yoga practice, with an increase in yoga practice from 3.7 to 5.1 percent of Americans from 1997 to 2002. Again, researchers noted the factors associated with the highest rates of CAM usage to be female gender, non-black/non-Hispanic race, higher income, and ages 40-64.

After these two large studies of CAM usage, researchers began to study the growth of yoga as a particular form of CAM. In the first published study on yoga prevalence and patterns of use in the U.S., a national survey conducted in found 7.5 percent of Americans used yoga at least once in their lifetime, and 3.8 percent of citizens had practiced yoga in the past year (Saper, Eisenberg, Davis, Culpepper, and Phillips, 2004). Yoga users were significantly more often female, ages 40-64, educated beyond high school, and resided in urban areas. Persons who practiced yoga were also more likely to use other forms of CAM therapy. The study also noted that during the past year,

approximately two-thirds (64%) of persons reported using yoga for wellness, and almost half (48%) used it for health conditions, notably back or neck pain. The vast majority of yoga users (90%) believed yoga to be very or somewhat helpful, and a little over three-fourths of participants did not report any expenses related to yoga.

Published Research on Yoga and Physical and Psychological Health

As of January 2007, a Pubmed and Medline search with the word “yoga” in the title of journal articles yielded 392 hits from years 1951 to the present. When the search was expanded to include the word yoga in the title *and* abstracts of these databases, the number of articles reached 628. A further bibliometric analysis using the psycINFO database resulted in 302 hits with the word “yoga” in the titles of article and books, from years 1896 until present. Thus, we can see that while yoga participation has been on the rise in the past several decades, the scientific work on the efficacy of yoga trials has just begun, and the exploration of yoga for its psychological and physical benefits can be said to be somewhat in its infancy.

Khalsa (2004) conducted his own bibliometric analysis of published research studies on yoga as a therapeutic intervention. The analysis showed that the growth of yoga in clinical research had grown since the 1970s, most of it in the form of clinical trials. A variety of physical diseases had been studied, most clustering around cardiovascular and respiratory diseases as well as psychopathological concerns. Khalsa also noted that the majority of this research has been published in Indian journals and by Indian investigators, though he believed this trend was shifting in the United States as well.

Including the groupings listed above of clinical trials associated with yoga, most of the literature focused on special populations, either patients with some disease,

minority groups, or different age groups (Manjunath & Telles, 2005). For instance, research assessing nine studies on yoga for cancer patients and survivors indicated that yoga practice yielded modest results in mood, stress, sleep quality, cancer-related symptoms and overall quality-of-life (Bower, Woolery, Sternlieb, & Garet, 2005). A more recent study noted similar physical and psychological benefits of yoga in terms of improved physical fitness and psychosocial variables such as emotional irritability, cognitive disorganization, and mood disturbances for people with cancer (Culos-Reed, Carlson, Daroux, & Hatley-Aldous, 2005).

Clinical trials have recently grown in number to test theories about yoga's efficacy to improve physical problems. In fact, yoga has been shown to reduce physical deterioration in patients with post-polio syndrome, reduce insomnia, improve cardiovascular functioning, improve carpal tunnel syndrome, relieve irritable bowel syndrome, and many others (Demayo, Singh, Duryea, & Riley, 2004; Khalsa, 2004; Jayasinghe, 2004; Garfinkel, Singhal, Katz, Allan, Reshetar, & Schumacher, 1998; Taneja, Deepak, Poojary, Acharya, Pandey, & Sharma, 2004).

Studies also focused on the physical benefits to community-dwelling adults, but these studies were in the minority. One recent study that was often cited in the popular press examined participants aged 50 to 76 who were part of a cohort study on vitamins and lifestyle (Kristal, Littman, Benitez, & White, 2005). The authors found that yoga practice was associated with attenuated weight gain in healthy middle-aged men and women. Though the results of this study were not used for causal inference, the authors postulated that consistent yoga practice could benefit persons who wish to lose or maintain weight.

In a study of the physiological and psychological effect of hatha yoga exercise in healthy women, Schell, Allolio and Schonecke (1994) found that the yoga group had a significant decrease in heart rate compared to the control group. Further significant differences were found between experimental and control groups with respect to psychological parameters. The personality inventory given to both groups yielded lower scores in excitability, aggressiveness, emotionality, and somatic complaints among yoga participants as well as higher levels of life satisfaction among practitioners. At the conclusion of this experiment, the yoga group also had lower levels of stress and higher positive affect than controls.

Not only has yoga been found to ameliorate physiologic function, it has also been a preferred method of healing chronic conditions as compared to other treatments. For instance, in a study of patients who had recurrent and persistent lower back pain, low-back function was improved and chronic low-back pain was significantly decreased for a yoga group when compared to an exercise and self-care condition (Sherman, Cherkin, Erro, Miglioretti, & Deyo, 2005). Yoga also improved self-rated sleep in a geriatric population and decreased the amount of time taken to fall asleep as compared to groups who received Ayurveda (Manjunath and Telles, 2005). Ayurveda is an ancient Indian discipline covering a wide range of health measures, particularly massage and herbal preparations.

Research has also supposed supported yoga's efficacy in the treatment of several affective disorders including anxiety, depression, and schizophrenia. In a meta-analysis of research conducted on yoga and depression, the authors found overall positive effects of yoga practice on depressed mood (Pilkington, Kirkwood, Rampes,

& Richardson, 2005). Another meta-analysis suggested the likely benefit of yoga on anxiety-related disorders, with the caveat that there was a need to account for methodological weaknesses in several of the existing studies (Kirkwood, Rampes, Tuffrey, Richardson, Pilkington, & Ramaratnam, 2005).

For instance, both the research on yoga for depression and anxiety have suffered from lack of detail in describing research methods, non-randomization of subjects, non-blinded assessment, and arbitrary cut-off points for outcome measure differences. Additionally, few studies provided power calculations, and almost none speak to the clinical significance of results. The authors noted that despite these inadequacies, results were still promising for yoga as a treatment for anxiety.

Unpublished and “In Progress” Research on Yoga and Health

The National Institutes of Health, one of the top funding agencies for health-related grants in this country, funded approximately 47,300 research grants in 2005 (National Institutes of Health, 2007). Grants are funded based on public health priority which can be measured in disease burden, community concern, and other factors which shape the climate of health research in this country (American Public Health Association, 2006).

NIH-funded research on the effects of yoga on health outcomes has represented a small fraction of a percentage of total grants awarded at NIH. Despite the advent of the National Center of Complementary and Alternative Medicine (NCCAM) in 1999, most of the funded grants on yoga were granted through the other 26 agencies or centers of NIH. From 1972 until present, only 39 research grants with yoga in their title have been funded, though other studies may have yoga interventions as part of their protocols.

Among the 39 funded grants on yoga, only two have relevance for the current proposed dissertation in terms of looking at stress and anxiety and the results of these grants are yet unpublished. These two grants are entitled “Yoga, Health, and Meditation” and “Yoga for Generalized Anxiety Disorder,” with Principal Investigators Frederick Hecht and Peter Wolsko, respectively (Computer Retrieval of Information on Scientific Projects, 2006).

The first study created an international collaboration between University of California at San Francisco and a large yoga center in India for the purpose of conducting Phase I and Phase II studies. The research examines the effects of yoga on diurnal variations in cortisol levels and the potential influence of these levels on diabetes. Preliminary data was also collected on the effects of yoga on depression, quality of life, and immunologic outcomes.

The second study by Wolsko obtained preliminary estimates of the safety and efficacy of a yoga treatment or a wait-list control group on generalized anxiety disorder (GAD). The main outcome measure was difference over the course of the study on the Hamilton Anxiety Scale, but they were also considering many other self-report measures, including the State Trait Anxiety Inventory. There are other self-report measures in the study that assess quality of life and one’s sense of coherence.

Given that these are the only two studies funded at NIH with a central treatment focus of yoga on stress-related outcomes, much more work needs to be done to understand and explain yoga’s potential efficacy to improve or enhance mediators and moderators that are associated with stress and health events. The rationale for this dissertation topic came from the dearth of research on this topic and some initial focus

group findings from another more recent study conducted in late 2005 by researchers at University of Maryland.

Atkinson and Permuth-Levine (submitted, 2007) sought to explore perceived benefits, barriers, and expectations of yoga practice among adults. They conducted six focus groups, two each with: 1) persons who had never practiced yoga, 2) practitioners of one year or less, and 3) practitioners for more than one year. The Health Belief Model was the theoretical foundation of inquiry. Results indicated that all participants acknowledged a variety of benefits of yoga practice. Additionally, every focus group mentioned that yoga was a technique used to deal with stress, more than other forms of physical activity.

Persons who had practiced yoga for more than one year noted that yoga improved their ability to cope with stressful situations and improved communication with their spouses and other people in general. This quote from a 55-year old male illustrated this point, “There is something about yoga that makes me more even-keeled. I don’t get angry as easily. I stop to think about what I am saying and that definitely helps my relationship with my wife.” When the other focus group members were asked to react to this sentiment, they were unanimous in their agreement.

Thus focus group findings strongly suggested that persons who practiced yoga, especially those who have practiced yoga longer (i.e., who were not new to yoga), tended to perceive stressful situations differently. Yoga participants often received positive messages from their teachers in class telling them to be respectful of their bodies and to be accepting of themselves – not to push beyond their limits. It could be that these positive messages created helpful internal dialogues that mediated the impact of negative

thoughts so that subsequent perceptions of stress were not viewed as so portentous or ominous. Mediated cognition could then also lead to more positive health behaviors.

Finally, an unpublished dissertation by Oleshansky (2004) found similar results to this study using the COPE for her primary measure of coping. The researcher recruited 111 adult men and women who did and did not practice Hatha yoga in an exploration of the relationships between Hatha yoga use, stress levels, coping skills, and self-efficacy. Oleshansky used the full COPE questionnaire as opposed to the Brief COPE that was used in this study. She combined subscales to assess general coping patterns, with higher scores indicating higher use of coping strategies.

While her research examined adults in the population as opposed to college-aged students, she found no significant differences in levels of daily stress in persons who did and did not use Hatha yoga, nor did she find that levels of stress declined with increased number of yoga classes per week. Oleshansky did find that persons in the yoga group used a greater number of coping skills during stressful situations than individuals who did not practice yoga.

There are several key differences between the Oleshansky dissertation and the current research, but both studies found an increased use of coping strategies in yoga participants as opposed to persons who do other forms of exercise. The Oleshansky study, however, did not differentiate between positive and negative coping strategies, or in her terms, “adaptive and maladaptive strategies.”

The Role of Yoga in Stress Management and Anxiety Reduction

The role of yoga in stress management has been an area of interest in the scientific literature and has been of much interest in CAM and western medicine because of the

growing belief that mind and body systems are interrelated. Parshad (2004) argued that the practice of Hatha yoga sends messages to the muscles to relax and in turn enables the individual to expand this relaxation principle to one's sub-conscious mind in order to be able to control involuntary muscles and physiological functioning of the body. Given that subconscious processes are not easily amenable to scientific study, a body of literature has attempted to operationalize physiologic changes that may accompany yoga practice.

For instance, studies have shown that the physical postures of yoga enhance muscular strength and flexibility as well as promote oxygen uptake and improve blood circulation (Telles, Reddy, & Nagendra, 2000; Khanam, Sachdeva, Guleria, & Deepak, 1996; Tran, Holly, Lashbrook, & Amsterdam, 2001). The meditational aspects of yoga are postulated to help regulate the autonomic nervous system (Lazar, Bush, Gollub, Fricchione, Khalse, & Benson, 2000). Because of these physiological benefits, yoga participants may become more resilient to environmental stressors thus reducing their risk for acute and chronic diseases (Parshad, 2004).

One component of hatha yoga practice, namely yogic breathing, has been shown to improve stress, anxiety, and depression in clinical populations (Khalsa, 2006). This form of breathing, called *pranayama* can be comprised of numerous techniques, yet the goal of these techniques is for the practitioner to gain conscious control of the breathing process (Feuerstein, 2001). Brown and Gerbarg (2005) conducted a review of the use of *Sudarshan Kriya*, a particular type of pranayama, in clinical studies and found improvements in depression after one week of this technique. Further, if patients with

mild to moderate depression had repeated the breathing treatments frequently, they produced better outcomes over time than persons who discontinued treatment.

Studies have also shown that yoga programs that include breathing exercises and meditation have shown benefits in clinical populations with anxiety disorders, medical students with exam-related anxiety, persons in the workplace, and caregivers of demented patients. Breath work has also been shown to improve insomnia and post-traumatic stress disorder (Malathi & Damodaran, 1999; Gura, 2002; Waelde, Thompson, & Gallagher-Thompson, 2004). The meditational component of yoga was also helpful in combating stress and treating psychological problems. Shannahoff-Khalsa (2004) utilized a protocol of meditation techniques to improve Obsessive-Compulsive Disorder (OCD), which is one type of anxiety disorder. His study found that yogic breathing was helpful in ameliorating symptoms of OCS and mentioned other studies that were under way to test different components of yoga practice and their effects on various anxiety-related outcomes.

In addition to improving health outcomes, Malathi, Damodaran, Shah, Patil, and Maratha (2000) found yoga to improve self-reported mood and well being among research participants. In a study of 50 volunteers who participated in a four-month yoga course, subjective well being and self-reported quality of life improved significantly. Though this study did not have a control group, it has been one of the only studies that broke down the components of subjective well-being into several factors (measured by the Subjective Well Being Scale). The two most statistically significant changes were in improved coping ability and reduced anxiety over physical and mental ailments after the intervention than at baseline.

Yoga has been shown to combat psychological stress as well. Waelde, Thomson, and Thompson (2004) found that a combined yoga and meditation intervention improved subjective improvements in physical and emotional functioning among caregivers for patients with dementia. They conducted a controlled prospective non-randomized study in 24 self-referred female subjects who perceived themselves as emotionally distressed. Sixteen subjects were in the experimental group and the remainder was on a wait-list control. The experimental condition received two yoga classes per week for three months. Outcome measures were scores on the Perceived Stress Scale (PSS), State-Trait Anxiety Inventory (STAI), Profile of Mood States (POMS), a depression scale and other well-being and physical symptom inventories. The experimental group reported significantly less perceived stress, less anxiety, and less physical symptoms than the control group.

Yoga Interventions among College Students

Yoga interventions in the college student population were not common in recent literature reviews in the psychological, sociological, and public health literature. However, given that college students are an accessible population for many researchers, there were some research studies that examined the relationship between yoga and various outcomes in this group.

In a comprehensive mind/body intervention to reduce psychological distress and perceived stress in college students, researchers found that the experimental group had significantly greater reductions in psychological distress, state anxiety, and perceived stress than the control group (Deckro, Ballinger, Hoyt, Wilcher, Dusek, Myers, Greenberg, Rosenthal, & Benson, 2002). These researchers examined the

effect of a six-week intervention that incorporated various relaxation-response-based skills (including yoga), cognitive behavioral interventions, lecture, and individual practice on an experimental group of 50 students and a similar number of controls.

In their pre-test for this study, the researchers used the Symptom Checklist-90 to measure psychological distress, as well as the Spielberger State-Trait Anxiety Inventory (STAI), the Perceived Stress Scale (PSS) and other assessments on demographics and health promotion activities. In the pre-test, almost three-fourths of all students reported having “excessive stress” in their lives, and two-thirds of students rated themselves as being “more anxious than most people.” Students reported several health-related problems as well.

West, Otte, Geher, Johnson, and Mohr (2004) examined the effects of hatha yoga and African dance on perceived stress, affect, and salivary cortisol on college students. The authors used the Perceived Stress Scale and the Positive and Negative Affect Schedule to measure stress and mood. Results indicated that while both dance and yoga reduced perceived stress and negative affect, only yoga led to decreased cortisol, which indicated that yoga participation could be a salient factor in decreasing physiological arousal related to the development of disease.

Only a few other studies have studied the effects of yoga on mood in college students. Berger and Owen (1992) compared the mood benefits of hatha yoga and swimming among 87 college students. After the intervention, yoga students had greater decreases in scores in anger, confusion, depression, and tension than the swimmers and a control group receiving a lecture. Further, this study demonstrated that students who attended all classes more regularly reported more psychological benefits than those who

did not. Berger and Owen's (1988) earlier study comparing four different modes of physical exercise on mood enhancement and stress, which included yoga, fencing, weight training, and swimming found similar results in that *all* of these activities reduced self-reported stress and enhanced mood.

Woolery, Myers, Sternlieb, and Zeltzer (2004) also confirmed yoga's positive effect on improving negative affect. These researchers conducted a study on adults aged 18-29 with elevated symptoms of depression. Subjects either participated in a short yoga course or a wait-list control. Participants in the yoga course demonstrated significant decreases in self-reported symptoms of depression and trait anxiety. These changes began mid-way through the yoga course and persisted until the end of the study. Netz and Lidor (2003) found that even one yoga session could lead to improved mood and suggested that yoga and mindfulness-based exercises should be offered to communities as a means to improve anxiety and affect.

Physical Activity Interventions among College Students

Physical exercise is a well-known means of reducing stress and improving health outcomes across different population groups. Increasing physical activity has been suggested to improve psychological and emotional well-being and has been shown to reduce reactivity to psychological stress (Gauvin & Spence, 1995; Calvo, Szabo & Capafons, 1996; Jin, 1994; Sandlund & Norlander, 2000). Generally, participants engaging in regular physical activity have displayed more desirable health outcomes across a variety of physical conditions. Clinical trials on various forms of physical activity have shown several positive health outcomes, including better general and health-

related quality of life, better functional capacity, and better mood states (Penedo & Dahn, 2005).

Several interventions have shown the efficacy of different modes of physical activity in improving stress, perceived stress, and mood among college and university students. Bass, Enochs, and DiBrezzo (2002) compared weight-training versus aerobic dance on psychological stress in college students using the Survey of Recent Life Experiences to appraise stressfulness of experiences before and after the exercise intervention. The weight-training group (n=45) experienced an immediate reduction in post-exercise stress after the eight-week intervention; however, neither the control group (n=34) nor aerobic group (n=35) experienced this effect.

Given the limitation of the short nature of the intervention period, this study did show that stress reduction could be one of the immediate benefits of an exercise session. The authors also recommended that students enjoy the mode of exercise in which they are engaging to reap the most positive change in affect post-workout (Miller, Bartholomew, & Springer; 2005; Lane, Jackson, & Terry, 2005).

Lochbaum and colleagues (2005) found evidence that physical activity may serve to lessen the relationship between stress and health complaints in college students. University participants completed a battery of questionnaires in order to assess their health concerns, personality characteristics, and perceived stress. Results indicated that perceived stress was a significant predictor of health complaints. These and other studies show that physical activity in almost any form serves to lessen stress and improve mood among the general population, as well as for college students.

Given that various forms of physical activity have been shown to benefit college students, an investigation of whether hatha yoga could bring the same results to this population was a logical direction to expand this line of growing research.

Psychological Stress Theory

This study is guided by psychological stress and coping theory. This framework is an outgrowth of the physiological theory of stress, first proposed by Selye (1976). The theory is based upon the premise that stress has an effect on a person's coping ability and the ability to adapt to the pressures of injury and disease. Further, Selye believed that the accumulation of stressors would ultimately lead to physical disorders. Named the General Adaptation Syndrome (GAS), this three-stage process of alarm, adaptation, and exhaustion would ultimately bring some sort of physiologic disruption in functioning.

Psychological stress theory was born out of the belief that, while researchers knew that stress caused physical changes, the underlying mechanisms that regulated the subsequent reactions to the stress were elusive. Psychological theory proposed that there was some cognitive (mediation/moderation) between the stressful event and one's reaction to this event. Thus psychosomatic views of stress seek to understand, 1) the psychological processes which create the 'meaning' for an individual that an event is stressful, 2) the coping processes that are elicited in stress management, and 3) the sequence of events that may or may not lead to disease (Lazarus, 1974).

In psychological stress theory, there are two concepts that are central to understanding how individuals perceive and react to stress. *Appraisal* is an individual's evaluation of the significance of what is happening for their well-being, and *coping* is an individual's effort in thought and action to manage specific demands (Lazarus, 1993).

Stress is not viewed as a singular event in psychological stress theory but rather as a relationship or ‘transaction’ between individuals and their environment. Lazarus and Folkman (1986) thereby define psychological stress as “a relationship with environment that the person appraises as significant for his or her well being in which the demands tax or exceed available coping resources”(p.63). Hence, cognitive appraisal and coping are processes that mediate the person-environment transaction.

Lazarus (1991) defined coping as an effort to manage and overcome demands and critical events that pose a challenge, threat, harm, loss, or benefit to a person. Coping generally refers to an individual’s ability to adapt to adverse circumstances, yet there is a recent trend in psychology that has broadened this definition to include goal attainment strategies, personal growth, and a general positive slant (Schwarzer & Knoll, 2005; Snyder, 1999). Coping strategies are generally referred to as ‘positive’ or ‘negative.’ Positive coping reduces anxiety associated with a situation and does not harm the individual. These strategies also improve situations into the future, rather than simply provide a quick-fix solution. Negative coping strategies do not solve problems, they are temporary, and they may cause harm to the individual or others.

Stress and coping are also related to affect, or emotion. Lazarus (1999) maintains that emotion is also affected by cognitive appraisal of events and positive emotions can occur even under dire circumstances (Folkman & Moskowitz, 2000). Further, positive emotions have been shown to be important facilitators to adaptive coping styles and adjustment to various types of stressors (Folkman, 1997).

The interrelationship between stress, coping styles, emotion, and subsequent anxiety is the premise for the research in this dissertation. If all constructs are indeed

related, then it could be argued that there may be significant differences in all of these items between the two groups of students under study. Because of this assumption, the analysis strategy and subsequent interpretation follow from this assertion.

Chapter Three: Methods

Description of Population

This study used a cross-sectional survey to explore the effects of participation in physical education courses on self-reported perceived stress, affect, trait anxiety, and coping strategies among undergraduate university students. Though graduate students are eligible to enroll in the undergraduate classes, they were excluded from most analyses because they have unique stressors that may be inherent to that group (Kreger, 1995). The physical education courses sampled were among the Summer semester 2006 offerings in the Kinesiology Department of the College of Health and Human Performance at the University of Maryland at College Park. The Chair of the Kinesiology Department (KNES) and the professors of the individual courses granted permission to survey the classes.

The University of Maryland at College Park provides detailed statistics on its website about the demographic composition of its student body. For Fall 2005, 25,442 undergraduate students were enrolled, which comprised 72 percent of the total number of enrollees for that term. Further, about 26 percent of undergraduates were minority students, meaning they were Black or African American, Hispanic, Asian, or Native American. The gender composition of undergraduates at the university was almost equal, and the majority of undergraduates (90.1%) had full-time status in Fall 2005 (University of Maryland, 2006).

There were fourteen Physical Education one-credit courses offered in the Kinesiology Department in Summer 2006. About half were offered in the first summer

session, which lasted from June 5 until July 16, and the other half started on July 17 and ended on August 27. Among these 14 courses, there were 435 available open seats and 304 eventual enrollees. Courses met an average of four and one-half hours per week for six weeks. Table 3.1 shows a list of available courses and the number of students enrolled per class.

Also listed in the last column of this table is an indication of the level of physical intensity of each of the courses. Physical activity ratings were based on general principles of measuring physical activity intensity – in terms of metabolic equivalents (MET), as defined by the Centers for Disease Control (2006). An activity burning less than 3 METS is considered light, three to six METs is considered moderate-intensity, and more than six is considered vigorous or heavy. This information is given because level of physical activity was a factor of interest in later analysis, as a covariate.

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Table 3.1**List of Summer Kinesiology One-Hour Physical Activity Courses**

Course Number	Course Title	Number Enrolled	Intensity Level
KNES 121J	Martial Arts Rape Defense	17	Light
KNES 131J	Horseback Riding	14	Light
KNES 134N	Bowling (Beginning)	7	Light
KNES 134O	Bowling (Intermediate)	16	Light
KNES 137N	Golf (Beginning)	34	Light/Moderate
KNES 137O	Golf (Intermediate)	12	Light/Moderate
KNES 154T	Swimming for Fitness	12	Vigorous
KNES 155N	Tennis (Beginning)	23	Moderate/Vigorous
KNES 155O	Tennis (Intermediate)	21	Moderate/Vigorous
KNES 157N	Weight Training (Beginning)	30	Moderate
KNES 157O	Weight Training (Intermediate)	27	Moderate
KNES 161F	Yoga for Fitness	37	Moderate
KNES 161R	Step Aerobics (Beginning)	12	Vigorous
KNES 161T	Yoga (Beginning)	42	Light/Moderate
<i>14 Total Classes</i>		<i>304 Enrolled</i>	

Description of Sampling Procedure

The sampling strategy for this cross-sectional survey was based on a nonprobability sampling method, using both purposeful and convenience-sampling principles, even though these strategies seem to be at odds. Given the nature of these sampling techniques, caution should be used when interpreting results at the conclusion of this study. Convenience sampling strategies are frequently used in exploratory studies when resources may be limited or the cost and time required to generate a random sample of individuals may be prohibitive (Kish, 1995).

The Kinesiology courses were those that could be conveniently sampled during summer 2006. At the same time, the sample was purposeful, in that all subjects that were

eligible to be sampled were enrolled in physical education courses in this department. The main criterion for sampling was that individuals were enrolled in one of these courses and could not have graduate student status.

Recruitment

The chair of the Kinesiology department granted permission to contact the professors of the KNES summer classes. Thus, the sample frame from this study was all physical activity one-credit courses being offered in summer 2006. Kinesiology professors were contacted by email in May 2006 and asked if they would allow a doctoral researcher to survey their classes for approximately 30 minutes during one of their class sessions that would be held near the end of the semester. These emails included a forwarded message from the Kinesiology Department Chair that spoke favorably of this research and encouraged professors to participate. Two more emails were sent to the professors if they did not respond. The doctoral candidate also visited the professors in person, when possible during the summer semester, though this only resulted in the addition of one more class to be surveyed. Institutional Review Board permission was also granted for this study, and recruitment solicitations indicated such.

The Kinesiology instructors of the following courses gave permission for their courses to be sampled: yoga for fitness, beginning yoga, beginning and intermediate bowling, step aerobics, beginning and intermediate weight lifting, and beginning golf. The other instructors did not respond to recruitment solicitations. Courses that were not included were rape defense/martial arts, horseback riding, tennis, intermediate golf, and swimming due to nonresponse. All professors were told that coercive strategies to encourage their students to participate would not be allowed.

Power Calculations

Power calculations were conducted to obtain the minimum number of respondents needed to respond to this survey in order to find a significant difference in the main outcome measure. The main outcome measure was the total score on the Perceived Stress Scale (PSS) at the conclusion of the semester. Other outcome measures were total scores at on the Positive and Negative Affect Scales (PANAS), the trait sub-scale of the State Trait Anxiety Index (STAI), and Brief COPE. These indices are described later in this chapter.

Using recommendations for power calculations by Cohen (1992) and searching for a large effect size for use in ANOVAs, a total sample size of 52 students was required, or approximately 26 students per group (yoga students and non-yoga students). This sample size was calculated for a one-tailed test with a Power of .80 and alpha equal to .05.

Data Collection

Inclusion and Exclusion Criteria

Subjects for the survey administration were included, or selected, based on being age eighteen or older, enrolled in one of the summer 2006 KNES physical education courses participating in the study, and having undergraduate status. The other special characteristic for inclusion was self-reported attendance at the majority of the class sessions (approximately three-fourths of classes) during the semester.

Students in these classes were excluded if they had graduate status or were under 18 years old. Additionally, respondents were excluded from analyses if they indicated that they a) used medication for mental health concerns or b) saw a mental health practitioner for mental health problems. Students were also excluded from analyses

comparing yoga and non-yoga groups if they reported practicing Tai Chi or were enrolled in more than one Kinesiology class during the same semester (where one of those classes was yoga).

For the purposes of this paper, persons who were currently enrolled in more than one summer Kinesiology physical education class were excluded because of classification purposes into yoga and non-yoga groups. That is, if students were enrolled in yoga and another form of activity, it would have been impossible to attribute any outcomes to the yoga classes, as they would have been confounded by other class participation. The decision was made to exclude these individuals rather than to control for number of classes as a covariate because of the additional loss of power that would have contributed to the MANCOVA analysis.

Those persons taking Tai Chi were excluded because it is another mindfulness exercise with similar mind-body principles as yoga and may have acted as a confounder (NCCAM, 2007; Sandlund & Norlander, 2000). Persons taking medication for a mental health program and those seeking therapy for mental health issues were also excluded as these two activities have been shown to lessen stress and negative affect (Seaward, 2002; Watson, Clark, & Tellegen, 1988), thus were potential confounders for the outcome measures.

Survey Administration

Potential participants were provided with information about the nature and purpose of this study at the beginning of each of the separate physical education classes, or when designated by the instructor. The doctoral student introduced herself and reviewed informed consent procedures. Once informed consent procedures were

completed, the students who wished to participate were seated as far apart as possible to ensure privacy and began to complete their survey instrument. Students who did not wish to participate were encouraged to read their course material or engage in another course-related activity and were not penalized. If students were enrolled in more than one physical activity course, they were only asked to fill out this survey one time.

The survey instrument was comprised of six short indices. The names of the indices were not included on the survey itself, but there were indications where each index began and ended. The sections of the survey were as follows: the Perceived Stress Scale, Brief COPE, Inventory of College Students' Recent Life Experiences, Positive and Negative Affect Scales, State Trait Anxiety Index, and Student Characteristics and Attitudes section. Each index assessed information on independent and dependent variables in the context of the previous month if not otherwise indicated. Names of students were not placed anywhere on the survey instruments. Students were also encouraged to contact the Principal Investigator, Dr. Robert Gold, or doctoral candidate with any questions or concerns at any time. Administration and completion of the survey took an average of 30 minutes total, including instructions.

Data from the course instructors/professors and other observational data were also collected. These items included the following: number of students enrolled in the class, a description of the class setting (e.g., location, amount of background noise, private/public location, etc.), class syllabi, and questions concerning whether reinforcement and positive messages were used by the professors during the semester.

Instrumentation

There were five indices used to measure independent and dependent variables in this study. There was also a sixth section that collected student characteristics, attitudinal information, and other questions deemed relevant to the purpose of this study.

Perceived Stress Scale (PSS)

Cohen, Kamarck, and Mermelstein developed the Perceived Stress Scale (PSS) in 1983. The current 10-item scale is a shortened version of their original 14-item index and has been found to maintain the same psychometric properties. The items on this scale were based on psychological stress theory, which states that a person interacts with his or her environment, and in turn, appraises stressors in light of available coping resources. It is thus the individual's perception of stress rather than the stress/stressors themselves that cause pathology and illness behavior (Spacapan & Oskamp; 1989).

The PSS measures the degree to which situations in one's life are deemed to be stressful. Specifically, items tap unpredictability, uncontrollability, and feelings of being overloaded. The scale also includes queries about current levels of experienced stress. Evidence for the scale's predictive validity indicated that the PSS provided better predictions of psychological and physical symptoms than life-event scales and that higher PSS scores were related to harmful health behaviors such as failure to stop smoking and depression (Glasgow, Klesges, Mizes, & Pechacek, 1985; Kuiper, Olinger, & Lyons, 1986).

Data obtained in 1987 by a random digit dialing national area-probability sample of adults revealed that internal reliability of the PSS as measured by Cronbach's alpha was .78 and was at least as good a measure of perceived stress as the original 14-item

scale. Also obtained in this sample were norms that break down scores by gender, age, and race (Spacapan & Oskamp, 1988). While there were not mean scores for the PSS specific to college students, this 1987 study did produce norms for the 18-29 age group.

The PSS items are scaled from 0-4, with a continuum ranging from '0' indicating the person 'never' felt or thought a certain way over the past month to '4' indicating that the person felt or thought certain way 'very often' Reversing responses to the four positively stated items and then summing across all scale items produces the total score for the PSS. Thus the possible range of PSS scores is from 0-40. A lower score indicates lower levels of perceived stress. The score on the PSS was the main outcome variable of interest for this dissertation research. In other words, the goal was to understand whether students who participated in yoga classes had lower PSS scores at the end of the semester than students who were enrolled in other physical education courses. The PSS has been used frequently to measure perceived stress among college students (Naquin & Gilbert, 1996; West et al., 2004; Kohn, Lafreniere & Gurvenich, 1990; Dill & Henley, 1998; Deckro et al., 2002).

Brief COPE

The Brief COPE was created from the Lazarus and Folkman (1984) literature on coping. The original COPE was comprised of 15 scales, each with a focus on some meaningful aspect of coping. It was intended to be a flexible instrument, meaning that researchers may pick and choose from the relevant scales to use for the purposes of their studies. It is often used in health-related research to assess coping processes and has often found to be predictive of future physiological effects.

This abbreviated instrument was created in response to criticisms that the complete version of the COPE scale was too burdensome for respondents in terms of length of time to take the scale and because of the redundancy of items. The development of the Brief COPE, which has 28 items instead of the original 60, was guided by factor loadings from previous analyses and previous cognitive testing that indicated that certain items provided more clarity to respondents than others (Carver, 1997; Carver, Scheier, & Weintraub, 1989).

The Brief COPE has 14 sub-scales and no “overall” coping index score, thus the author does not recommend a particular means of generating a dominant coping style for any given person. On the contrary, Carver encouraged the creation of second-order factors from among the scales and for researchers to use the factors as predictors using their own unique data. For the purposes of this dissertation, however, two summated scores were created based on the ten subscales that dealt with positive coping strategies and for the four subscales that mentioned negative coping strategies. This strategy was used because Carver grouped his scales conceptually into “active” and “avoidant” coping strategies. Instead of using these terms, this study named the scales “positive coping

strategies” and “negative coping strategies.”

There are ten ‘positive’ and four ‘negative’ scales that are grouped in the following manner: Positive scales are: Self-Distraction (items 1 and 19); Active Coping (items 2 and 7); Use of Emotional Support (items 5 and 15); Use of Instrumental Support (items 10 and 23); Venting (items 9 and 21); Positive Reframing (items 12 and 17); Planning (items 14 and 25); Humor (items 18 and 28); Acceptance (items 20 and 24); and Religion (items 22 and 27). Negative scales are Denial (items 3 and 8); Substance Use (items 4 and 11); Behavioral Disengagement (items 6 and 16); and Self-blame (items 13 and 26).

Each of the 28 items on the Brief COPE is scored from 1 through 4, with self-report ratings of the frequency with which a person engages in a particular coping strategy. The value of ‘1’ indicates the person hasn’t been doing it at all, ‘2’ is a little bit, ‘3’ is a medium amount, and ‘4’ is a lot. The Brief COPE also allows the researcher to tailor instructions in the context of the particular stressor(s) of interest. Thus, for this dissertation project, there will be two outcome scores related to this index. One score will be an aggregate of ‘negative coping’, which ranges from 4-16 possible points. The higher the score, the more often negative coping strategies are used. It is important to note that a lower score indicates that a person is not engaging in negative coping, so that must be considered in analysis as well. Since there are 10 ‘positive coping’ strategies, the score range is from 10-40. Scores must be interpreted with caution along this scale as well, because lower scores indicate that an individual may not be using these coping strategies with great frequency.

Carver (1997) assessed the soundness of the internal structure of the Brief COPE

by completing an exploratory factor analysis on the item set to obtain factor loadings. The Brief COPE's factor structure was very similar to that of the original instrument. Reliability analyses across three administrations of the Brief COPE indicated that each of the scales (with two items each) met or exceeded Cronbach's alpha of .50 and all exceeded .60 except for three of the scales: Venting, Denial, and Acceptance. Therefore, Carver believed that these data support internal reliability of abbreviated scales. In particular, since reliability measurements are artifacts of the number of items in a particular scale, the Cronbach's alphas here are acceptable (Carver, 1997).

Data concerning the predictive validity of the Brief COPE is similar to that for the full instrument. Carver, Pozo, Harris, Noriega, Scheier, Robinson and others (1993) reported that this instrument assesses many coping responses that are often named in the coping process and that some are predictive of future physiological effects. For instance, Antoni, Goodwin, Goldstein, LaPerriere, Ironson, and Fletcher (1991) found that denial and behavioral disengagement scales were prospective predictors of distress in HIV-positive men, with acceptance as a coping response as a predictor of lower distress in a subsequent study. In a 1995 study by Antoni, Esterline, Lutgendorf, Fletcher, and Schneiderman, denial and behavioral disengagement predicted greater HIV progression a year later in subjects.

Inventory of College Students' Recent Life Experiences (ICSRLE)

In their 1990 study, Kohn, Lafreniere, and Gurevich describe the development and validation of their decontaminated hassles measure, the Inventory of College Students' Recent Life Experiences (ICSRLE). By decontaminated, the authors mean that distressed physical and mental responses to stress are not placed in the same scale as

items that measure exposure to daily hassles. The authors sought to create a scale that measured exposure to hassles so that they could determine more accurately their influence on health outcomes.

This scale is comprised of 49 items. Original instructions asked respondents to rate each item for its severity on a scale from 1-4, ranging from '1' = not at all a part of my life, to '4' = very much part of my life. These ratings provided little insight into whether the respondent perceived the event to be stressful or not. Instead, these ratings were deleted and instructions were added asking each respondent to indicate with a checkmark if the event was part of his or her life during the past month. The possible range of scores for this scale was now from 0-49, with 0 indicating no hassles reported in the last month. Lower scores coincided with lower levels of hassles. The rationale for this decision was that a simple count of hassles could be utilized as a covariate to control for the outcome measures. This scale lent itself well to that purpose with the deletion of the rating instructions because it contained stressors that were unique to the college population.

Cronbach's alpha for the original ICSRLE was reported to be .88, and this scale was correlated with the Perceived Stress Scale, with correlations of .52 for a college male sample and .66 for college females. There were seven factor loadings from the ICSRLE, which were named as developmental challenges, time pressure, academic alienation, romantic problems, assorted annoyances, general social mistreatment, and friendship problems. Osman, Barrios, Longnecker, and Osman (1994) found that the ICSRLE showed concurrent validity with positive and significant correlations to related measures of daily hassles (Daily Hassles Scale and College Maladjustment Scale) and that

correlational analyses showed that the ICSRLE subscales are likely not contaminated by general psychological symptoms.

Positive and Negative Affect Scale (PANAS)

Watson, Clark, and Tellegen (1988) proposed this two-factor model of mood states that has revealed itself in the literature to predict highly distinctive dimensions of emotion. Positive Affect (PA) is state of high energy, pleasurable engagement, and alertness. Moroseness and lethargy characterize low PA. Negative Affect (NA) is the dimension with aversive mood states and subjective distress. Calmness characterizes a lack of NA.

The PANAS was developed as a succinct, 20-item index, which was the result of multiple attempts to sort a large sample of descriptors that were part of a comprehensive sample of affective terminology. Resultant items had high factor loadings and all contributed significantly to the reliability and validity of the scale. These psychometric data were collected primarily from undergraduate students in psychology classes and were also collected among adult employees at the same university.

The PANAS scale intercorrelations and Cronbach's alpha were all very high, ranging from .86 to .90 for PA and .84 to .87 for NA, and all were based on data from undergraduates enrolled in various psychology courses in a southern university. The two scales have low correlations, ranging from $-.12$ to $-.23$, indicating discriminant validity between scales or a good degree of independence. PANAS scales have also exhibited a significant level of test-retest reliability across time frames.

The PANAS lists twenty adjectives that describe different feelings or emotions. Respondents are asked to read each item and mark the appropriate number, from 1-5,

which indicated the way that they have felt this way during the past few weeks. A score of '1' means very slightly or not at all, '2' means a little, '3' is moderately, '4' quite a bit, and '5' is extremely. Ten adjectives measure positive affect and ten measure negative affect. Both the PA and NA scales are scored similarly, with score ranges of 10-50. Lower scores on the PA scale indicate lower levels of Positive Affect. Lower scores on the NA scale indicate lower levels of Negative Affect – hence these scores should be interpreted with caution.

The scales also have high external validity. The results are highly correlated with related constructs such as state anxiety, depression, and other types of psychological dysfunction (Tellegen, 1985). PANAS scores are also used in conjunction with other widely used inventories such as the Beck Depression Inventory, State Trait Anxiety Inventory (STAI), and Hopkins Symptom Checklist (HSCL).

State-Trait Anxiety Inventory, (Form Y/ STAI-Y)

Spielberger (1983) developed the STAI-Y as a revision to his previous instruments that were inadequate in differentiating diagnoses of depression versus anxiety. The resultant scale has been used extensively in experimental and clinical research as the premier measure of state and trait anxiety among adults. The STAI-Y is comprised of two separate 20-item self-report scales that measure both state (S-Anxiety) and trait (T-Anxiety) anxiety, which are printed on the front and back sides of the STAI questionnaire. The S-Anxiety scale is referred to as Form Y-1 and the T-Anxiety is referred to as Form Y-2. This dissertation only measured trait anxiety using the second form, or sub-scale.

Since Form Y-1 deals with state anxiety, participants are asked to report on “how you feel right now, that is at this moment” by rating feelings or thoughts indicated the presence or absence of anxiety. Items are scored on a continuous four-point scale: (1) not at all; (2) somewhat; (3) moderately so; (4) very much so. Conversely, Form Y-2 is concerned with trait anxiety, or how a respondent generally feels. The items have the following four-point scale: (1) almost never; (2) sometimes; (3) often; (4) almost always.

Each of the forms is scored separately and has score ranges from 20-80. Lower scores indicate lower levels of each type of anxiety. Spielberger also provides guidance for the researcher in terms of how to compute scale scores in the instance of minimal amounts of missing data due to nonresponse. There have been several validity and reliability studies on this instrument (Tanaka, Sakamoto, Kijima, & Kitamura, 1998; Goldenberg & Waddell, 1990). Internal consistencies of the trait subscale of this instrument were as follows: Trait Anxiety Absent (0.80), and Trait Anxiety Present (0.78).

Spielberger and colleagues at several years in the STAI’s development also assessed content, concurrent, and construct validity of the STAI (Spielberger, 1983). For instance, many of the items on the STAI were adapted from other anxiety scales and the STAI showed high correlations with other highly reputable scales that were already in existence – the Manifest Anxiety Questionnaire and the Anxiety Scale Questionnaire. Over 10,000 adolescents and adults have been tested as part of the construction and validation of this scale, resulting in norms for several populations, including college students.

Cronbach's alpha for a sample of 855 college students in a southern university was .92 for trait anxiety. Spielberger also provided normative data for college females and males in terms of the means and standard deviations on this subscale (Spielberger, 1983).

Student Characteristics and Attitudes Section

This section of questions measures constructs that are potentially related to outcome measures of interest. The section contains 18 questions total, with some questions allowing for skip patterns if respondents answer a specific way. Nine variables allowed the researcher to classify the students demographically: 1) age, 2) year in school, 3) gender, 4) race/ethnicity, 5) GPA, 6) number of credit hours taken during summer semester, 7) full or part-time status, 8) having a job, and 9) Kinesiology class enrollment. Additionally, the remainder of the questions ask about 9) current practice of meditation, 10) motivation for enrollment in the class, and 11) general yoga participation. Information was also gathered on individual perceptions of the benefits of exercise and whether the individual currently uses psychotherapeutic medication or visits a mental health professional. There is a final question on self-reported attendance. If students did not report at least attending three-fourths of the class sessions, their data was not used in the analysis. All of the Kinesiology one-credit classes have an attendance policy whereby students receive an 'F' if they miss more than three classes. Additionally, penalties for missed classes result in points lost from their total grade.

In addition to the survey given to the students, the instructors were asked via email or in person about whether they talked about stress management techniques in their class or whether they used positive health messages and/or reinforcement while teaching.

This research also noted class size and setting in order to gauge whether these variables influenced outcomes. Syllabi were also collected from the professors as a means of exploring what, if any, other variables might be important in analysis.

Comprehension and Timing of Full Instrument among College Students

Nine college students, aged 18-23, were recruited to pilot test the survey instruments named above (in their aggregate). Four males and five females participated. The order of the indices was the same as how they were mentioned previously in this chapter. The names of the indices were not indicated anywhere on the survey form; however, participants received instructions noting the end of each section and were instructed to turn the page when appropriate.

None of the students reported finding any of the items in the questionnaire to be offensive in language, and none of the students believed that the questions were invasive or too personal. The doctoral student asked each of the pilot testers specifically about the student characteristics and attitudes questions concerning seeing a mental health professional or taking medications for anxiety or depression and did not receive any concerns about content. The testers believed these questions to be appropriate given the context of the whole questionnaire.

The mean time of the nine participants to complete the entire questionnaire was 18 minutes, with a range of 11 to 26 minutes. A few of these respondents thought that the wording of certain parts of the questionnaire was redundant, as in the items on the ICSRLE, but, with a closer reading, they agreed that each of the items measured something different. The instructions on the Brief COPE were of concern to two students. One student suggested modifying wording of the instructions to ask “how

much” someone engaged in a particular coping strategy as opposed to “how frequently.” This change was made, especially because the author of this index encourages tailoring instructions to different populations (Carver, 1997).

Procedural Outline of Steps Followed in Completing the Study

The following Table 3.2 detailed the timeline for all phases of this dissertation project. This timeline assumed a May 2007 graduation time.

Table 3.2

Steps followed to complete dissertation

Activity	Anticipated Due/Completion Date
Institutional Review Board Submission	April 21, 2006
Dissertation Proposal Defense	June 16, 2006
Modifications of Instrument to Institutional Review Board	June 30, 2006
Revisions to All Chapters as suggested by Committee	February 8, 2007
Obtain Permission by Kinesiology professors to sample students in their Summer Courses	May 31, 2006
Data Collection Phase and Data File Setup	July 17, 2006 – August 27, 2006
Data Cleaning and Entry	September 1, 2006
Data Analysis	January 31, 2007
Chapter Four Draft	February 9, 2007
Chapter Five Draft	March 10, 2007
Final Revisions of all Chapters	March 31, 2007
Copies of Dissertation to Committee	April 3, 2007
Dissertation Oral Defense	April 13, 2007

Proposed Data Analysis Specific to Hypotheses and/or Research Questions

Descriptive statistics were used to detail any potential differences between yoga students and students enrolled in the other physical education courses. Each research question also had a data analysis plan as outlined below. Given that all of the research questions used similar analysis strategies (using MANOVA or MANCOVA with post-hoc tests), it is only detailed once in this chapter; however, it applied to all outcome measures.

Cronbach's alpha was run for each of the indices used in this study in order to check internal consistency and to compare them against established college student norms, where available. This statistic assesses the reliability of the indices in this population and will provide information on how multiple items assessed similar underlying constructs.

General Analysis Plan

Total scores on the PSS, Brief COPE (positive coping scores), PANAS (both positive and negative affect scales) and trait anxiety scale of the STAI were analyzed using a multivariate analysis of variance (MANOVA) to compare the yoga and non-yoga groups. All non-yoga respondents were grouped together for analysis. Unlike ANOVA, the MANOVA assesses group differences across multiple dependent variables simultaneously. Thus, for this study, a MANOVA assessed whether there were group differences in perceived stress, positive and negative affect, trait anxiety, and positive coping ability. The MANOVA provided the solution to the problem of conducting multiple independent ANOVAs on the outcome variables by decreasing the Type I error rate and implicitly testing the linear combination of the dependent variables that provides the most convincing evidence of overall group differences (Hair, Anderson, & Tatham, 1987).

If the overall MANOVA value was significant at the $p < .05$ level, post hoc one-way ANOVAs were conducted on the subscales in addition to Tukey's HSD or Sheffe's Tests in order to control for Type I error rate. Items in the survey that were not total index scores were analyzed using independent-samples t-tests to compare yoga and non-yoga groups. Categorical variables were compared using Chi-Square analyses.

Given that several potential covariates or independent variables in this study may have accounted for differences between groups, a multivariate analysis of covariance (MANCOVA) was used, in the second research question, to control possible confounding variables. In lay terms, a MANCOVA assumes that all participants scored “equally” on the covariates of interest, so that the effect of the factors beyond the covariates can be isolated. Thus, a MANCOVA was calculated for this study with the four outcome variables mentioned above and controlled for the following independent variables: year in school, gender, race, full or part-time status, having a job outside of school, perception of exercise as stress reduction, perception of exercise as improving mood, and number of days per week of self-reported exercise. In addition, the MANCOVA controlled for the total index score on the ICSRLE, which was a measure of the total number of stressors that students reported during the last month.

Research Questions and ANOVA/MANOVA/MANCOVA Rationale

The research questions explored in this dissertation are restated below. For the first two questions, two groupings of students were compared: those who practiced yoga (that is, they were enrolled in one of the two yoga classes offered), and those who were enrolled in the other sampled Kinesiology courses. For the third research question, students were grouped by level of physical activity. There are also subquestions corresponding to the first two of these overall queries.

Research Question One: Was there a relationship between perceived stress, positive and negative affect, positive coping strategies, and trait anxiety among students who practiced yoga versus those who did not?

The first research question used a MANOVA at the .05 level to determine whether the outcome measures of interest were related to one another, and that taken together, they differed between students enrolled in the summer yoga courses and those students who were enrolled in other physical activity courses. Perceived stress was defined as the total score on the PSS. Affect was broken down into positive and negative affect, as indicated by the two scale scores on the PANAS. Trait anxiety was the second scale score on the STAI. The positive coping strategies outcome was defined as the summated score of ten aforementioned subscales on the Brief COPE.

Since this question used statistical techniques that could not differentiate where specific relationships between independent and dependent variables lie, there were four additional research questions proposed to elucidate which variables were of significance. Each proposed using post-hoc tests in the form of a one-way ANOVA with significance level less than .05.

1a. Did students enrolled in a yoga course perceive lower levels of stress than those students who were enrolled in other physical activity courses?

The primary outcome of interest for this study was perceived stress. Thus this research question explored whether students enrolled in the summer yoga courses perceived less stress at the end of the semester than those students who were enrolled in other physical activity courses. Specifically, the research examined whether yoga students had lower levels of perceived stress at the semester's end by comparing total scores on the PSS. Lower scores on the PSS are associated with lower levels of perceived stress. An ANOVA with $\alpha < .05$ was used to explore this question.

1b. Did students enrolled in yoga courses use a greater number of positive coping strategies than students enrolled in other types of physical activity courses?

Because perceived stress can be reduced by the use of positive coping strategies (Lazarus, 1984), another research question was whether students enrolled in yoga courses used a greater number of positive coping strategies at the end of the semester than those students enrolled in other types of physical activity courses. Positive coping strategies are indicated by specific numerical responses to ten subscales of the Brief COPE by Carver (1997). The Brief COPE is an abbreviated form of a larger instrument (the COPE), which measures an array of individual coping responses and their frequency. An ANOVA with $\alpha < .05$ was used to explore this question.

1c. Did students enrolled in yoga courses experience higher levels of positive affect and lower levels of negative affect than students enrolled in other types of physical activity courses?

This research question asked whether yoga participants experienced higher levels of positive and lower levels of negative affect than their non-yoga peers at the end of the semester. These constructs were measured by scores on the Positive and Negative Affect Scale (PANAS). Higher scores on the Positive and Negative Affect subscales indicate higher levels of these constructs (Watson, Clark, & Tellegen, 1988). The PANAS measures 10 positive affects and 10 negative affects that respondents are asked to rate on the extent to which they have felt that way over a certain time frame. Each question was explored separately (the scale measuring positive affect and the scale measuring negative affect) using an ANOVA with $\alpha < .05$.

1d. Did students enrolled in yoga courses experience less trait anxiety than students enrolled in other types of physical education/activity courses?

The last question stemming from the overall query explored whether yoga participants experienced less trait anxiety at the end of the semester compared to non-yoga peers. The second sub-scale on the State Trait Anxiety Inventory (STAI) measures trait anxiety. Lower scores on this subscale of the STAI indicate less trait anxiety (Spielberger, Gorsuch, Lushere, Vagg, & Jacobs, 1983). This question was explored using an ANOVA with $\alpha < .05$.

Because the types of college students who engaged in physical in different physical activity classes may have differed based on sex, race, or other variables that needed to be understood in light of the main research question, the **second research question asked:**

2. Was there a relationship between perceived stress, affect, positive coping strategies, and trait anxiety among students who practice and those who do not – when controlling for potential covariates such as number of reported stressors, gender, race, courseload, amount of hours worked outside of school, and others?

Other potential covariates are detailed above. Finally, since persons may also choose to be enrolled in a particular physical activity class due to its level of physical exertion required, it may be that certain types of activities elicit more of a relaxation response than others. Thus the final research question asked:

3. Was there a difference in perceived stress, affect, coping strategies, or anxiety among persons enrolled in low, moderate, and high intensity physical activity courses? For this question, three groups of students were compared. Low intensity

courses were defined as bowling, golf, and beginning yoga. Moderate intensity courses were beginning weight lifting and yoga for fitness. High intensity courses were step aerobics and intermediate weight lifting. This analysis controlled for the number of stressors in the past month.

MANOVA Rationale.

Multivariate analysis of variance (MANOVA) is an ANOVA with several dependent variables. For this study, the dependent variables have been shown to be related in the scientific literature (Lazarus, 1999; Lazarus & Folkman, 1986). That is, perceived stress, affect, coping ability, and anxiety in particular are interrelated, thus making a multivariate analysis of variance (MANOVA) useful in testing the hypotheses of whether enrollment in certain physical education courses can lead to changes in these variables over time. A MANOVA's main objective is to determine if the dependent variables are altered by the manipulation of independent variables (such as course in which they are participating). A MANOVA can also provide the main effects of the independent variables, their interactions, the importance of the dependent variables and their strength of association, and how the covariates effect outcomes. A MANCOVA was used to statistically control for covariates. See Table 3.3 for a summary of variables to be used in this study and their scoring (on next page).

Table 3.3
Summary of Variables and Their Scoring

<i>Construct/Variable</i>	<i>Index</i>	<i>Type of Variable</i>	<i>Scoring</i>
Perceived Stress	Perceived Stress Scale	DV	0-40
Coping	Brief COPE	DV	10-50
Current Stressors	ICSRLE	Covariate	0-49
Positive Affect	PANAS	DV	10-50
Negative Affect	PANAS	DV	10-50
Trait Anxiety	STAI	DV	20-80
Age	Student Characteristics and Attitudes (SCA)	Covariate	18+
Year in School	SCA	Covariate	1 = freshman 2 = sophomore 3 = junior 4 = senior
Gender	SCA	Covariate	1=female 0=male
Race/Ethnicity	SCA	Covariate	1=White 2= Black or African American 3=American Indian or Alaskan Native 4=Asian Indian etc.
GPA	SCA	Covariate	0.0-4.0
# of Credit Hours	SCA	Covariate	0.0-?
Full or Part-Time Status	SCA	Covariate	1 = full-time 2 = part-time
Job Outside of School	SCA	Covariate	1 = yes 2 = no
# hours per week at job	SCA	Covariate	0.0-?
Name of KNES class	SCA	Covariate	See questionnaire
Motivation for Class	SCA	Covariate	open ended
# of days exercise/wk	SCA	Covariate	0-7
Meditation (yes/no)	SCA	Exclusion Criteria	1=yes 0=no
# of days meditate	SCA	Exclusion Criteria	0-7
Tai Chi/Yoga Practice (yes/no)	SCA	Exclusion Criteria	1=yes 0=no
Ever Practiced Yoga	SCA	Exclusion Criteria	1=yes 0=no
Time Practicing Yoga	SCA	Exclusion Criteria	1=less than one year 2=more than one year
Mood Enhancement	SCA	Covariate	0-not at all 1=a little bit 2=a good deal 3=a great deal
Stress Enhancement	SCA	Covariate	0-not at all 1=a little bit 2=a good deal 3=a great deal
Mental Health Practitioner	SCA	Exclusion Criteria	1=yes 0=no
Prescription Drug	SCA	Exclusion Criteria	1=yes 0=no

[Note. DV = dependent variable; ICSRLE = Inventory of College Students' Recent Life Experiences; PANAS = Positive and Negative Affect Scales; STAI = State Trait Anxiety Inventory; GPA = grade point average].

Delimitations

Delimitations are the constraints that the researcher has decided upon when constructing his or her methodology. This study had been delimited by having only students selected from physical education classes at the University of Maryland. This delimitation hampers external validity because findings may not necessarily be generalizable to other students at the university or other students at other types of universities. Furthermore, students are a self-selected population who are typically quite different from the population as a whole. Additionally, students who take summer classes may be dissimilar to students enrolled in fall and spring semesters.

There are also a limited number of questions on the survey about preexisting mental conditions that may predispose students to have higher levels of stress than others. Despite having an index of current stressors, there would be too much respondent burden to have more questions about psychological symptoms related to stress, anxiety, affect, and coping responses.

Chapter Four: Results

Description of Sample

Fifteen out of the twenty-one (71%) possible one-credit physical activity courses offered through the Kinesiology department were sampled during summer semester 2006. The courses sampled were as followed: beginning and intermediate bowling, beginning golf, beginning and intermediate weight lifting, yoga for fitness, beginning yoga, and step aerobics. Courses that were not sampled were swimming, horseback riding, martial arts (women's defense), intermediate golf, and beginning and intermediate tennis. The reason some courses were not sampled was because the instructors of those courses did not respond to multiple solicitations for the doctoral researcher to attend one of the class sessions to distribute her survey. At least three attempts were made to contact these instructors either by phone, email, or in person.

In the fifteen classes, 143 of 144 students (total number of students in the classes) completed the survey, and only one student refused to do so, thus the response rate for survey completion in the sampled classes was 99 percent. All students present at the time of the survey completed it. Since the survey was administered near the end of the semester, most often during finals, the vast majority of students were in attendance in any given class.

A total of 12 students (8.4%) were enrolled in both a yoga class and another one-hour credit Kinesiology course. Those students were asked to fill out the survey only once. These twelve students were excluded from any analyses that necessitated yoga participation (yes/no) as a main variable of interest because outcomes could not be attributed to either form of exercise for certain. Also excluded were students who

reported either taking prescription medication (n=6) or those currently seeing a mental health professional (n=7). One student who currently took Tai Chi was already excluded from analysis due to her graduate status.

Of the 143 respondents, there were approximately as many females (n=69) as males and the majority of students were seniors (62%). About three-fourths of the students were 21 years or older (75.9%) and were White (48.3%) or Black/African-American race (20.3%). Twelve students were graduate students and thus were excluded from all analyses other than those describing the sample.

The majority of students in this sample managed both school and outside employment activities. Seventy-six percent of this sample (n=109) attended school full-time. Almost three-fourths (n= 102) maintained a job outside of school, with 46% percent of these students working 20 or more hours per week. In addition to outside employment, students took an average of seven credit hours during both summer sessions.

The reported GPAs of students varied widely, from 1.7 to 4.0, with a mean value of 2.9. Finally, the students did not miss many classes during the semester. About two-thirds (68.5%) missed either zero or one class. The policy of many of the instructors of these courses is that if students miss more than one class, they will receive an F. Please see Table 4.1 on the following page for a summarization of the characteristics of this sample.

Table 4.1

Characteristics of Sample

	Percent	N	Mean	Standard Deviation
Age (years)			22.9	4.95
18-24	79.7	114		
>25	18.9	27		
Year in College (%)			n/a	n/a
Freshman	0.7	1		
Sophomore	9.1	13		
Junior	18.2	26		
Senior	62.2	89		
Graduate	8.4	12		
Gender (%)			n/a	n/a
Female	48.3	69		
Male	51.0	73		
Race/Ethnicity (%)			n/a	n/a
White	48.3	69		
Black, African American	20.3	29		
American Indian or Alaskan Native	1.4	2		
Asian Indian	4.9	7		
Chinese	7.7	11		
Korean	2.8	4		
Vietnamese	1.4	2		
Other	12.6	18		
Grade Point Average (1.0-4.0 scale)			2.9	0.59
1.70-1.99	3.5	5		
2.00-2.99	43.4	62		
3.00-4.00	50.4	72		
Mean Number of Credit Hours			7.0	4.58
1-5	49.7	71		
6-9	19.6	28		
≥10	28.0	40		
Enrollment Status (%)			n/a	n/a
Full time	76.2	109		
Part time	19.6	28		
Job outside of school (%)			n/a	n/a
Yes	73.4	105		
No	25.9	37		
Hours worked (n=106)			23.6	11.76
≤ 10	14.0	20		
≤ 20	24.5	35		
>20	31.5	45		

Information Gained from Syllabi and Questions to Professors

A review of all syllabi provided by the instructors of the classes did not provide insight into the nature of the classes. Syllabi among the different courses varied greatly in terms of content and length. The common theme across these guidelines was the attendance policy, which uniformly stated that missed classes would result in a reduction of course grade and more than three missed courses would result in an F for the semester. Thus, all students surveyed had missed less than three classes during the summer semester. The yoga syllabi were the most detailed, detailing not only the training on the physical postures of yoga but also several class sessions on yogic philosophy and meditation.

All courses fostered a social atmosphere where students often worked and conversed together. Students frequently assisted others in weight lifting, bowling, and golf. Yoga and step aerobics classes practiced routines together; bowling was done in groups, as was golf. While weight lifters were encouraged to follow their own individual training plans, many students often assisted others.

All professors mentioned that they gave positive reinforcement throughout the semester to their students - however, this theme of positivity was a constant in yoga classes. Both yoga teachers also mentioned how they professed personal acceptance. Both the weight-lifting professor and the two yoga instructors mentioned that they encouraged students to listen to their bodies and to push them when necessary or to rest when needed.

Environment did not seem to have an influence on perceived stress scores. The bowling alley was boisterous and loud, with video games and a large television in the

background. Step aerobics was held in a large aerobics studio with loud music, talking, and clapping. The calmer environments were the golf course, weight-lifting room, and yoga classes.

Distribution of Students by Class

The number of students enrolled in each Kinesiology class in this study is detailed in Table 4.2. The majority of students were enrolled in either yoga or a weight lifting class. Students were able to be enrolled in more than one class and noted such on their surveys.

Table 4.2

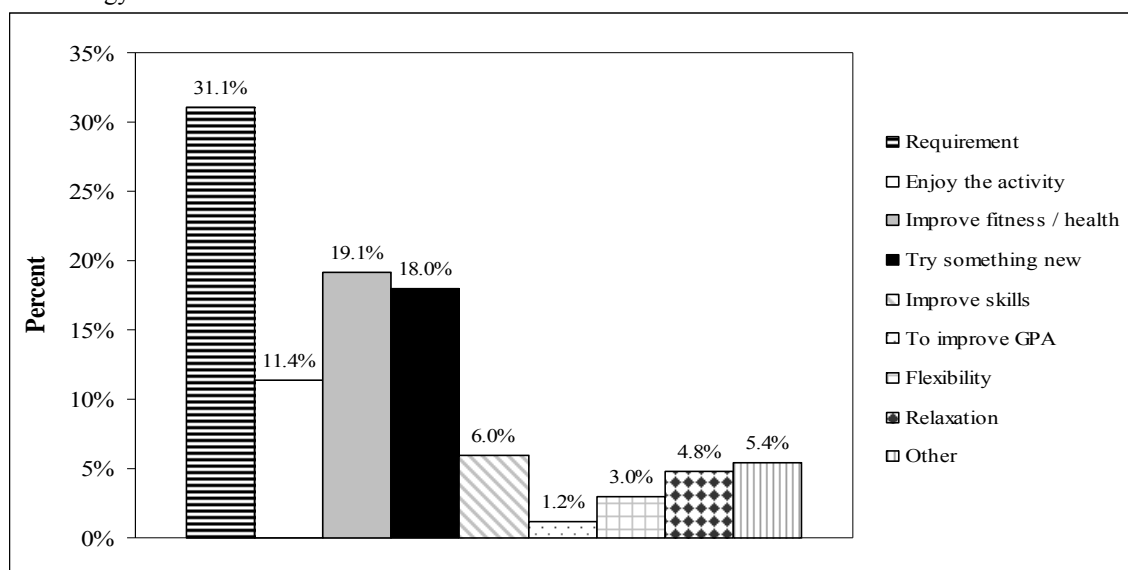
Number of Students enrolled per Kinesiology Class

Kinesiology Class	Female	Male	Total
Bowling (Beginning)	3	8	11
Golf (Beginning)	3	20	23
Golf (Intermediate)	1	1	2
Weight Training (Beginning)	4	24	28
Weight Training (Intermediate)	4	14	18
Yoga for Fitness	16	7	23
Step Aerobics (Beginning)	8	1	9
Yoga (Beginning)	33	8	41
Total	72	81	155

Reasons for Course Participation

The subjects in this study answered an open-ended question about their reasons for enrolling in their selected Kinesiology courses. The students provided 218 reasons in total, many of which were easily categorized into eight themes and are presented in Figure 4.1. About one-third of students indicated that the course was a requirement for graduation in their major. Although the majority of students did not indicate this reason, Kinesiology majors must take eight one-hour physical activity courses in order to graduate.

Figure 4.1. Reasons given for why students chose to enroll in their particular Kinesiology class or classes.



Note. Students were able to select more than one reason.

Descriptive Statistics: Comparison of Yoga and Non-Yoga Groups

For this section of results, the twelve graduate students were excluded, as well as those students ($n=15$) who reported current prescription medication use for a mental health disorder or concern. Also excluded were persons who were seeing a mental health practitioner at the time of survey administration, or who were currently doing Tai Chi.

There were also twelve students excluded who reported taking more than one Kinesiology class, where one of those classes was yoga. The resulting total of students included in the majority of the remaining analyses was 108, as some of the students had overlapping exclusion criteria.

The only significant differences found between yoga and non-yoga groups on certain demographic variables were that students who were not enrolled in yoga classes exercised on significantly more days during the week than yoga-only students ($p < .01$) and were enrolled in more one-credit physical activity classes than students enrolled in a yoga class ($p < .04$). For an overview of the characteristics of students in the sampled Kinesiology courses, please see Table 4.3.

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Table 4.3
 Characteristics of Sample by Yoga or Non-Yoga Grouping (N=141)

Variable	Yoga	Non-Yoga	Chi-Square	Sig.
Age (%)			25.45	0.085
18-24	35	42		
> 25	14	9		
Year in College (%)			7.47	0.113
Freshman	0	1		
Sophomore	4	6		
Junior	7	11		
Senior	26	37		
Graduate	6	1		
Race/Ethnicity (n)			4.61	0.708
White	28	41		
Black/African American	14	15		
American Indian or Alaskan Native	0	2		
Asian Indian	3	4		
Chinese	5	6		
Korean	3	1		
Vietnamese	1	1		
Other	10	8		
Grade Point Average (n)			34.43	0.544
1.70-1.99	1	3		
2.00-2.99	24	38		
3.00-4.00	38	35		
Number of Credit Hours (n)			15.53	0.557
1.0 - 5.0	30	41		
6.0 - 9.0	15	13		
>= 10.0	17	23		
Enrollment Status (%)			0.14	0.832
Full-time	37	39		
Part-time	8	9		
Job Outside of School (%)			0.41	0.568
Yes	35	37		
No	12	15		
Hours Worked (n = 101)			26.79	0.421
<= 10	9	11		
<=20	16	19		
>20	22	24		

Reliability of Scales: Cronbach's Alpha

Cronbach's alpha is a statistic used to measure how well a set of variables measures a single latent construct. It is a measure of internal consistency reliability. While the authors of the five indices used in this study have reported high reliability on their own samples, it was important to calculate Cronbach's alpha for each index for this specific study to make comparisons to other normative groups. The results, as well as other psychometric data, are presented below in Table 4.4.

Table 4.4

Psychometric Data for Scales

Index	α	mean	sd
Perceived Stress Scale	.76	18.4	5.26
Brief COPE (Positive Coping Strategies)	.82	43.6	13.28
PANAS - Positive Affect	.85	31.9	6.81
PANAS - Negative Affect	.81	20.7	6.91
ICSRLE	.95	13.7	9.97
STAI-Y Trait Anxiety	.91	44.7	14.32

Measures of Correlation and Covariance among Dependent Variables

To assess the degree of shared variance among the dependent variables included in the multivariate model, correlation and covariance matrices including summary scores from each of the dependent variables were calculated. In addition to the five dependent variables listed above in research question one, the total score for number of stressors was added in. Results of these matrices are provided in Table 4.5.

The inter-item correlation and covariation matrix summarizes correlation coefficients between each of the composite scores representing the five dependent variables included in the multivariate analysis. The inter-item covariance matrix summarizes the degree of shared variance among the dependent variables (an estimate of the degree to which the items co-vary). Pearson correlations are indicated by the top line and have either one or two asterisks showing significance at the .05 level or .01 level, respectively.

Note that the covariance matrix gives the degree to which items covary with each other (and themselves); the values are in raw scores. The correlation matrix gives the degree to which items covary in a standardized manner, around a standard deviation of 1.0, resulting in the correlation coefficient.

As seen in this table, the strongest relationships between dependent variables and the main covariate exist among negative affect and the number of stressors ($r = .429$), meaning that the greater number of reported stressors over the past month, the higher level of negative affect indicated by students. Additionally, a strong positive relationship occurred between perceived stress and negative affect ($r = .532$).

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Table 4.5
Correlation and Covariation Matrix Among Dependent Variables and Total Number of Stressors

Scale Score		1	2	3	4	5	6
1. Perceived Stress	Correlation	1.000	0.156	-0.172*	0.532**	0.190*	0.315**
	Covariance		10.303	-6.250	17.487	5.493	15.918
2. Positive Coping	Correlation		1.000	0.278	0.264**	0.275**	0.129
	Covariance			26.322	22.615	20.470	17.034
3. Positive Affect	Correlation			1.000	-0.098	0.173*	0.014
	Covariance				-4.615	7.003	1.037
4. Negative Affect	Correlation				1.000	0.255**	0.429**
	Covariance					9.230	28.018
5. Trait Anxiety	Correlation					1.000	0.080
	Covariance						4.550
6. Stressors	Correlation						1.000
	Covariance						

Note. * Correlation is significant at the 0.05 level (2-tailed)

** Correlation is significant at the 0.01 level (2-tailed)

Answers to Research Questions

As indicated in Chapter Three, there were three research questions that were explored in this dissertation, each with subquestions that were answered if the overall queries proved significant. The findings of these questions are indicated below.

Research Question One

Was there a relationship between perceived stress, positive and negative affect, positive coping strategies and trait anxiety among students who practiced yoga versus those who did not?

This research question was answered using a Multivariate Analysis of Variance (MANOVA) with all outcome variables of interest entered into the model. Table 4.6 presents descriptive statistics on the means in yoga versus non-yoga students for all dependent variables. All summed index variables were entered as dependent variables. With alpha set at .05, the one-way MANOVA was significant at

$F(7,94) = 3.311, p = .003$. This statistic indicated that there was indeed some effect of yoga on the outcome variables mentioned above.

Dependent Variables	Mean	Standard Deviation	p
Perceived Stress (PSS)			
No Yoga	17.1	4.82	.002*
Yoga	20.3	5.70	
Positive Coping (Brief COPE)			
No Yoga	40.8	13.31	.008*
Yoga	47.4	12.89	
ICSRLE Total Score			
No Yoga	14.1	8.56	NS
Yoga	16.9	8.43	
Positive Affect (PANAS)			
No Yoga	32.8	6.97	NS
Yoga	31.0	6.66	
Negative Affect (PANAS)			
No Yoga	19.2	6.12	NS
Yoga	22.1	7.60	
TRAIT Anxiety of STAI			
No Yoga	44.3	5.36	NS
Yoga	45.4	6.69	

Note. *One-sided alpha = .05

Post-hoc analyses

1a) Did students enrolled in a yoga course report lower levels of perceived stress than those students who were enrolled in other physical activity courses?

Contrary to the expectation that students enrolled in yoga classes would report lower levels of perceived stress compared to non-yoga students, yoga students actually reported significantly higher levels of this construct in comparison to students enrolled in other physical activity courses ($p < .002$). Along the same lines, students enrolled in weight lifting classes ($n=42$) reported significantly less stress than their non-weight

lifting peers ($n = 86$, $p < .049$). No other significant differences were found by type of physical activity.

Students reported substantial levels of perceived stress over the past month. Among all undergraduate students who were included in these analyses, about 20% reported that they have been upset either fairly often or very often because of something that happened unexpectedly during the last month. Almost one-quarter of students (24%) felt that they were unable to control the important things in their life. Further, 42% of students often felt nervous and stressed during the past month and twelve percent felt that difficulties were piling up so high that they could not overcome them.

1b) Did students enrolled in yoga courses use a greater number of positive coping strategies than students enrolled in other types of physical activity courses?

Students who practiced yoga used significantly more positive coping responses than students enrolled in other physical activity courses ($p < .008$). The most commonly reported positive coping strategies used over the past month were concentrating on personal efforts to improve a situation, taking action to improve the situation, strategizing for solutions to stress, accepting the reality of one's situation, and thinking hard about what steps to take. Persons marked either a score of '3' for "I've been doing this a medium amount" or '4' for "I've been doing this a lot" in response to the aforementioned coping strategies.

1c) Did students enrolled in yoga courses experience higher levels of positive affect and lower levels of negative affect than students enrolled in other types of physical activity courses?

Students who practiced yoga did not differ significantly from their non-yoga peers on either positive or negative affect levels. Women did experience significantly higher levels of negative affect than males, however ($F = 6.174, p < .01$). Incidentally, this was the only significant difference across gender for all dependent variables.

The mean Positive Affect score for this sample was 32.5, and the mean Negative Affect score was 20.2. During the past few weeks, about 6 percent of students felt extremely distressed and approximately 10 percent reported feeling extremely irritable. On the other hand, about one-third of students reported feeling either extremely or quite a bit attentive or inspired over the past few weeks and about 60 percent felt extremely or quite a bit determined.

4) Did students enrolled in yoga courses experience less trait anxiety than students enrolled in other types of physical education/activity courses?

Students who practiced yoga did not differ significantly on trait anxiety from students enrolled in other physical activity courses. The mean score on the trait anxiety scale of the STAI for this sample was 44.7 with a standard deviation of 5.6. Trait anxiety scores did not differ significantly by gender.

Research Question Two

Was there a relationship between perceived stress, positive and negative affect, positive coping strategies, and trait anxiety among students who practiced yoga and those who did not – when controlling for potential covariates such as number of reported stressors (total ICSRLE score), gender, race, number of credits taken, amount of hours worked outside of school, year in school, full- or part-time

status, perception of exercise as stress reduction, perception of exercise to improve mood, and number of days of self-reported exercise?

A Multivariate Analysis of Covariance was run to explore this research question. The covariates entered were those listed above. The fixed factor was yoga participation (yes/no), and all dependent variables were entered. A MANCOVA is an extension of the basic principles of a MANOVA, in that a MANCOVA is essentially a MANOVA of regression residuals – variance in the dependent variables not explained by the covariates. For this model, the covariates accounted for 66% of the variance in the outcome measures. To obtain this figure, all R-squared coefficients were added for the outcome variables.

The overall F test for the MANCOVA revealed significant group differences in the mean for the yoga and non-yoga groups for the following dependent variables: negative affect, $F(13, 80) = 2.97, p < .002$; perceived stress, $F(13, 80) = 1.97, p < .037$; and positive coping, $F(13, 80) = 2.14, p < .023$. The omnibus F tests for the following dependent variables were not significant: positive affect and trait anxiety.

The multivariate component of the MANCOVA revealed a significant effect of total ICSRLE score, Hotelling's Trace $F(5, 80) = 5.23, p < .001$. That is, controlling for the covariates in the model, the total number of reported stressors on the ICSRLE remained a significant predictor of scores on the dependent variables for the yoga and non-yoga groups. Yoga students reported significantly more stressors than non-yoga. None of the other covariates or factors was found to have a significant effect.

Research Question Three

Was there a difference in perceived stress, positive and negative affect, positive coping strategies, and trait anxiety among persons enrolled in low, moderate, and high intensity physical activity courses?

This research question was answered using a Multivariate Analysis of Covariance with all outcome variables of interest entered into the model. The total ICSRLE score was entered as a covariate. The fixed factors were the groupings of low, moderate, and high physical activity groups. Low intensity groups were defined as beginning and intermediate bowling, beginning and intermediate golf, and beginning yoga (n=50). Moderate intensity activities were beginning weightlifting and yoga for fitness (n=35). High intensity activities were intermediate weight lifting and step aerobics (n=19).

Table 4.7 presents descriptive statistics on the means on the dependent variables for the light, moderate, and high intensity groups. With alpha set at .05, the Wilks' Lambda coefficient for the overall model was not significant, indicating that there was no relationship between the outcome variables and level of physical activity. In other words, the null hypothesis was retained indicating that the means of the outcome variables did not differ significantly across groups, when controlling for number of stressors.

Table 4.7

Means and Standard Deviations of Outcome Scores by Level of Physical Activity

Outcome Variable	Physical Activity Group	Mean	Std. Deviation	N
Perceived Stress Score	Heavy	18.1	3.96	18
	Moderate	18.3	5.42	31
	Light	18.0	5.83	50
	Total	18.1	5.36	99
Positive Coping Score	Heavy	42.7	11.29	18
	Moderate	45.2	11.02	31
	Light	43.0	15.26	50
	Total	43.6	13.30	99
Positive Affect Score	Heavy	34.2	5.36	18
	Moderate	31.6	7.49	31
	Light	32.3	6.55	50
	Total	32.4	6.66	99
Negative Affect Score	Heavy	22.2	5.40	18
	Moderate	19.2	5.89	31
	Light	20.0	7.43	50
	Total	20.2	6.66	99
Trait Anxiety Score	Heavy	43.9	3.67	18
	Moderate	43.7	4.99	31
	Light	45.6	6.57	50
	Total	44.7	5.69	99

Post-hoc power analysis

A post-hoc power analysis was conducted to assess whether research question number three was adequately powered to have a fair enough chance to reject an incorrect null hypothesis. Using G*Power software by Buchner, Erdfelder, and Faul (1997), with alpha set at .05 and a large effect size (.50) as specified by Cohen (1988), results indicated that for a MANCOVA with five dependent variables, that the study was adequately powered at .98.

Chapter 5: Discussion, Recommendations, and Conclusions

Study Summary

This study was conducted to broaden the literature on the relationship between yoga participation and perceived stress. In addition, there were several constructs related to stress that have had little attention in the context of yoga practice: namely, positive and negative affect, trait anxiety, and coping skills. Thus, this research examined the level of association between yoga practice and the constructs mentioned above and whether the levels of these operationalized constructs differed between college students who practiced yoga and those who engaged in another form of physical exercise. According to the public health literature, this is an important topic with potential implications for clinical medicine and health education due to the increase in morbidity and mortality in the United States due to stress-related diseases (McEwen, 1998; McEwen, 2005).

The professors of fifteen of twenty-one one-credit Kinesiology courses during summer 2006 semester at University of Maryland agreed to have their classes surveyed in this study. Almost all of the students in these courses completed the survey. Although students could be enrolled in more than one Kinesiology course over the same semester, they only filled out the survey one time.

Descriptive statistics were used to detail any potential differences between yoga students and students enrolled in the other physical education courses. To answer the three research questions, multivariate tests were used to assess general differences between groups, and post-hoc tests determined where those differences existed in research question number one. These analyses were conducted with 108 college undergraduates who met all inclusion criteria.

Pearson correlations indicated that there was a large positive relationship between perceived stress and negative affect ($r = .532, p < .01$) as well as a moderate relationship ($r = .429, p < .01$) between negative affect and the number of stressors during the past month. The students who participated were enrolled in the following courses: beginning yoga, yoga for fitness, beginning and intermediate bowling, beginning and intermediate golf, step aerobics, and beginning and intermediate weight lifting. This group was mostly white, undergraduate, of traditional college age (i.e., between 18-and 21-years-old), and equally divided by gender. Most students were seniors and indicated that they needed these courses to graduate.

Students completed a survey comprised of five existing instruments and one new section on student characteristics and attitudes. The first research question asked if there was a relationship between perceived stress, affect, coping strategies, and anxiety among students who practiced yoga versus those who did not. The MANOVA used to address this question was significant at the .05 level and two post-hoc tests between groups were significant. Students enrolled in yoga courses actually had higher levels of perceived stress than non-yoga students, $F(1,107) = 9.91, p < .002$, resulting in rejection of the null hypothesis. However, yoga practitioners reported more positive coping strategies than nonpractitioners, $F(1,107) = 7.12, p < .008$.

The second research question asked if there was a relationship between the constructs mentioned in the first research question among students who practiced yoga and those who did not – when controlling for potential covariates. Results indicated that holding all covariates constant, there were significant differences in perceived stress, negative affect, and positive coping strategies between yoga and non-yoga groups.

The last research question asked whether there was a difference in perceived stress, affect, positive coping strategies, or anxiety among persons enrolled in low, moderate, and high intensity physical activity courses. A MANCOVA was used to control for the number of stressors in the past month (total ICSRLE score). The MANCOVA did not produce significant results.

The results of this study lay the groundwork for a rich discussion of how these findings can be interpreted in the context of previous research on yoga. This chapter will focus on future directions, implications for health practitioners, and suggestions for strengthening methodology to improve power in the design and greater interpretability of results.

Discussion of Results in the Context of Research Questions

Research Questions One and Two

As an exploratory study, this research generated hypotheses to be examined in future work, in addition to providing credibility to the existing research on yoga, stress, anxiety, and coping. The main finding of this study, that students who practiced yoga reported higher levels of perceived stress than their non-yoga peers was contradictory to what was expected. Despite higher levels of perceived stress, yoga practitioners reported using more positive coping skills over the past month.

The finding that students enrolled in yoga classes were more stressed than their peers is consistent with the overall purpose of many yoga trials. Specifically, many yoga trials seek to decrease stress and increase coping ability in several populations that might be highly stressed in the first place (Parshad, 2004; West et al, 2004; Oleshansky, 2004; Culos-Reed et al., 2005; Schell, Allolio, & Schonecke, 1993). In other words, college

students who are enrolled in yoga classes appear to be a stressed subpopulation of students who may have learned positive coping skills to deal with life events.

The findings that yoga students reported more stress than nonpractitioners and concurrently used more positive coping strategies than other students may be explained in the context of the ability to self-regulate as a result of practice. Some researchers suggest that yoga brings an individual more self-awareness and the ability to self-regulate than other forms of exercise (Nayak & Shankar, 2004; Parshad, 2004). This ability can in turn influence coping style. As a result, persons can control negative thinking and cope with stressors more positively (Campbell & Moore, 2004). This may be the reason for the findings in this study that persons who had higher stress levels had to learn some coping mechanisms to deal with stress effectively (Lazarus, 1999; Lazarus & Folkman, 1984; Folkman, Lazarus, Dunkel-Schetter, DeLongis, & Gruen, 1986). While it is not certain where the students learned these strategies, both yoga instructors in this study admitted to teaching self-acceptance and mindfulness theory in their classes. These positive health messages may have influenced the subsequent usage of coping strategies among yoga students.

Yoga is a form of mind-body medicine (NCCAM, 2007). Since hatha yoga teachers often incorporate mindfulness-based language throughout their classes, it could be argued that if yoga students are attending to these messages and are altering their behavior accordingly. In a review article on the mechanisms of mindfulness by Shapiro, Carlson, Astin, and Freedman (2005), the authors define the psychological construct of ‘mindfulness’ and investigated the mechanisms underlying mindfulness based interventions.

The authors proposed that mindfulness-based interventions teach individuals to re-perceive situations. Re-perceiving is an overarching mechanism that instructs people to self-regulate, clarify values, create openness to new situations, and to expose themselves differently to stressors or stressful environments. Further, being mindful suggests that persons are approaching situations with the intention to react in a more positive manner.

If we assume that yoga students are a stressed population and that they practice with the *intention* of lowering stress with a positive attitude, then indeed these students may reduce stress over time, and then may use positive coping strategies to do so. As Atkinson and Permuth-Levine (2007, submitted) found, yoga teachers repeatedly advised students to pay attention to their bodies. Yoga practitioners in this study may have developed the ability to self-regulate over the semester as they attended to the physical sensations in their bodies.

This study also showed that controlling for covariates, yoga students still had significantly higher reported stress, used more positive coping strategies, *and* had higher levels of negative affect than students enrolled in other classes. These results are consistent with the growing research on other forms of complementary and alternative medicine that suggest that persons who seek alternative or adjuvant therapies are likely less well, more depressed, or more anxious than other population groups (Campbell & Moore, 2004; Jain & Astin, 2001; Honda & Jacobson, 2005). Many have exhausted or become frustrated with other forms of medicine to improve their condition (Jain & Astin, 2001; Astin 1998). Because yoga is one form of complementary and alternative medicine (CAM), persons who practice yoga may have the same behavioral correlates as those who

seek other forms of CAM (Honda & Jacobson, 2005; Barnes, Powell-Griner, McFann, & Nahin, 2004).

The MANCOVA results may also suggest that the cognitive appraisal processes with regard to stress and emotions may be different between yoga students and non-yoga and these processes are something that may or may have not been learned in their classes. For instance, Lazarus (1999) says that cognitive mediation is an essential feature of emotional processes because it helps people to adapt to threatening situations and it will produce different patterns of stress responses in different people. Further, Lazarus notes that if people feel anxiety, there could be an underlying characteristic to the class of people who experience it. Thus, while at present this factor is unknown, that fact that yoga participants tend to have more stress and more negative affect indicates that they may appraise situations differently than persons who aren't in yoga classes and that their cognitive strategies are different as well.

Research Question Three

With regard to lack of significant findings for research question three, it was difficult to determine whether this was the result of the conceptual groupings of students being inadequate, the heavy intensity group being underpowered, or some other factor that was not yet understood. If more physical education instructors would have agreed to have their courses sampled, this may have improved the data with which this question was answered. Furthermore, even though the CDC provided guidelines of how to assess the level of physical activity during certain forms of exercise, few of the classes practiced exercise on a continued basis without starting and stopping. All classes, except for step

aerobics took breaks during the course of the class when engaging in the main form of exercise.

Discussion of Analytic Strategy

As mentioned above, this was primarily an exploratory hypothesis generating study that used MANOVA and MANCOVA to address the three research questions. In this study, the main question asked if there was a difference between yoga students and non-yoga students on the group of outcome variables, taken in their entirety. The MANOVA gives an answer to this question but does not indicate which dependent variable(s) produce such effects. Univariate tests conducted after a significant MANOVA elucidated where relationships existed.

The strength of using the MANOVA in this study is that it confirms previous research that stress, emotion, coping, and anxiety are indeed related (Lazarus, 1999; Lazarus, 2000). Moreover, the MANOVA suggested that these constructs differed between students who practiced yoga and those who did not. Therefore, this test was the first step in elucidating relationships between variables. The MANCOVA provided additional confirmation of the MANOVA's results, as certain relationships persisted despite controlling for many related covariates.

Field (2000) suggests discriminant analysis as an alternative approach to univariate ANOVAs as follow-ups to a significant MANOVA. It would have strengthened the study to use discriminant analysis, as it finds linear combinations of the dependent variables that best separate groups. This type of analysis would have provided insight to the relationship between outcome variables and group membership. There would be a problem with this technique however if the data were not linear.

Comparison of Index Scores to Other Studies

Among all students who participated in this study, the mean score on the Perceived Stress Scale (PSS) was 18.4 with a standard deviation of 5.26. Cohen (1988) used a Harris Poll to gather information on the ten-item PSS. Though the age categories used in his study do not match this sample precisely, he did find that the mean PSS score among males and females aged 18-29 ($n = 645$) to be significantly lower than the mean score for this sample ($M = 14.2$, $SD = 6.2$). While the reason for this disparity is not known, it could be that the students in this sample were more stressed due to finals and other stressors inherent to college life such as a compressed summer schedule or because they were close to graduation. Cronbach's alpha for the 1994 normative study of the PSS was .78 which was similar to this sample's alpha of .76.

Results on the Positive Affect scale ($M = 31.9$, $SD = 6.8$) and Negative Affect scale ($M = 20.7$, $SD = 6.9$) for this entire sample were comparable to national norms. Watson, Clark, and Tellegen (1988) normed these scales for college students ($n = 586$) asking about positive and negative affects over the past two weeks. In their sample, results indicated a mean of 32 and standard deviation of 7.0 for positive affect. For negative affect, the mean was 19.5 and standard deviation 7.0. Women in both samples showed significantly higher levels of negative affect than males at the .05 level of significance. Cronbach's alpha for the normed PA scale was .87 and NA was .87 as well. These alpha coefficients were quite similar to those calculated for this study (.85 and .81 respectively).

Spielberger (1983) reported norms for college students ($n=777$) on both the state and trait anxiety scales. He found that women had slightly higher anxiety scores on both

scales than their male counterparts, though the differences were not significant. The mean trait anxiety score for his college sample was 39.3, with a standard deviation of 19.3. The total sample from this study had significantly higher levels of trait anxiety as compared to these national norms ($M = 44.7$, $SD = 14.3$). Again, this finding could be due to the fact that this assessment was taken during finals time at the university. Cronbach's alpha for the trait anxiety scale for this sample was .86, which was similar to the national sample (.91).

Finally, it is somewhat difficult to compare scores from this sample with national norms on the ICSRLE because the scale's properties were changed for this study. Kohn, Lafreniere, and Gurevich (1990) developed the ICSRLE as a decontaminated hassles scale, which was tested on 100 undergraduates along with the Perceived Stress Scale (PSS). This initial experiment resulted in the condensation of the ICSRLE to 49 items, all of which had significant correlations against the PSS. A confirmatory factor analysis yielded seven interpretable factors that proved free of contamination by psychological distress constructs. Results of the 1990 study indicated an alpha reliability of the scale of .88, with a correlation against the PSS to be .59 ($p < .0005$). Further the mean score on the ICSRLE was significantly higher for women than men. For this study the correlation between the PSS and ICSRLE was .32 ($p < .001$). Cronbach's alpha for the altered ICSRLE scale used in this study was .95.

Return to Psychological Stress Theory

This exploratory study was viewed through the lens of psychological stress theory, which states that there are two concepts that are central to understanding how individuals perceive and react to stress. *Appraisal* is an individual's evaluation of the

significance of what is happening for their well being, and *coping* is an individual's effort in thought and action to manage specific demands (Lazarus, 1993). Coping generally refers to an individual's ability to adapt to adverse circumstances.

Stress researchers consider coping to be a major factor in the relationship between stressful events and certain outcomes such as depression and psychological and physical illness (Folkman, Lazarus, Dunke-Schetter, DeLongis, & Gruen, 1986). Coping has two major functions according to these researchers: to regulate stressful emotions and to alter the person-environment relationship that is causing distress.

DeLongis, Folkman, and Lazarus (1988) also found that there was a significant relationship between everyday hassles and mood disturbance, particularly when persons reported that they were in unsupportive relationships. Coping also has been shown to mediate emotion. Lazarus (1999) mentions that coping is involved in the emotion process from the start to the end of an encounter. This means that even though coping, appraisal, stress, and emotion are all separate theoretical constructs, they are interrelated in actuality.

In the context of this study, yoga students reported using significantly more positive coping strategies than non-yoga students, and they were more stressed. Higher levels of negative affect in yoga-students approached significance ($p < .053$) as compared to their non-yoga counterparts. In sum, for yoga practitioners in this sample, there is more stress, more negative affect, but higher positive coping skills that may be countering the first two constructs or necessitated by them.

Lazarus (1984) refers to coping as a process formation. In order for coping strategies to be effective, they have to be adaptable to stressful events or unsatisfactory

life conditions. In the context of this study, it could be that yoga students were learning processes to help them cope with difficult situations, or they view yoga as a coping mechanism for their existing stressors. The yoga instructors in this study mentioned that they stressed the concepts of flexibility of mind and body to their students and to be accepting of their limits. Perhaps these messages enhanced adaptability to stressors or appraisal of them. It is also possible that yoga students learned to reconstruct negative thought patterns or were being more self-accepting.

Limitations

There are limitations inherent to a quasi-experimental design and a cross-sectional survey such as this one. With a naturalistic observation study, such as this one, there was the primary limitation of non-randomization of participants. This means that certain random factors among college students who enroll in physical activity courses are not randomly distributed across “treatment” (yoga) and “control” (non-yoga) groups. Instead, there were many factors involving self-selection processes that may have led students to enroll in the various courses (Cook & Campbell, 1979). Unfortunately, this study did not measure perceptions about the forms of physical activity so we cannot know if certain courses are perceived more negatively than others or less rigorous, or less or more desirable for some other reasons.

This study was comparable to a post-test only design with nonequivalent groups (Cook & Campbell, 1979). In this case, the treatment (a six-week physical activity course) had been implemented before research and assessment had begun. No pretest was given at the beginning of the six-week course, nor was any type of archival data available on the subjects. Given that there was no pretest given, we do not know whether the differences between yoga and non-yoga groups were attributable to yoga classes themselves (or non-yoga classes for that matter), or to selection differences between the groups. Additionally, we could not measure pre-existing levels of stress, so we do not know if these levels decreased over time.

The Perceived Stress Scale is one of the most widely used stress scales in psychological literature (Cole, 1999). Additionally, the use of the ICSRLE in this study is very appropriate because the stressors listed are systemic, that is they are tied to college

students in their environment. Both instruments also show high reliability. The problem with both inventories, however, is that they do not include a sampling of items to assess chronic stressors in the students' lives. As Cohen, Kessler, and Gordon (1995) argue, event checklist stressors do not provide a comprehensive picture of all of the past and current events in a person's life that might contribute to poorer mental health outcomes.

Recommendations for Future Studies

Prospective studies on different population groups and among persons of different ages should be conducted on the long-term effects of yoga on perceived stress and other outcomes. These studies can take many forms. For instance, the study by Kristal and colleagues (2005) conducted a longitudinal study using the 2002 National Health Interview Survey (NHIS) to show that there was attenuated weight gain among middle-aged women and men who reported long-term yoga usage. More researchers could start using the NHIS Complementary and Alternative Medicine Supplement with questions on yoga usage to explore relationships among yoga practice and other health issues. Similarly, more questions on yoga usage could be added to other large health surveys.

Research in the future needs to explore what types of persons attempt yoga practice and what the determinants of yoga practice may be. Astin (1998) investigated the possible predictors of alternative health care use using a national survey examining use of alternative health care, health status, values, and attitudes toward conventional medicine. Even though his study did not examine yoga in particular, the parallels to yoga usage exist as yoga is a form of alternative therapy (USDHHS, 2007).

Astin (1998) found that the following variables predicted alternative health care use: more education, poorer health status, a holistic orientation to health, having had a transformational experience that changed the person's worldview, and having had a

variety of certain health problems. Some examples of health problems that were predictive were anxiety, back problems, chronic pain. Astin noted that persons who chose alternative medicine found these types of health care alternatives to be more aligned with their own values, cultural groups, beliefs, and philosophical views on life.

Before embarking on large quantitative studies, it is necessary to gather qualitative data on what perceived benefits, barriers, and expectations of yoga practice might be. Based on this study, over one-third of the students chose their selected physical activity course as a requirement to graduate. However, because many of these students did not indicate other reasons for choosing their classes, we do not know with any certainty why certain students chose yoga while others did not. More knowledge of these factors would strengthen the methodology and power of future studies.

There are a handful of studies that have explored barriers and facilitators to CAM use in general, that may have implications for yoga studies as well, as hatha yoga is often referred to as a form of CAM (Feuerstein, 2001). Jain and Astin (2001) authored a quantitative exploration of barriers to acceptance of CAM use among a random sample of Stanford University Alumni. The researchers learned that the following variables predicted CAM disuse: being male, being healthy, lack of physician support for CAM use, and believing CAM treatments are ineffective or inferior. More work needs to be done to find if the barriers to yoga use are similar to those to general CAM treatments.

Future studies on yoga would be strengthened if they proposed a theoretical framework to help elucidate the mechanisms behind any outcomes observed in the study (Rothman, 2005; Jeffrey, 2005). Very few studies examined in the literature review for this dissertation relied on theory as a basis for their research. If future yoga research

utilized behavioral theory, researchers might gain a better idea of the pathways and relationships among constructs that influence certain outcomes resulting from yoga practice. The use of theoretical frameworks might also add to the ability to replicate studies more easily across different populations groups, particularly if the same instruments are used across studies (Rothman, 2000).

These data can also be used for theory development in future studies. Because students in yoga classes utilize more positive coping strategies than non-yoga students, it could be because these students believe that they have more ability to take control of their stressful situations. This hypothesis could actually become a bridge to further develop psychological stress theory. Belief in the personal ability to take control of stressful situations could be comparable to the constructs of self-efficacy or perceived control from the Theory of Planned Behavior (Ajzen, 1991). It is possible that elaborating upon psychological stress theory with another construct could add depth to its explanatory power.

Recommendations for Health Education Practice

There are recommendations for health education practice in general and yoga instructors in particular that may be gleaned from this research. Many studies have shown that various forms of physical exercise can improve well-being and perceived stress in college students (Bass, Enochs, & Dibrezzo, 2002; Lochbaum, Lutz, Sell, Ready, & Carson, 2004; Fox, 1999). The question that remains is for how long do these effects last and if they do persist, how can we be certain that a particular form of exercise is the causal factor? Many of the studies mentioned above mentioned that they needed

longer follow-up timeframes to ascertain whether the effects of the physical exercise itself leads to changes in outcomes, or whether some other variable is at play.

The American Medical Association (2006) has advocated for more mental health services on college campuses particularly because of the significant burden of depression and substance abuse among this population. Kitzrow (2003) reviewed the mental health needs of college students and suggested that faculty, staff, and the institutions themselves must respond to the growing need for services due to increased depression, suicide, stress, and anxiety in this population. She noted that many student-counseling centers set limits on student caseloads so that the burden of seeing to many students does not become overwhelming. Often counselors assign students to group therapy after an individual intake, many students are referred to off-campus resources, and students may be discouraged from making frequent appointments.

The administrators and therapists at counseling centers can begin to partner with health educators to try to improve several aspects of mental health services on college campuses. For instance, trained educators can assist the counseling centers in disseminating information about counseling center services and they can also help create classes on stress management strategies. Educators can also help target certain high priority populations through written materials such as brochures, flyers, and other educational materials.

It is difficult to make recommendations for the application of yoga to reduce student stress based on the findings of this study given that this is a cross-sectional study and causal inference is not possible. Therefore, the finding that yoga students reported more perceived stress than non-yoga students should be interpreted with caution. Before

universities spend resources on implementing yoga programs, more research should be conducted with pre-and post-tests and with different subpopulations of students to ascertain whether yoga practice might actually lead to reductions of stress over time and whether students learn to use more positive coping strategies over time as well. If studies suggest that yoga participation indeed reduces stress, then yoga programs may be implemented more frequently as course offerings, or as part of stress management courses that already exist.

The usage of yoga and other CAM techniques continues to grow in the United States and among college students as well (Tindle et al., 2005; Saper et al., 2004; Lamariné, Fisher, & Sbarbaro, 2003). It will benefit several types of health practitioners to become conversant with the potential benefits that yoga can offer in terms of stress management, injury prevention and rehabilitation, pain management, and others – as well as the limitations of yoga for ameliorating certain ailments. Particularly in a college setting where the prevalence of mental health problems continue to grow, yoga may offer a low-cost and accessible form of physical activity for students to help them reduce stress and perhaps ameliorate symptoms of depression and anxiety.

Summary

In summary, the examination of whether perceived stress, anxiety, coping ability, and affect are related to yoga practice offered a useful stepping stone for further research on elucidating the mechanisms that may explain how yoga practice can improve psychological and physical complaints. Given that yoga students reported using more positive coping strategies than non-yoga students, it would benefit the field of yoga research to conduct more qualitative work about what actually goes on during a class

session or sessions. What messages are teachers giving to students? What type of reinforcement occurs during the classes? How is the teaching of yoga similar or dissimilar to other forms of teaching group exercise classes?

Future studies should examine the correlational evidence found in this research to see if stress really persists over time among yoga students and whether positive coping strategies increase or decrease over time. Additionally, given the unique life stressors reported by college students, college health services may elect to offer yoga classes or trainings on "mindfulness" disciplines to promote improvements in relaxation response and stress in this population. With improvements in methodology and increased resources, researchers will be able to conduct more yoga interventions with control groups to be able to make more sound conclusions about the benefits of yoga practice.

APPENDIX

**SURVEY ON PHYSICAL ACTIVITY, STRESS, EMOTION,
AND COPING**

Dear Student,

Thank you for your participation in this important study on physical activity, stress, emotion, and health. Please understand that all of your responses are completely confidential. Please do not put your name anywhere on this document. You do not need to answer any questions you are not comfortable with, though we do encourage you to answer as many as possible. You may discontinue participation at any time without penalty.

Thank you again for participating.

Sincerely,

**Robert S. Gold, PhD. (Principal Investigator)
Rachel Permuth-Levine, MSPH (Doctoral Student)**

PLEASE TURN THE PAGE TO BEGIN THIS SURVEY.

BEGIN HERE:

INSTRUCTIONS: The questions in this scale ask you about your feelings and thoughts during the last month. In each case, please indicate *with a check* how often you felt or thought a certain way.

1. In the last month, how often have you been upset because of something that happened unexpectedly?
☐ 0=never ☐ 1=almost never ☐ 2=sometimes ☐ 3=fairly often ☐ 4=very often
2. In the last month, how often have you felt that you were unable to control the important things in your life?
☐ 0=never ☐ 1=almost never ☐ 2=sometimes ☐ 3=fairly often ☐ 4=very often
3. In the last month, how often have you felt nervous and "stressed"?
☐ 0=never ☐ 1=almost never ☐ 2=sometimes ☐ 3=fairly often ☐ 4=very often
4. In the last month, how often have you felt confident about your ability to handle your personal problems?
☐ 0=never ☐ 1=almost never ☐ 2=sometimes ☐ 3=fairly often ☐ 4=very often
5. In the last month, how often have you felt that things were going your way?
☐ 0=never ☐ 1=almost never ☐ 2=sometimes ☐ 3=fairly often ☐ 4=very often
6. In the last month, how often have you found that you could not cope with all the things that you had to do?
☐ 0=never ☐ 1=almost never ☐ 2=sometimes ☐ 3=fairly often ☐ 4=very often
7. In the last month, how often have you been able to control irritations in your life?
☐ 0=never ☐ 1=almost never ☐ 2=sometimes ☐ 3=fairly often ☐ 4=very often
8. In the last month, how often have you felt that you were on top of things?
☐ 0=never ☐ 1=almost never ☐ 2=sometimes ☐ 3=fairly often ☐ 4=very often
9. In the last month, how often have you been angered because of things that were outside of your control?
☐ 0=never ☐ 1=almost never ☐ 2=sometimes ☐ 3=fairly often ☐ 4=very often
10. In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?
☐ 0=never ☐ 1=almost never ☐ 2=sometimes ☐ 3=fairly often ☐ 4=very often

PLEASE TURN TO THE NEXT PAGE.

INSTRUCTIONS: These items deal with ways you've been coping with the stress in your life since you've been in college. These items ask what you've been doing to cope with them. Obviously, different people deal with things in different ways, but I'm interested in how you've tried to deal with them. *Each item says something about a particular way of coping.* I want to know to what extent you've been doing what the item says. Don't answer on the basis of whether it seems to be working or not—just whether or not you're doing it. Use these response choices. Try to rate each item separately in your mind from the others. If an item below refers to “it”, please think of “it” as the problem or problems in your life that come to mind. Make your answers as true FOR YOU as you can (please place the appropriate number in the blank beside each item).

- 1 = I haven't been doing this at all
 2 = I've been doing this a little bit
 3 = I've been doing this a medium amount
 4 = I've been doing this a lot

1. I've been turning to work or other activities to take my mind off things. ____
2. I've been concentrating my efforts on doing something about the situation I'm in. ____
3. I've been saying to myself "this isn't real." ____
4. I've been using alcohol or other drugs to make myself feel better. ____
5. I've been getting emotional support from others. ____
6. I've been giving up trying to deal with it. ____
7. I've been taking action to try to make the situation better. ____
8. I've been refusing to believe that it has happened. ____
9. I've been saying things to let my unpleasant feelings escape. ____
10. I've been getting help and advice from other people. ____
11. I've been using alcohol or other drugs to help me get through it. ____
12. I've been trying to see it in a different light, to make it seem more positive. ____
13. I've been criticizing myself. ____
14. I've been trying to come up with a strategy about what to do. ____
15. I've been getting comfort and understanding from someone. ____
16. I've been giving up the attempt to cope. ____
17. I've been looking for something good in what is happening. ____
18. I've been making jokes about it. ____
19. I've been doing something to think about it less, such as going to movies, watching TV, reading, daydreaming, sleeping, or shopping. ____
20. I've been accepting the reality of the fact that it has happened. ____
21. I've been expressing my negative feelings. ____
22. I've been trying to find comfort in my religion or spiritual beliefs. ____
23. I've been trying to get advice or help from other people about what to do. ____
24. I've been learning to live with it. ____
25. I've been thinking hard about what steps to take. ____
26. I've been blaming myself for things that happened. ____
27. I've been praying or meditating. ____
28. I've been making fun of the situation. ____

PLEASE TURN TO THE NEXT PAGE.

INSTRUCTIONS: The following is a list of experiences which many students have some time or another. Please put a checkmark in the spaces below indicating for each experience below **IF it has been a part of your life over the past month.**

1. Conflict with your boyfriend's/girlfriend's/spouse's family _____
2. Being let down or disappointed by a friend _____
3. Conflict with a professor _____
4. Social rejection _____
5. Too many things to do at once _____
6. Being taken for granted _____
7. Financial conflicts with family members _____
8. Having your trust betrayed by a friend _____
9. Separation from people you care about _____
10. Struggling to meet your own academic standards _____
11. Having your contributions overlooked _____
12. Being taken advantage of _____
13. Not enough leisure time _____
14. A lot of responsibilities _____
15. Struggling to meet the academic standards of others _____
16. Dissatisfaction with school _____
17. Decisions about intimate relationships _____
18. Not enough time to meet your obligations _____
19. Dissatisfaction with your mathematical ability _____
20. Important decision about your future career _____
21. Financial Burdens _____
22. Dissatisfaction with your reading ability _____
23. Important decisions about your education _____
24. Loneliness _____
25. Lower grades than you had hoped for _____
26. Conflict with teaching assistant(s)/tutors _____
27. Not enough time for sleep _____
28. Conflicts with your family _____
29. Heavy demands from extracurricular activities _____
30. Finding courses too demanding _____
31. Conflicts with friends _____
32. Hard effort to get ahead _____
33. Poor health of a friend _____
34. Disliking your studies _____
35. Getting "ripped off" or cheated in the purchase of services _____
36. Social conflicts over smoking _____
37. Difficulties with transportation _____
38. Disliking fellow student(s) _____
39. Conflicts with boyfriend/girlfriend/spouse _____
40. Dissatisfaction with your ability for written expression _____
41. Interruptions of your school work _____
42. Social isolation _____
43. Long waits to get service (e.g., at banks, stores) _____
44. Being ignored _____
45. Dissatisfaction with your physical appearance _____
46. Finding course(s) uninteresting _____
47. Gossip concerning someone you care about _____
48. Failing to get an expected job _____
49. Dissatisfaction with your athletic skills _____

PLEASE TURN TO THE NEXT PAGE.

INSTRUCTIONS: This scale consists of a number of words that describe different feelings and emotions. Read each item and then mark the appropriate number in the space next to that word. Indicate to what extent you have felt this way during the past few weeks.

1 = very slightly or not at all

2 = a little

3 = moderately

4 = quite a bit

5 = extremely

___ interested

___ irritable

___ distressed

___ alert

___ excited

___ ashamed

___ upset

___ inspired

___ strong

___ nervous

___ guilty

___ determined

___ scared

___ attentive

___ hostile

___ jittery

___ enthusiastic

___ active

___ proud

___ afraid

PLEASE TURN TO NEXT PAGE.

INSTRUCTIONS: A number of statements which people have used to describe themselves are given below. Read each statement and then write the number in the blank at the end of the statement that indicates *how you feel right now*, that is, *at this moment*. There are no right or wrong answers. Do not spend too much time on any one statement but give the answer which seems to describe your present feelings best.

1 = not at all
2 = somewhat
3 = moderately so
4 = very much so

1. I feel calm ____
2. I feel secure ____
3. I am tense ____
4. I feel strained ____
5. I feel at ease ____
6. I feel upset ____
7. I am presently worrying over possible misfortunes ____
8. I feel satisfied ____
9. I feel frightened ____
10. I feel comfortable ____
11. I feel self-confident ____
12. I feel nervous ____
13. I am jittery ____
14. I feel indecisive ____
15. I am relaxed ____
16. I feel content ____
17. I am worried ____
18. I feel confused ____
19. I feel steady ____
20. I feel pleasant ____

PLEASE TURN TO NEXT PAGE.

INSTRUCTIONS: A number of statements which people have used to describe themselves are given below. Read each statement and then write the number in the blank at the end of the statement that indicates *how you generally feel*. There are no right or wrong answers. Do not spend too much time on any one statement but give the answer which seems to describe how you generally feel.

1 = not at all
 2 = somewhat
 3 = moderately so
 4 = very much so

21. I feel pleasant ____
22. I feel nervous and restless ____
23. I feel satisfied with myself ____
24. I wish I could be as happy as others seem to be ____
25. I feel like a failure ____
26. I feel rested ____
27. I am "calm, cool, and collected" ____
28. I feel that difficulties are piling up so that I cannot overcome them ____
29. I worry too much over something that really doesn't matter ____
30. I am happy ____
31. I have disturbing thoughts ____
32. I lack self-confidence ____
33. I feel secure ____
34. I make decisions easily ____
35. I feel inadequate ____
36. I am content ____
37. Some unimportant thought runs through my mind and bothers me ____
38. I take disappointments so keenly that I can't put them out of my mind ____
39. I am a steady person ____
40. I get in a state of tension or turmoil as I think over my recent concerns and interests ____

PLEASE TURN TO THE NEXT PAGE.

INSTRUCTIONS: This information is requested to understand your exposure to different kinds of exercise and experiences in college. Please complete the following questions as accurately and honestly as possible. Again, all information obtained from this survey will be kept confidential.

Please circle the corresponding answers or fill in the blanks as appropriate.

1. Age: (fill in blank) _____
2. Year in School (circle): Freshman Sophomore Junior Senior Graduate
3. Gender (circle): Female Male
4. What is your race? (select circle all that apply)
 - a) White
 - b) Black or African American
 - c) American Indian or Alaskan Native
 - d) Asian Indian
 - e) Japanese
 - f) Native Hawaiian
 - g) Chinese
 - h) Korean
 - i) Gaumanian or Chamorro
 - j) Filipino
 - k) Vietnamese
 - l) Samoan
 - m) Other _____ (please fill in blank)
5. What is your GPA? _____
6. How many credit hours are you taking this semester? _____
- 6a. Do you have full-time or part-time status at University of Maryland?
 - a) Full-time
 - b) Part-time
7. Do you have a job(s) other than going to school? Yes _____ No _____
- 7a. If yes, about how many hours per week do you work at this job/these jobs? _____

8. Which KNES class or classes are you in (please circle the letter(s) A-M for all that apply)

- A. **KNES134N Physical Education Activities: Coed: Bowling**
- B. **KNES134O Physical Education Activities: Coed: Bowling**
- D. **KNES137N Physical Education Activities: Coed: Golf**
- E. **KNES137O Physical Education Activities: Coed: Golf**
- F. **KNES155N Physical Education Activities: Coed: Tennis**
- G. **KNES155O Physical Education Activities: Coed: Tennis**
- H. **KNES157N Physical Education Activities: Coed: Weight Training**
- I. **KNES157O Physical Education Activities: Coed: Weight Training**
- J. **KNES161F Physical Education Activities: Coed: Yoga for Fitness**
- K. **KNES161R Physical Education Activities: Coed: Step Aerobics**
- L. **KNES161T Physical Education Activities: Coed: Yoga**

9. What motivated you to take this class (or these classes)? Please fill in the blank below. List as many reasons that you can think of.

10. About how many days per week do you exercise? Please count participation in your KNES class as exercise (fill in number of days) _____

11. Are you currently practicing **Tai Chi or Yoga** (please answer 'yes' for Yoga even if you reported that you were are taking a yoga class above)? Please circle the letter below:

- a) No (Skip to Question 13)
- b) Yoga Only (Go to Question 12)
- c) Tai Chi Only (Skip to Question 13)
- d) Both Yoga and Tai Chi (Go to Question 12)

12. If **you are currently practicing yoga**, what is the total time you have practiced yoga in your lifetime? Please approximate by filling in the number of months and years. Please put "0" for years, if you have practiced less than one year.

_____ years and _____ months

13. Do you currently practice any form of meditation? (circle): Yes No
14. How much do you feel exercise improves your mood? (please circle the letter)
- a) not at all
 - b) a little bit
 - c) a good deal
 - d) a great deal
15. How much do you feel that exercise improves your stress level? (please circle the letter)
- a) not at all
 - b) a little bit
 - c) a good deal
 - d) a great deal
16. Do you currently see a therapist, counselor, psychologist, psychiatrist, or any other mental health practitioner? (please circle letter)
- a) Yes
 - b) No
17. Do you currently take any prescription medicine for a mental health disorder or concern?
(please circle letter)
- a) Yes
 - b) No
18. About how many classes this semester of this KNES Course have you missed for any reason? Please fill in the blank.

YOU ARE FINISHED WITH THIS SURVEY. THANK YOU SO MUCH FOR YOUR PARTICIPATION.

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