



2009-12-02

College Students and Stress Management: Utilizing Biofeedback and Relaxation Skills Training

Shannon Jones Anstead
Brigham Young University - Provo

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COLLEGE STUDENTS AND STRESS MANAGEMENT: UTILIZING BIOFEEDBACK
AND RELAXATION SKILLS TRAINING

Shannon Jones Anstead

A thesis submitted to the faculty of
Brigham Young University
in partial fulfillment of the requirements for the degree of
Education Specialist

Rachel E. Crook Lyon, Committee Chair
Lane Fisher, Committee Member
Marleen Williams, Committee Member

Department of Counseling Psychology and Special Education

Brigham Young University

December 2009

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BRIGHAM YOUNG UNIVERSITY

GRADUATE COMMITTEE APPROVAL

of a thesis submitted by

Shannon Jones Anstead

This thesis has been read by each member of the following graduate committee and by majority vote has been found to be satisfactory.

Date

Rachel E. Crook Lyon, PhD

Date

Lane Fischer, PhD

Date

Marleen Williams, PhD

BRIGHAM YOUNG UNIVERSITY

As chair of the candidate's graduate committee, I have read the thesis of Shannon Jones Anstead in its final form and have found that (1) its format, citations, and bibliographical style are consistent and acceptable and fulfill university and department style requirements; (2) its illustrative materials including figures, tables, and charts are in place; and (3) the final manuscript is satisfactory to the graduate committee and is ready for submission to the university library.

Date

Rachel E. Crook Lyon, Committee Chair

Accepted for the Department

Ellie L. Young
Graduate Coordinator

Accepted for the College

Barbara Culatta
Associate Dean, McKay School of
Education

ABSTRACT

COLLEGE STUDENTS AND STRESS MANAGEMENT: UTILIZING BIOFEEDBACK AND RELAXATION SKILLS TRAINING

Shannon Jones Anstead

Department of Counseling Psychology and Special Education

Educational Specialist in School Psychology

This study was undertaken to evaluate the effectiveness of biofeedback and relaxation skills training to help alleviate college students' stress symptoms. Data was collected from 659 full-time college students who attended a total of 1,170 biofeedback sessions over the course of two years. Results of the study indicated that the top three stress-related symptoms students experienced were (a) feeling overwhelmed, (b) feeling anxious, and (c) difficulty concentrating. Furthermore, the top three stressors rated by students were (a) too much to do, (b) homework, and (c) classes and school. In addition, the top three coping strategies utilized by students to manage their stress were (a) prayer, (b) exercise, and (c) talking to friends. Moreover, results also showed significant differences on all three pre and post measures regarding skin temperature readings, EMG readings, and students' subjective self-report ratings of degree of stress. Specifically, students' skin temperature increased and their muscle tension decreased, indicating less physiological tension at the end of the session. Furthermore, comparisons of students' self-report ratings of their degree of stress before and after the session indicated that they felt less stressed and more relaxed at the conclusion of the session. These findings lend support to the utility of colleges providing biofeedback and relaxation skills training as an intervention for college students to utilize. In this way students become empowered to self-regulate their stress symptoms and optimize their health. Indeed, students can utilize and benefit from these skills both during and beyond their college years.

Keywords: [biofeedback, college students, coping, relaxation, stress]

ACKNOWLEDGMENTS

I would like to extend my deepest gratitude to Doctor Michael Maughan, the pioneer of the Biofeedback and Stress Management Lab at Brigham Young University. Doctor Maughan established the lab in 1976 and worked selflessly counseling students and teaching them stress management strategies until his retirement in 2008. I had the privilege of working in the Biofeedback lab with Doctor Maughan, my mentor, for 6 years. He is ultimate proof of the benefits associated with applying the principles of biofeedback and relaxation skills as a way of life. He is the most relaxed and serene person I have ever known. His wisdom and quiet example changed the lives of countless students over the years. My grateful thanks go also to Doctor Barbara Morrell who now supervises the lab and with whom I also had the pleasure to work. Her commitment to the lab and her dedication to teaching students how to apply the principles of biofeedback and relaxation in their daily lives are truly commendable.

I would also like to acknowledge the significant contribution of Doctor Rachel Crook-Lyon for her mentorship, expertise, insight, and patience throughout my thesis experience. I am also extremely grateful to the wonderful professors in the Counseling Psychology and Special Education Department for their commitment to excellence in education and for their selfless and tireless dedication to their students.

I would also like to express my sincere love and appreciation to my parents, Alma and Alton, for their constant love, support, and prayers during the eight years I was studying at Brigham Young University and unable to visit them back home in South Africa. In addition, my

most sincere love and gratitude goes to my husband of 6 months, Scott, for his moral support, enthusiasm, and endless patience. He was my rock and cheerleader. I could not have completed my studies without his encouragement, strength, and unconditional love and belief in me.

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Introduction

Results of a recent annual nationwide survey undertaken by the American Psychological Association (APA) indicated that the declining state of the nation's economy is taking a physical and emotional toll on people nationwide (APA, 2008). In addition, the results of a large poll conducted by mtvU and the Jed Foundation in partnership with The Associated Press regarding the emotional health of today's college students indicated that college students also reported feeling greatly concerned and stressed about the state of the nation's economy and how it is impacting them (MTVu, 2009). Thus, the results of these and other studies indicate that a significant number of people are affected by stress in today's society. Therefore, today more than ever, there is a pressing need for emphasis to be placed upon research to address the role of stress and its function and its impact on mental and physiological health. Moreover, even greater emphasis needs to be placed upon research regarding effective low-cost strategies and interventions to combat, reduce, or prevent the effects of stress.

Stress is inevitable. However, knowledge of effective stress management strategies may serve to empower individuals to become more self-efficacious in the management of their health and well-being. Indeed, the more informed, educated, and knowledgeable society becomes regarding effective stress management tools to monitor and regulate their response to stress, the more healthy and better equipped society will be to cope with the pressure and stress associated with living in today's society.

The Nature of Stress

The word stress originally comes from the 14th century and is a form of the Middle English *destresse* via Old French from the Latin *stringere*, meaning to draw tight (Keil, 2004). However, Hans Selye – an endocrinologist and one of the leading pioneers in research associated

with stress – defined the word *stress* in biological terms as “a state produced within an organism subjected to a stimulus perceived as a threat” (Selye, 1956, p. 52). In 1992 Benson and Stuart published a definition of stress: “Stress is the perception of a threat to one’s physical or psychological well-being and the perception that one is unable to cope with that threat” (Benson & Stuart, 1992, p. 180). Thus, stress may refer to physiological changes in response to perceived physical or psychological events.

It has been over 100 years since Walter Cannon identified the fight (aggress) or flight (flee) response as being the physiological reaction to a threat (Cannon, 1914). One can imagine that, in prehistoric times, the fight response may typically have been exhibited as aggressive combative behavior – such as when tribes were confronted with a neighboring group vying for occupation of a sheltering cave. The flight response may have been exhibited as running for one’s life in response to being confronted by a large, hungry, hairy mammoth.

Clearly, the physiological activation of the stress response served a valuable and appropriate purpose in prehistoric times, as it does today. However, there are situations in which one’s stress response may become activated where physical action is inappropriate or unnecessary. In today’s society, although the same physiological responses are available to us, the fight or flight responses have assumed a wider range of behaviors. For example, the fight response may be exhibited as punching or kicking to protect oneself when attacked; however, it may also be exhibited as verbal, argumentative behavior. Similarly, while the flight response may be manifested by running away from a large, menacing, barking dog, it may also be exhibited by social withdrawal, substance abuse, and even television viewing (Friedman & Silver, 2007).

The Impact of Stress on the Nation

In the United States, the declining state of the nation's economy is taking a physical and emotional toll on people nationwide. In June 2008, the American Psychological Association (APA) commissioned its annual nationwide survey Stress in America, 2008 to examine the state of stress across the country and its impact upon the nation. The data was collected from adults aged 18 and over who reside in the United States. Findings from this study indicated that nearly half of Americans report that their stress level has increased over the past year. Furthermore, 30% of the people rated their average stress level as being in the extreme range. In addition, 66% of the people rated the economy to be significant sources of stress while 76% of the people specified money to be a significant source of stress. Overall, financial stressors topped the list of sources of stress, regardless of ethnicity.

Results from the survey (APA, 2008) indicated that one in five employed people between the ages of 44-62 reported their average stress level at work as being extreme, rating it at 8, 9, or 10 on a 10-point scale. Furthermore, 60% of Americans reported losing some amount of productivity at work during the previous month due to stress. In addition, 29% of people between the ages of 18-29 reported extreme stress levels of 8, 9, or 10 on a 10-point scale. Moreover, 48% in this age group (18-29) felt that the amount of stress they were experiencing had increased over the past year.

It was interesting to note that when it came to recognizing the physical and mental toll of stress, more than 8 in 10 people (86%) recognize that stress increases their likelihood of becoming sick and the negative impact of stress upon conditions such as depression, heart attack, or stroke, high blood pressure, cancer, obesity, and insomnia (APA, 2008). However, nearly half of all Americans (48%) say they would be somewhat or very uncomfortable asking others for

help managing their stress. In addition, nearly 6 in 10 (58%) people reported that they would be uncomfortable seeking professional advice to help manage their stress or stress-related problems.

The survey also indicated that more people reported physical and emotional symptoms due to stress than the previous year (APA, 2008). In addition, some of the symptoms of stress that people reported as being higher than the previous year (2007) were feeling irritable or angry, fatigue, lying awake at night, headache, upset stomach, muscular, tension, teeth grinding, tightness in chest, feeling nervous or anxious, and feeling depressed or sad.

In addition, the survey also indicated that Americans relied less on engaging in healthy behaviors to manage their stress in 2008 than they did the previous year (APA, 2008). It was interesting to note the percentages of those reporting the following unhealthy behaviors as being effective in managing stress: smoking (40%); gambling (41%); shopping (35%); and, drinking alcohol (27%). Furthermore, more Americans (48% versus 43%) reported overeating or eating unhealthy foods to manage stress in 2008 than the previous year, and 4 in 10 (39% versus 36%) reported skipping a meal during the previous month because of stress.

Thus, it may reasonably be concluded that as the economy worsens, so does stress, stress-related symptoms, and illnesses. Besides the adverse effects of stress on human health, stress also takes a costly toll on the economy. To illustrate, in 1994 the National Council on Compensation Insurance reported that stress-related symptoms and illnesses caused industry a conservatively estimated \$150 billion a year in medical expenses, lost productivity, and absenteeism. Furthermore, in 1994 it was also estimated that over \$30 billion was spent on stress-related illnesses and diseases (Seaward, 1994, p. 5). In comparison, the 2008 APA study revealed that stress in the workplace is costing business \$300 billion annually due to loss of

productivity, absenteeism, turnover, and increased medical costs. This is exactly double the cost of a mere 14 years ago.

The Impact of Stress on College Students

College students are also reporting feeling greatly concerned and stressed about the state of the nation's economy and how it is impacting them. For the second year in a row, mtvU (MTV's 24-hour college network) and the Jed Foundation (the nation's leading organization working to reduce emotional distress and prevent suicide among college students) partnered with The Associated Press and conducted a poll to explore the emotional health of today's college students. The poll was conducted between April 22-May 4, 2009 and included interviews with 2,240 college students at 40 randomly selected four-year postsecondary institutions.

Overall results of the poll indicate that the impact of stress can be seen across all areas of students' lives – affecting them both academically and socially. Specifically, 85% of students reported experiencing stress on a daily basis (up from 80% last year). For example, according to the poll, more than half (63%) of college seniors are worried that they may not be able to secure employment after graduation. In addition, nearly one in three (32%) college students reported financial pressures as being a big source of daily stress for them. This figure indicates a 27% increase from last year. Specifically, 48% of students reported that they are somewhat/very worried about having enough money to pay for school next year. Moreover, almost one in five students (18%) reported having a parent who experienced job loss since the beginning of the year. Alarming, 17% of students considered dropping out of school in the past three months – citing financial pressure as being the primary cause (MTVu, 2009). In addition, credit card debt among undergraduate college students is becoming a problem nationwide (Adams & Moore,

2007). High levels of debt are stressful, thus compounding student's stress levels (Adams, & Moore, 2007).

Studies have shown that when stress becomes excessive, it can affect both health and academic performance (Campbell, Svenson & Jarvis, 1992). It appears that findings from the poll give substantial evidence in support of this research. Indeed, the findings indicate that, despite the larger national issues, academic concerns such as school work and grades (77% and 74%, respectively) maintain top positions as being responsible for students' stress (MTVu, 2009).

In addition, it appears that many students are struggling with mental health issues related to their stress. A total of 1 out of 10 students reported signs of moderate to severe depression. Moreover, 6 out of 10 students reported having felt so stressed that they could not get their work done on one or more occasions (41% once or twice, 19% several times). Furthermore, the poll revealed that 53% of students reported feeling so stressed that they did not want to hang out with their friends on one or more occasions (MTVu, 2009).

Alarming, 17% of students reported that their friends have talked about wanting to end their lives. In addition, 10% reported having a friend who had made a suicide attempt, and seven percent reported that they had seriously thought about ending their own lives in the past year. Moreover, 11% of students reported having had thoughts that they would be better off dead, or hurting themselves in some way. It was interesting to note that only about half (48%) of the students reported being familiar with counseling resources available on their campus and among students reporting signs of moderate to severe depression, 47% stated that they were not familiar with the counseling resources available on their campuses (MTVu, 2009). Clearly, results of the poll appear to indicate that there is a resource-disconnect for those students that need it the most.

The Utility of Stress Management and Biofeedback Modalities

It has been suggested that *stress management* is the ability to reduce or cope with stressors by controlling frequency, intensity, and duration of the stress reaction to decrease unhealthy conditions (Girdano, Everly & Dusek, 1997). In the broadest sense, stress management may include any type of stress intervention; however, it may also include a narrow set of individual-level interventions such as relaxation training, meditation, or biofeedback (Murphy, 1995). *Biofeedback* is a modality which provides immediate information, or feedback, regarding specific physical states of the body, such as electrical activity of muscle and skin temperature (Davis, Eshelman & McKay, 1994). Indeed, biofeedback has been identified as an effective tool to directly modify the stress response (Everly & Lating, 2000).

Although biofeedback and relaxation training have been shown to be effective ways to manage stress in the general population (Moss, 2001), there is little research investigating the use of biofeedback and relaxation training with college students. Hence, the purpose of this study was to determine whether biofeedback and relaxation skills training is a helpful tool that students can utilize to help them reduce physiological tension.

Literature Review

In this review, a discussion on the origins and development of research concerning stress is presented and followed by a historical overview regarding the origins and development of the field of biofeedback. The empirical literature regarding the uses and effectiveness of biofeedback training in relieving stress and maintaining health will be presented as well as research pertaining to the effectiveness of relaxation techniques in producing a state of relaxation. A description of eight specific relaxation techniques and their role in reducing various stress-related symptoms will follow. In addition, empirical literature regarding the impact of stress of college students will be reviewed, including types of stressors they experience, various stress-related symptoms, and common coping strategies utilized by college students to alleviate their stress.

The Origins and Development of Research Relating to Stress

Many early researchers made significant contributions to the study of stress. Examples of such contributions include identification of the natural causes and results of the innate stress response or *fight-or-flight response*, the concept of physiological balance or *homeostasis*, the finite nature of the body's capacity to utilize adaptation energy, the principle of voluntary control over physiological responses to stress, and the development of an electrical apparatus designed to measure muscle tonus.

The Pioneering Researchers in the Field of Stress

Pioneering researchers in the field of stress were, among others, Claude Bernard, Walter A. Cannon, Edmund Jacobson, and Hans Selye. The efforts of these pioneers laid the foundation for later researchers to build upon, resulting in a more comprehensive understanding of the role of stress today. Indeed, these original researchers into the field of stress paved the way for later

researchers to more completely identify the components of stress and its various functions in producing distress and causing illness.

Claude Bernard. In 1929 Claude Bernard developed the concept of physiological *homeostasis* (Selye, 1974). The word is derived from the Greek *homoios* meaning similar, and *stasis* meaning position, thus, the ability to stay the same or static. According to Bernard, homeostasis is a state of equilibrium and is the major process by which the body maintains itself including taking care of processes such as digestion, and tissue repair, for example. Homeostasis is believed to be maintained by a negative feedback loop, which is a hypothesized mechanism within the body that provides information to the physiological system to decrease activity if its functioning levels are higher than normal, or to increase activity if levels are below normal. The occurrence of physical and mental disease was thought to occur due to malfunctioning of some part of the homeostatic feedback mechanism. One of the major effects of homeostatic imbalance is stress (Schwartz & Olson, 2003).

Walter Cannon. In 1932 Walter Cannon published his book, *The Wisdom of the Body*, in which he presented the concept of the natural causes and results of the innate stress response, which he named *fight or flight*. The fight or flight response is the body's psychophysiological arousal and preparation for fighting or fleeing actual or perceived threatening stimuli. The response is initiated and coordinated by the autonomic, or involuntary nervous system, and the endocrine system. These systems direct specific changes in how the body is functioning, in order to prepare the body to deal with the threat and get the body out of danger quickly, in order to return the body to its previous state.

Edmund Jacobson. In the United States, investigations into the principle of voluntary control over physiological responses began as early as the 1920's and 1930's and was pioneered by Edmund Jacobson who developed a device employing low micro voltage to detect muscle tension. Jacobson discovered that tension and exertion was accompanied by a shortening of the muscular fibers, and that reducing muscular tension decreased the activity of the central nervous system (Jacobson, 1933). His apparatus made the first accurate electrical measurement of muscular tonus. Later, during the 1960's, John Basmajian began exploring voluntary control over the skeletal muscles using needle and surface electrodes with oscilloscope and audio feedback. He demonstrated that individuals could develop control of single motor units of a muscle within a brief time, given feedback for discrimination (Basmajian, 1967).

Jacobson also developed a technique named progressive relaxation to reduce muscular tension. He was also able to prove the connection between excessive muscular tension and various disorders of mind and body. After twenty years of research he established that relaxation was contrary to the state of tension and would, therefore, be beneficial in promoting reduction of physiological tension and thus promote a healthier state (Jacobson, 1938).

Hans Selye. Through his research with laboratory animals in the 1930's, the endocrinologist Hans Selye was able to identify physiological responses associated with exposure to cold, muscular effort, and other stressors. Indeed, Selye's research contributed greatly to the understanding of stress and its physiological impact on the body. For example, Selye noted that the laboratory animals were not able to resist exposure to stressors indefinitely. Lengthy or indefinite exposure to stressors eventually led to exhaustion. The significance of this led Selye to conclude that the body's adaptability, or capacity to utilize adaptation energy, was finite (Selye, 1974).

In his book *Stress without Distress* (1974), Selye presents the biological stress syndrome, also known as the general adaptation syndrome (G.A.S.). According to Selye, the G.A.S. is a triphasic conceptualization of the course of the physiological stress response. The three stages are (a) alarm reaction, (b) stage of resistance and, (c) stage of exhaustion. Once the alarm reaction occurs the body begins to adapt and begin to resist. The length of the resistance period depends upon two things (a) the body's innate adaptability, and (b) the intensity of the stressor. However, over time, the energy utilized during the stage of resistance becomes depleted and the stage of exhaustion occurs (Selye, 1974).

The Emergence of Behavioral Medicine

It was due to findings such as the aforementioned that a call went out for more emphasis to be placed upon research to address the impact of stress upon the human body. Thus, research regarding stress became a major focus during the 1970's. One example of such research efforts was conducted by Paul Rosch (1979), a physician who headed the American Institute of Stress at that time. Based upon his findings, Rosch commented that, "Stress has surpassed the common cold as the most prevalent health problem in America" (Rosch, 1979, p. 427).

In the late 1970's behavioral medicine emerged as a distinct discipline – having developed within behavior therapy and psychosomatic medicine. It focuses on applications of learning theories to medical disorders and other health-related topics. An important area of behavioral medicine is ongoing research concerning the effects of stress producing physical symptoms and altering the immune system (Schwartz & Weiss, 1978).

Schwartz and Weiss (1978) gave a definition of *behavioral medicine* which was proposed at a Yale conference held in 1977:

Behavioral medicine is the field concerned with the development of behavior science knowledge and techniques relevant to the understanding of physical health and illness and the application of this knowledge and those techniques to diagnosis, prevention, treatment, and rehabilitation. (p. 379)

Behavioral medicine also came about because traditional medical approaches at the time appeared to be insufficient for managing and treating many chronic diseases, conditions, and maladaptive behaviors damaging to health. Indeed, behavioral medicine recognizes the significant roles of stress, lifestyle, habits, and environmental factors in the development, maintenance, and treatment of various diseases and conditions. Behavioral medicine also stresses the importance of the patient's role in prevention as well as recovery from such related diseases and conditions. Both the fields of behavioral medicine and biofeedback have their roots partly in research associated with stress.

In 1991, the U.S. Senate established the Office of Alternative Medicine (OAM) within the National Institutes of Health (NIH) and gave it a mandate to “more adequately explore unconventional medical practices” (National Institutes of Health, [NIH], 1995, p. iv). In 1995 the OAM convened a workshop in Chantilly, Virginia, in which leading researchers and educators in all areas of alternative medicine presented research findings concerning clinical applications of unconventional medical therapies. The government issued report that contains those findings and recommendations has become known as the *Chantilly Report* (NIH, 1995).

In 1998, the OAM became the National Center for Complementary and Alternative Medicine (NCCAM), thus reflecting the ongoing national priority on developing evidence-based practices of alternative and complementary medicine. At the convention *mind-body medicine* was defined as a set of interventions originating in both Western and non-Western paradigms

directed at treating disease or preserving health based on the inter-connection or integration of mind and body. According to the Chantilly report, mind-body interventions include meditation, guided imagery, hypnosis, biofeedback, yoga, dance therapy, music therapy, art therapy, prayer, and intentional healing at a distance (NIH, 1995).

It is of interest to note that after having established that more than 99% of surveyed schools reported had either a separate course on complementary and alternative medicine (CAM), or had integrated CAM modalities in other nurse-practitioner courses, the National Organization of Nurse Practitioner Faculty (NONPF) prepared guidelines regarding integrating complementary and alternative modalities in nurse practitioner programs (Quinn, 2002). This serves to underscore the importance which has been placed on the role that CAM modalities – of which biofeedback is one – are playing in mainstream health care delivery.

The Link Between Stress and Illness

Between the 1970's and 1990's, a large amount of research was done to examine the connection linking stress and disease. According to Selye a certain degree of stress is necessary for good mental and physical health. This type of stress compels one to act with optimum performance in order to achieve one's goals. Selye named this type of beneficial stress, *eustress*. The word is derived from the Greek root *eu*, meaning good. Selye suggested thinking of eustress as a combination of euphoria and stress. Selye elaborated further by suggesting that it is only when stress is poorly managed or becomes overwhelming that the negative effects are experienced, which he referred to as distress (Selye, 1956). Over time, the resulting awareness of the deleterious effects of stress on health and disease has brought about an increased awareness of the need for effective stress management modalities of which, among others, biofeedback and

relaxation treatment and training have become well established (Amar, 1995; Critelli & Ee, 1996; Moss, Andrasik, McGrady, Perry & Baskin, 2001).

The word *distress* refers to the unhealthy, negative, destructive outcomes of stressful events (Quick, Quick, Nelson & Hurrell, 1997). According to researchers distress may be manifest in any one, or a combination, of behavioral, psychological or physiological consequences (Quick, et al., 1997, p. 66). Behavioral consequences may include excessive tobacco use (Naquin & Gilbert, 1996) and alcohol use (Weitzman, 2004), for example. Psychological consequences may include anxiety disorders (Papp & Gorman, 1993), sleep disturbances (Giesecke, 1987; Farnill & Robertson, 1990), and depression and suicidal ideation (Garlow, et al., 2008), for example. Physiological consequences may include hypertension (Walker, Unützer & Katon, 1998), coronary heart disease (Rozanski, Blumenthal & Kaplan, 1999), cancer (Penninx, Guralik & Pahor, 1998), headache (Labbe, Murphy & O'Brien, 1997), diabetes mellitus (Glasgow, et al., 1999), upper respiratory infection (Hamrick, Cohen & Rodriguez, 2002), and chronic fatigue syndrome (Lapp, 2003).

The immune system responds to signals from many systems within the body, particularly the nervous system and the endocrine system (Segerstrom & Miller, 2004). Thus, environmental events to which the nervous and endocrine systems respond can also elicit responses from the immune system. Over the past 30 years, more than 300 studies have been done on stress and immunity in humans (Segerstrom & Miller, 2004). Collectively, these studies have found that as stressors become more chronic, the immune system's ability to fight disease is diminished (Herbert & Cohen, 1993; Zorilla, et al., 2001). According to Sternberg et al., disruption in communication among the major biological systems during and after serious stress or the accumulation of multiple, minor, difficult events increase the risk for physical and emotional

illness (Sternberg, et al., 1992). In addition, chronic stressors of long duration are associated with the most global immunosuppression (Segerstrom & Miller, 2004).

The Origins and Development of the Field of Biofeedback

The development of biofeedback has its origins in the United States in the 1950's at a time when various disciplines such as biomedical engineering, cybernetics, behavior therapy and behavioral medicine, stress research, and psychophysiology, began to converge (Schwartz, & Olson, 2003). The term *biofeedback* was coined in the late 1960's to describe laboratory procedures, which had been developed in the 1940's. These procedures were being utilized to train research participants to alter bodily functions that are not usually controlled voluntarily, such as blood pressure and heart rate. In this way, researchers were able to prove that many individuals actually have the ability to alter their involuntary responses. Indeed, by the early 1970's the three major bodily systems, namely, the autonomic, skeletal muscle, and central nervous system, had all been shown to be subject to voluntary control (Gilbert, & Moss, 2003).

In addition, researchers were able to show that through the utilization of biofeedback instrumentation, individuals could be fed back information – either visually or audibly – and thereby recognize some processes occurring within the body such as muscle tension. Electronic biofeedback instruments such as Electromyograph (EMG) and Thermal Feedback are designed to record levels of functioning non-invasively. Most biofeedback instruments record from the surface of the skin. The EMG utilizes surface electrodes to detect fluctuating voltage through the skin and stream the data continuously via some form of visual display (Gilbert, & Moss, 2003). In this way the person being recorded as well as the therapist, technician, or coach can attend to the information being displayed and incorporate the information in a way so as to guide the person's progress throughout the session. In thermal, or temperature feedback, a thermistor is

most commonly taped to a finger so as to detect changes in blood flow resulting in changes in skin temperature. Changes in blood flow are most usually linked to changes in emotions related to anxiety, or fear. Such emotions bring about vasoconstriction in the smooth muscles which results in cooler surface skin temperature (Gilbert, & Moss, 2003).

Biofeedback was officially named in 1969 at a Santa Monica, California, conference at which the Biofeedback Research Society was founded (Schwartz & Olson, 2003). In 1988 the Association for Applied Psychophysiology and Biofeedback (AAPB) was established. The association has a scientific journal named *Applied Psychophysiology and Biofeedback* which publishes empirical investigations on biofeedback (Schwartz & Olson, 2003).

Today, biofeedback is one of several methods approved by the National Institutes of Health (NIH) for use as a complementary alternative therapy (Davies, 2003). Complimentary therapies are those that are used along with conventional medical treatments to treat a particular illness or symptom. Biofeedback is not a treatment. Rather, it is an educational training process which aids in learning specialized mind/body skills. Biofeedback provides immediate feedback as to the levels at which certain physiological symptoms within the body are functioning. Thus, biofeedback training has proven to be effective in teaching individuals to become aware of their internal and external manifestations of stress.

Ultimately, with the aid of various biofeedback modalities, one is able to learn how to voluntarily alter physiological processes such as heart rate, temperature, perspiration, blood flow, or muscle tension with conscious thought (Gilbert & Moss, 2003). In this way one can learn how to moderate or cope with the inevitable effects of stress.

The Effectiveness of Biofeedback Training in Relieving Stress and Maintaining Health

Biofeedback is often recommended for headache treatment such as tension-type headaches and migraines, (Moss, Andrasik, McGrady, Perry, & Baskin, 2001), irritable bowel syndrome (Blanchard, 2001), anxiety, depression, attention deficit disorders, alcoholism and addictions (Shannon, 2001). In addition, temperature feedback has been found to be effective in the treatment of Reynaud's disease (Freedman, 1987) by learning to prevent, limit, or reverse vasospasms of the blood vessels causing restriction of blood supply. The goal of temperature feedback in this case, is to aid individuals in learning how to regulate and maintain circulation in the hands and feet (Freedman, 1987).

In addition, electromyograph and thermal feedback have been found to assist in long-term reduction of blood pressure previously elevated by emotional stress (Goebel, Viol, & Orebaugh, 1993). Ideally, over time and with practice, biofeedback enables an individual to cultivate a relaxation response, reversing each aspect of the stress response. In this way muscles relax, heart rate, blood pressure, and respiration decrease, and the individual experiences a quieting within the nervous system (Moss, 2001).

The Role of Relaxation Training in Stress Relief

In the United States, medical applications for relaxation were first developed by Edmund Jacobson (1938) in the 1920's and 1930's (Schultz & Luthe, 1969). Indeed, because of the well-known relationship between stress and vulnerability to various diseases and disorders involving dysfunction in emotional, autonomic, and immune systems, stress management and relaxation methods have been incorporated into many of the treatments thereof (Critelli & Ee, 1996). For example, according to Amar (1995), relaxation training is useful in overcoming anxiety, tension, and worry.

The role of relaxation training is to elicit or produce the relaxation response (RR). Relaxation methods work on the premise that it is impossible to be tense and relaxed at the same time (Amar, 1995). Studies by Hoffman and Lehmann indicated reduced responsiveness to the stress hormone norepinephrine after four to six weeks of daily RR practice (Hoffman, Benson, Arns, et al., 1982; Lehmann, Goodale, & Benson, 1986). Thus, regular practice of the RR increases one's resilience to stress. For example, stress-reduction exercises appeared to mediate the relationship between times of stress and likelihood of infectious illness among college students (Lepore, Miles, & Levy, 1997).

The Relaxation Techniques Utilized in this Study

Relaxation training (RT) is a skill that has been repeatedly validated by nursing, medical and psychology researchers (DeMarco-Sinatra, 2000). The *Wikipedia* website provides a comprehensive definition of a relaxation technique as being any method, process, procedure, or activity that helps a person to relax; to attain a state of increased calmness; or otherwise reduce levels of anxiety, stress or tension (http://en.wikipedia.org/Relaxation_technique).

The following are descriptions of the eight relaxation techniques, including their functions, which were utilized in this study:

Autogenics. Autogenic training was developed by the German physician Johannes Schultz. It is effective in reducing fatigue, tension, high-blood pressure, racing heart, irritability, and painful symptoms such as headaches and migraines. It can also reverse the fight-flight or freeze state associated with anxiety and panic attacks (Schultz & Luthe, 1969).

The technique is essentially a form of structured self-hypnosis involving passive concentration and repeating internal verbal formulae suggestive of warmth and heaviness in the limbs. Many changes take place within the body when the fight or flight response is activated,

one of these changes is the redirection of the blood away from the extremities. Thus, in many instances, cold hands are an indication of stress. Therefore, in autogenic training the theme of warmth is designed to bring about peripheral vasodilation, or, dilation of the blood vessels and capillaries, thereby improving circulation. Muscular relaxation is experienced as a feeling of heaviness in the arms and legs, thus, the theme of heaviness is designed to promote relaxation of voluntary muscles. Phrases that may be utilized include, “My hands are warm,” “My legs are heavy,” and “My forehead is cool.”

Body scan. According to Jacobson (1938), physiologically speaking, relaxation is the lengthening of muscle fibers whereas tension is the contraction of muscle fibers. The word relax is derived from the Latin word *laxus* meaning to be loose. According to Miller (1990), to relax means to regain the natural feeling of looseness and ease. Thus, the goal of this technique is to identify where tension is stored in the body and to bring about a loosening and relaxing of that area. Body scanning involves passively focusing on various areas of the body, most often beginning with the feet, systematically progressing upwards, and ending with the facial muscles. When an area of tension has been located, the individual focuses on relaxing and loosening the identified muscle or muscle group.

Diaphragmatic breathing. According to Wilhelm and Roth (1998), people who suffer from panic disorder experience hyperventilation and other dysfunctional breathing patterns. There is abundant evidence concerning the efficacy of biofeedback and diaphragmatic breath retraining in moderating both abnormal breathing patterns and panic. Indeed, studies have shown that breath retraining, respiratory biofeedback, and heart rate variability (HRV) biofeedback are tools which have proven to be useful in reducing anxiety disorders, especially panic disorder, and producing subjective calming (Berger & Gevirtz, 2001; Clark & Hirschman, 1990; von Scheele,

1998). Current treatment of anxiety disorders relies heavily on cognitive-behavioral interventions. However, it is of interest to note that in the aforementioned study conducted by Beger and Gevirtz (2001), breathing retraining alone produced as much improvement as cognitive-behavioral therapy alone.

Meditation. Herbert Benson (1975) established the medical benefits of meditation methods such as slowing down heartbeat and breathing, lowering high blood pressure, heart disease, and autoimmune diseases such as arthritis and diabetes. Mental focus on a singular object, mantra, soothing sound, or one's heartbeat, for example, serve to bring about a reduction in verbal thought and block anxiety, thus, meditation is also utilized to help curtail obsessive thinking, and excessive worrying. By inhibiting excessive mental activity, meditation also teaches individuals how to maintain focus and concentration (Benson, 1975).

Jon Kabat-Zinn is the founding executive director of the world-renowned Stress Reduction Clinic and the Center for Mindfulness in Medicine, Health Care, and Society at the University of Massachusetts Medical School. He is internationally known for his work in bringing mindfulness into the mainstream of medicine by pioneering the mindfulness meditation method. According to Kabat-Zinn, this technique was devised to increase mindfulness and awareness and to help individuals recognize and cope with stress, anxiety, pain, and illness (Kabat-Zinn, 1982).

Performance rehearsal. Performance rehearsal is particularly effective with enhancing performance and bringing about successful behavior change. It is well known that many athletic, theater, and musical performers utilize mental rehearsal to increase desired optimal performance. To help them transfer psychomotor skill performance from the nursing laboratory to the clinical

setting, nursing students at the University of Hawaii are taught a form of performance rehearsal (Contrades, 1991).

Progressive muscle relaxation. During the 1920's and 1930's Edmund Jacobson taught patients to enhance awareness of skeletal muscle tension by the methodical tensing and relaxing of various muscle groups. Minimum muscle tension is utilized in order for the individual to recognize the sensations of tension in specific muscle groups. The overall objective of progressive muscle relaxation (PMR) is to teach an individual to develop control over various muscles in order to make voluntary relaxation of the muscles possible. PMR is especially effective for muscular tension, neck and back pain, and muscle spasm. In addition, PMR also helps to reduce pulse and respiration rates (Jacobson, 1938).

Self-hypnosis. Not to be confused with hetero-hypnosis, which is induced by a licensed and trained clinical hypnotherapist, self-hypnosis is a form of hypnosis that is self-induced and utilizes conscious auto-suggestion combined with imagery. Emile Coué (1857-1926), sometimes known as the “father of applied conditioning” or the “prophet of self-suggestion” (International Association of Pure Hypnoanalysts, [IAPH], (2009), was originally trained as a pharmacist. He noticed that in certain instances he could improve the efficacy of a medicine simply by praising its effectiveness to the patient. Specifically, he noticed that those patients to whom he praised the medicine showed a marked improvement over those patients to whom he said nothing. This led to a lifelong study concerning the power of the imagination and autosuggestion (IAPH, 2009).

Coué believed that imagination is the principal force of the human being and is the language of the unconscious mind. Furthermore, he believed that all thoughts continue until they have been discharged by action, or changed by other thoughts. Indeed, Coué believed that if you can get a person to think and believe that they are getting better, they will do so. Self-hypnosis is

particularly effective for performance enhancement and anxiety and is often used as a form of personal development and motivation (IAPH, 2009). The goal of this technique, therefore, is to assist in bringing about a desired change in feelings and behavior when under stress.

For biofeedback purposes, once the particular needs of the client have been established, the client and lab technician design a formula of either one or more appropriate words such as “I am calm,” or “I can do this,” or “I am relaxed,” for example. The chosen words are descriptions of ways in which the client would like to feel, act, or be during situations that typically cause him or her feelings of stress and anxiety. The words are usually then recorded. Either the lab technician or the client’s voice may be utilized for the recording. The lab technician will then implement a relaxation technique and, once the client has become sufficiently relaxed, the recording of the affirmation/s is activated while the client mentally repeats them. While mentally repeating the words, the client is also encouraged to feel the effects of the words taking place – such as becoming more calm, relaxed, peaceful, or confident, for example.

Visualization. The Iowa Nursing Interventions Classification defined imagery as being the purposeful use of imagination to achieve relaxation and/or direct attention away from undesirable sensations (McCloskey & Bulechek, 1996). At the University of Hawaii, imagery is taught to nursing students to help them reduce anxiety, manage stress, and transfer psychomotor skill performance from the learning laboratory to the clinical setting (Contrades, 1991).

The Impact of Stress on College Students

Ramsey, Greenberg, and Hale (1989) indicated that the college experience may be the most stressful years in one’s life. Today’s college students have to deal with both the negative impact of the economy as well as the stress associated with college (Patrick et al., 1997). Besides the leap from the high school environment to that of college, one of the first major life transitions

students may have to make is moving away from home. During this transition process students often experience personal and emotional problems, global psychological distress, somatic distress, anxiety, self-criticism (Chang, 1998), and depression (Gerdes & Mallinckrodt, 1994). Indeed, researchers have indicated that the move from one's childhood home to college is a critical transition with the potential for creating disappointment, self-doubt, and encouraging self-defeating behaviors (Weiss, 1990).

Various stressors and symptoms experienced by college students. Overall, during their four-year college experience students may experience numerous stressors from a variety of sources. McEwan and Lasley (2002) postulated that stress may be seen as the pressure that life exerts on one and the way this pressure makes one feel. For example, sources of stress may include feelings such as negative self-evaluation and negative comparisons between self and peers, unrealistic expectations, pressure to succeed, perfectionistic tendencies, and competitiveness (Pritchard, Wilson, & Yamnitz, 2007), loneliness (Pierce, Sarason, & Sarason, 1991), and depression (Segrin, 1999), for example.

These negative mental emotions have the potential to cause physical illness (Kemeny & Miller, 1999). According to Allen (1983), psychosomatic diseases and other disorders occur when a state of mind triggers real physical damage. Allen elaborates further by describing a psychosomatic model consisting of a sequence that progress from stress to disease. These steps include sensory stimulus, perception, cognitive appraisal, emotional arousal, mind/body connection, physical arousal, physical effects, and disease. In addition, according to Allen, stress management works to interrupt this chain of events, thus preventing diseases and disorders (Allen, 1983).

In addition, external sources of stress may include poor housing, roommates, finding employment, scheduling classes, peer relations, adjusting to a change in sleeping and eating habits, for example (Murff, 2005). Indeed, according to Murff, college students report their biggest stressors as being adjusting to a change in sleeping and eating habits, managing new responsibilities and heavier workloads, and dealing with breaks in the academic year.

Various non-academic sources of stress reported by students include interpersonal conflicts within relationships such as being rejected by someone or relationship breakups (Frazier & Schauben, 1994), roommates (Ross, Neibling, & Teresa, 1999), financial pressures (Misra, et al., 2000), insufficient time (Macan, 1990), and self-esteem issues (Towbes & Cohen, 1996).

Academic pressure, however, may be the greatest overall stressor that students experience during their four-year college experience (Hirsch & Ellis, 1996). Previous studies have cited some academic stressors to be: pressure to earn good grades, excessive homework, weekly tests and papers, unclear assignments, and uncomfortable classrooms (Kohn & Frazer, 1986). Furthermore, receiving a lower grade than expected is another reported source of stress (Ross, Neibling, & Teresa, 1999). In addition to academic requirements, attitudes of faculty members towards students and students' towards faculty also impact stress levels (Williams & Winkworth, 1974). Ross et al. (1999) also reported computer problems as being an additional source of stress for students. Furthermore, Endres (1992) identified having to learn new technology as being an additional source of stress reported by students

Stress-related symptoms are the unpleasant side-effects or consequences of stress. Stress-related symptoms may be manifest physiologically or emotionally. For example, MacGeorge, Samte, and Gillihan (2005) suggested that stress from academics contributes to symptoms of

depression and physical illness in college students. Furthermore, research has indicated that poor mental health is associated with physical illness (Adams, Wharton, Quilter, & Hirsch, 2008).

Sleep is an important aspect of successful academic and personal life in college; however, sleep difficulties can significantly impair students' academic performance (Lack, 1986). Sleep deprivation, for example, negatively impacts students in a variety of ways such as increased feelings of sleepiness during the day, difficulty paying attention in class and adversely affecting their ability to perform on exams (Pilcher & Walters, 1997). Moreover, students' poor sleep quality is linked to increased tension, irritability, depression, confusion, and generally lower life satisfaction (Pilcher, Ginter, & Sadowsky, 1997). In addition, sleep deprivation may also decrease positive mood and increase negative mood states (Brendel, Reynolds, & Jennings, 1990).

Various coping strategies utilized by college students. In order to deal with their stressors or to alleviate the accompanying unpleasant symptoms, students may engage in a variety of coping strategies. Some coping strategies are healthy, while others are not. Examples of healthy coping strategies may include leisure and/or various fitness activities (Ragheb & McKinney, 1993), effective time management and study techniques (Brown, 1991), and social support (Wei & Sha, 2003), while examples of unhealthy coping strategies may include avoidance (Mattlin, Wethington, & Kessler, 1990), drugs, alcohol, and smoking, for example (Luquis, Garcia, & Ashford, 2003). In addition, according to Kiecolt-Glaser and Glaser (1988), peoples' efforts to manage the demands of a stressful experience sometimes lead them to engage in behaviors that could modify immune system processes. Thus, behavior may represent an important pathway that links stress with the immune system.

A study undertaken by Luquis et al. (2003) in which they investigated college students' perceptions of health behaviors produced some alarming findings. This study utilized focus groups in which students' responses to questions regarding their health behavior were recorded. Results of the study indicated that although physical activity, poor eating habits, and stress management were of concern to them, students engaged in some unhealthy behaviors. Reasons given for engaging in unhealthy behaviors were varied, such as wanting to fit in socially, to be less inhibited, or to alleviate boredom, for example. Students provided alarming responses when asked to provide reasons for utilizing drugs, alcohol, or tobacco. For example, some students responded that utilizing drugs served as a coping mechanism for stress and depression. Other students responded that alcohol served as a reward from a stressful week. In addition other students commented that using tobacco relieved their stress. Thus, although college students express concern about their health, many of them engage in unhealthy behaviors in response to their stress (Luquis et al., 2003).

The Role Research Plays on Stress in the Current Study

As previously mentioned, research has shown that learning how to monitor and regulate one's response to stress can serve to strengthen one's immune system's ability to maintain homeostasis and health, thereby increasing one's ability to function at more optimal levels. Furthermore, as previously mentioned, biofeedback and relaxation skills training are designed to assist in accomplishing the aforementioned goal. This study, therefore, was undertaken with the purpose of identifying the physiological effects of biofeedback and relaxation skills training on a sample population of college students. Moreover, in addition to contributing to the literature regarding stress and college students, it was hoped that the results of the study would provide

illumination regarding the effectiveness of such an intervention in aiding students to reduce their physiological tension and increase their sense of relaxation.

Statement of the problem. According to the National Center for Education Statistics in fall 2007 there were 6,764 Title IV postsecondary institutions in the United States with a total enrollment of 18.7 million graduate and undergraduate students. The American College Health Assessment (ACHA-NCHA, 2008), found that among a sample of 80,121 students across 106 campuses, the top reported health impediment to students' academic performance was stress.

Colleges are responsible to provide students with reasonable means to ensure their academic success. Furthermore, college health programs and health centers are responsible for advancing the physical and mental health of students. When one takes into consideration the magnitude of students in colleges throughout the country, the fact that they report stress as being the number one impediment affecting their academic performance, and, considering that students rate health educators to be the most believable source of health-related information, it appears that colleges need to step up their efforts in providing students with health-related education regarding stress: how to identify it and how to manage it in healthy ways.

There is relatively little research concerning the prevalence of, or types of relaxation skills training offered by colleges to help students cope with their stress-related symptoms. Furthermore, there is even less research concerning the use of biofeedback and relaxation skills training offered by colleges to help students cope with their stress symptoms. Therefore, much more research needs to be done regarding effective interventions for students to help them manage and cope with the inevitable stress associated with being a college student for four years.

Research questions. Consequently, several specific research questions were designed as a means to assist in accomplishing the overall purpose of the study. The following research

questions were determined: (1) What stress-related symptoms do college students report as being the most troublesome/problematic; (2) What stressors do college students report experiencing; (3) What are the major coping strategies utilized by college students to help alleviate their stress; (4) Would students' subjective ratings of stress change following a biofeedback and relaxation training session; (5) Would students' EMG readings change from pre- to post-session; and, (6) Would students' skin temperature readings change pre- to post-session?

Importance of the study. Research has shown that the duration of a stressor strongly influences its impact (Sternberg, et al., 1992). Short-duration stressors elevate neurotransmitters, but longer-duration stressors suppress them by depleting norepinephrine, lifting the inhibition of adrenocorticotrophic hormone (ACTH), releasing cortisol, and thereby suppressing the immune system (Sternberg, et al., 1992).

College is a lengthy four-year commitment during which many demands and pressures are placed upon students in order for them to be successful and achieve their goals. During this lengthy time period students may experience any number of stressors at various times, the duration of which may vary, resulting in an array of unpleasant and potentially debilitating distress symptoms. As mentioned earlier, lingering stress has the potential to compromise the immune system, resulting in greater vulnerability to physical illness and emotional distress.

As previously established, the overall purpose of biofeedback is to bring about an increased awareness of one's internal state. Addition, the overall purpose of relaxation skills training is to learn effective skills to produce the relaxation response, thus decreasing undesirable internal states. Specifically, the relaxation response is a set of physiological changes that are the opposite of the fight-or-flight (stress) response described by Cannon (1914). In combination, therefore, the overarching purpose of biofeedback and relaxation skills training is to learn how to

recognize signs of internal distress and execute effective measures to restore internal homeostasis.

By utilizing the modalities of biofeedback and relaxation skills training, colleges can provide students with a valuable resource that teaches them how to monitor and regulate their response to stress. In this way students experiencing stress can become more efficacious in reducing or alleviating the severity of their symptoms, strengthen their immune systems, and become more empowered to better manage their personal wellness.

Method

This study was conducted at a religiously-oriented private college located in the Western United States over a period of one-and-a-half years, beginning in September, 2006 and ending in April, 2008. The university has operated a Stress Management and Biofeedback Lab as an integral part of the universities' Counseling and Career Center since 1976. The lab is staffed by doctoral-level psychologists and graduate students who have been trained and are skilled in utilizing Electromyograph (EMG), thermal sensor, galvanic skin response (GSR), Heart Rate Variability (HRV), and respiration modalities in their sessions with students.

Participants

The data was collected from a total of 659 full-time students who attended a total of 1,170 biofeedback sessions, with most students participating in a single session of biofeedback and relaxation training. All students gave informed consent to utilize the data collected in the lab. The demographic characteristics of the sample included 64% ($n = 420$) female and 36% ($n = 237$) male students. In addition, 15% ($n = 97$) of the students were freshmen, 17% ($n = 112$) were sophomores, 18% ($n = 119$) were juniors, 28% ($n = 182$) were seniors, and 9% ($n = 57$) were graduate students. The students were referred to the biofeedback lab by various sources, for example 39% ($n = 256$) of the students participating in the study were referred to the lab by their professors as a class assignment, 23% ($n = 154$) were referred by a counselor, 22% ($n = 146$) of the students fell in the category marked "other," which included having heard about the biofeedback lab by a friend, parent, resident assistant, or having read a flyer about the lab posted in a building on campus or in the dorms. Lastly, 2% ($n = 11$) of the students included in the study were referred to the biofeedback lab by their physicians.

Measures

Participants completed the following measures prior to participating in the biofeedback session:

Intake form (Appendix: A). At the outset of the initial session, each student was invited to read and sign an Intake Form explaining the purpose of the Biofeedback lab and providing assurance of confidentiality regarding use of their personal information. In addition, students also were required to provide brief written answers to questions regarding the purpose of their visit; their exercise, sleep, and dietary habits; and, how they deal with their stress. In addition, students were also asked to list their current extracurricular commitments such as a job, volunteer work, marriage, or children, for example. Students were also required to give a subjective rating indicating the intensity of the level of stress they had experienced during the previous week by circling one of eleven numbers ranging from 0 - 10, with zero being an indication of no stress, and ten indicating extreme stress. There was also place provided on the form where the lab technician recorded the students' pre and post session self-rating of their stress level.

Stress-related symptoms. Students were also provided with a list of 15 stress-related symptoms such as headaches, muscle tension, and difficulty sleeping, for example, from which they were expected to circle the 3 most distressing symptoms they were experiencing.

Stressors. Furthermore, from a list of 27 possible stressors such as: exams, homework, roommates, and finances, for example, students were asked to circle the 3 most problematic stressors they experienced during the past week.

Coping strategies. In addition, from a list of 34 possible coping strategies such as: listen to music, read, eat, talk to friends, and exercise, for example, students were asked to circle the 3 coping strategies they utilized the most during the past week.

Consent form (Appendix A). This form was located on the back of the Intake Form and provided an explanation of the purpose of the study along with an opportunity for the student to participate. In addition, the form stated that by providing his or her voluntary consent to participate, the student was indicating his or her willingness to provide the recorded instrument readings generated from his or her session for inclusion in the data-base to be utilized for research purposes. The student was then required to sign on either one of two lines provided on the bottom of the Consent Form. One line indicated a willingness to participate in the study, the other line declining participation in the study. Information obtained from the sessions of students indicating that they did not wish to participate in the study was not utilized for research purposes and was filed separately.

Recording Form (Appendix B). While the student was hooked up to the instruments, the lab technician recorded changes in the instrument readings at approximately 30 – 60 second intervals for the duration of the session.

Instruments

The biofeedback instruments most frequently utilized by the lab technicians were the Electromyograph (EMG) and Thermal Feedback.

Electromyograph (EMG). As was previously mentioned, Edmund Jacobson's (1938, p. 220) pioneering work on the physiological manifestations of stress led him to discover that nerves send electrical impulses to muscles instructing them to contract or relax. Furthermore, he learned that tension and exertion was accompanied by a shortening of the muscular fibers and that, therefore, muscular tension was an indication of stress. He then went on to develop an apparatus employing low micro voltage to detect muscle tension. Indeed, this apparatus was able

to make the first accurate electrical measurement of muscular tonus. The modern Electromyograph (EMG) is a modern adaptation of that instrument.

Specifically, the EMG modality detects and measures the electrical activity occurring within certain muscles, the most common being the forehead and scalp (frontalis and temporalis), jaw (masseter), neck, back, and shoulder (trapezius) muscles. To measure electrical activity, the skin is cleansed with rubbing alcohol, after which conductive gel is placed on the sensors of surface electrodes and attached to the skin over the desired area. The sensors are connected to the biofeedback instrument which functions to detect fluctuating voltage through the skin and converting the raw signals into a visual display on a meter, thus providing a continuous stream of information.

Ideally, as individuals are guided through a relaxation technique while observing the resulting changes in the instrument readings, they are able to make the association between their initial state of tension and their increased sense of relaxation at the conclusion of the exercise. The overarching purpose of utilizing this modality is to sharpen an individual's awareness of internal sensations of muscle tension and discomfort, and taking corrective measures to bring about a decrease in those sensations.

Temperature feedback. Temperature biofeedback (TEMP) was developed to detect skin temperature. Changes in blood flow are linked with emotional tension – with cooler hand temperature being an indication of vasoconstriction correlating with anxiety. Negative emotions such as anxiety or anger, for example, cause the smooth muscles surrounding the blood vessels in the fingertips to contract resulting in disruption of peripheral blood flow to the fingers.

Electromyograph (EMG) and temperature training have shown to be effective in treating certain health problems which are related to blood flow, such as migraine headaches (Moss, et

al., 2001), Raynaud's disease (Freedman, 1987), and blood pressure (Goebel, et al., 1993). Skin temperature is monitored by taping a thermistor to an individual's finger or toe. The information is transposed through a processor into a visual or auditory signal. An individual's skin temperature may vary greatly during a session – depending on the amount of tension and anxiety being experienced. To illustrate, skin temperature can decrease by as much as 20° in 20 minutes as levels of tension increase. Conversely, skin temperature can increase by as much as 20° in 20 minutes as levels of tension and anxiety are replaced with increasing levels of relaxation.

Thus, by observing hand temperature, it can be established whether a person is becoming more, or less, relaxed. The overarching purpose of utilizing this modality is to give the learner the opportunity to observe changes in blood flow while implementing a relaxation procedure. In this way the learner not only gains a heightened awareness of an internal biological process that is normally beyond one's awareness, but also learns to implement an effective skill to self-regulate it.

Procedures

At the outset of the initial session, following initial introductions, each student was invited to read and sign the Intake and Consent Forms. As indicated in the Measures section, these forms provided students with an explanation of: the purpose of the Biofeedback lab, assurance of confidentiality regarding use of personal information, and the purpose of the study. In addition, space was provided for the student to indicate whether they wished to participate in the study or to decline participation therein.

Students were also required to provide brief written answers to questions regarding the purpose of their visit; their exercise, sleep, and dietary habits; how they deal with their stress; and, what their current commitments are. Furthermore, students were required to give a

subjective rating indicating the intensity of the level of stress they experienced during the previous week. In addition, from a list of symptoms, stressors, and coping strategies provided, students were asked to indicate the three most distressing stress-related symptoms they experienced during the previous seven days; the three most problematic stressors they experienced during the previous seven days; and, the top three coping strategies they had implement during the past week.

Upon completion of the aforementioned paperwork, the student was then asked to look at a Subjective Units of Distress (SUDS) scale numbered from zero to 10 – with zero indicating not feeling stressed at all, with 5 indicating feeling moderately stressed, and 10 indicating feeling extremely stressed – and invited to indicate his or her present feeling of degree of stress. The number indicated by the student was then recorded in the square provided for this purpose on the tracking form which the lab technician would be utilizing to record the instrument readings during the relaxation training part of the session.

Thus, based upon both the students' written and verbal responses during the initial stage of the session, the lab technician was able to glean a general understanding of the students' current responsibilities, workload, stressors, stress-related symptoms, and perceived level of stress. For clarification purposes the lab technician may have asked further questions regarding one or more of the student's responses. Overall, based upon the information provided by the student, the lab technician would then determine how the session would proceed.

Sternbach's (1966) stress diathesis model proposes that each human being shows a certain response stereotypy, responding physiologically to situations in a particular way. Some individuals are cardiovascular responders, some musculoskeletal, some gastrointestinal, and some cognitive. Each of the eight relaxation techniques taught in the biofeedback lab target one

or more of the aforementioned systems. In general, all eight techniques serve to bring about a deep state of relaxation. Individually, however, they were designed with specific target areas and symptom specific relief in mind. The relaxation techniques taught are: autogenics; body scan; diaphragmatic breathing; meditation; performance rehearsal; progressive muscle relaxation; self-hypnosis; and visualization.

Thus, based upon information gleaned during the intake interview, the lab technician is able to recognize the student's individual response pattern and choose a symptom appropriate technique aimed at targeting the appropriate system and from which the student is most likely to benefit the most. Therefore, the relaxation technique chosen may vary from student to student and session to session – based upon the student's presenting symptoms and particular need at the time.

In general, the session proceeded with the lab technician providing a brief overview of: (1) the purpose of the biofeedback lab, (2) the instrument/s to be utilized, and (3) the relaxation technique/s selected and its function/s in helping to alleviate the student's stress-related symptoms. The student was then hooked up to the appropriate biofeedback instrument/s and given a brief interactive demonstration showing how it worked. The demonstration was aimed at providing the student with a rudimentary understanding of how the instrument/s read, monitor, and record their bodies' physiological responses during the session.

The demonstration may have included, for example, having the student alternately activate and relax a certain muscle group, or, think of an unpleasant or pleasant experience while observing the accompanying changes on the instrument monitors. Changes in the instrument readings such as higher or lower numbers were an indication of either an increase or decrease in muscle tension or finger temperature, for example.

With the understanding that muscle tissue at rest is normally inactive, the student was encouraged to view the instrument/s periodically throughout the session in order to determine what he or she was doing to bring about the desired decrease in their tension level. The student was also encouraged to pay attention to how they felt as their tension levels decreased. The lab technician commenced the session by either playing soft background music while verbally guiding the student through a relaxation technique, or, by playing a professional recording of the desired relaxation technique to be practiced.

For the most part, the lab technician maintained a low-key presence once the relaxation procedure commenced – merely acting as a guide when necessary to provide further instruction, support, or encouragement, and to monitor the student's level of comfort. The lab technician's primary function once the session commenced however, was to intermittently record the instrument readings on a data-tracking form.

Because the relaxation recordings varied in length, the lab technician adjusted the length between recording changes in the instrument readings accordingly. For example, if the relaxation recording was 40 minutes in duration, the lab technician recorded readings approximately every 2 minutes. If, however, the relaxation recording was 20 minutes in duration, readings were taken at intervals of approximately every 1 minute.

At the conclusion of the practice part of the session the lab technician unhooked the student and once again presented the aforementioned chart, requesting the student to rate his or her current level of stress – with zero indicating not feeling stressed at all, with 5 indicating feeling moderately stressed, and 10 indicating feeling extremely stressed. The number indicated by the student was then recorded in the square provided for this purpose on the student's tracking form. Thus, each student's data tracking form provided subjective ratings of his or her current

level stress both pre- and post- intervention. This procedure was repeated for every session. Based upon these ratings, the lab technician was able to discern the student's subjective experience of the effectiveness of the relaxation technique.

In conclusion, the student was then shown the Recording Form containing the readings taken by the lab technician during the session with the lab technician offering an interpretation thereof – the interpretation serving to assist the student in identifying any progress made. If the readings did not indicate progress, or the student reported that they did not experience any change, the lab technician would suggest that the student return for another session and that a different technique be implemented for the subsequent session.

Data Analysis

The data obtained was entered into SPSS (Statistical Package for Social Sciences) for analysis. Analysis consisted of descriptive statistics which included means, degrees of freedom, frequency distributions, percentile ranks, standard deviations, and median and interquartile ranges. Because the data analysis was inferential in nature, a paired-samples *t* test was utilized for analysis purposes for this study. Specifically, the utility of the paired-samples *t* test is in comparing the means between two variables and testing for significance of these findings.

Descriptive data was utilized in order to obtain answers to the following research questions: (1) what stress-related symptoms do college students report as being the most troublesome/problematic; (2) what stressors do college students report experiencing; and, (3) what are the major coping strategies utilized by college students to help alleviate their stress.

In addition, paired sample *t*-tests were utilized in order to compute differences between pre and post session data in order to obtain answers to the remaining research questions: (4) would students' subjective ratings of stress change pre and post session; (5) is there a change in

EMG readings pre and post session, and, (6) is there a change in thermal temperature readings pre and post session?

Results

The results portion of this study commences with a discussion of the descriptive data which was utilized for data analysis. The dependent variables utilized in this study were the stressors, symptoms, and coping strategies which students reported having experienced and utilized during the previous week, prior to their biofeedback session. The results of these analyses can be viewed in Tables 1, 2, and 3 (p. 42-44).

In addition, in order to compare differences, paired sample t-tests were utilized by computing pre and post session data. Specifically, pre and post session data was utilized of each student's EMG instrument readings, skin temperature instrument readings, and subjective stress ratings at the commencement and at the conclusion of their session. The results of these analyses can be found in the section Pre and Post Treatment Measures (p. 45).

Dependant Variables

Prior to commencing each session, students indicated the stressors, symptoms, and coping strategies they had utilized the previous week. Analysis of this data revealed the order of stressors, symptoms, and coping strategies from most to least relevant.

Stressors. Before commencing with the session, students were also required to choose from a menu of 27 possible stressors, 3 major stressors they had experienced during the previous week. As indicated in Table 1, the results were as follows: too much to do (38%, $n = 249$); homework (34%, $n = 226$); and, classes/school (27%, $n = 178$). Students were less likely to report: transportation (2%, $n = 12$); death (1%, $n = 9$); or registration (1%, $n = 4$).

Symptoms. As previously indicated, before commencing with the biofeedback and relaxation training part of the session, students were required to choose from a menu of 16 possible stress-related symptoms, the 3 most problematic symptoms they had experienced during

the previous week , ranking them in severity on a scale of 0 to 10 – with 0 indicating “none” and 10 indicating “extreme.” As indicated in Table 2, the top three symptoms reported by students as occurring with high frequency included: feeling overwhelmed (36%, $n = 239$); feeling anxious (35%, $n = 232$); and, difficulty concentrating (29%, $n = 193$). Students were less likely to report feeling: forgetful (8%, $n = 50$), indecisive (7%, $n = 48$); or, feeling fearful (5%, $n = 33$).

Coping strategies. In addition, before commencing with the session, students were also required to choose from a menu of 27 possible coping strategies, 3 strategies they had utilized to help them handle their stress during the previous week. As indicated in Table 3, the results were as follows: pray (27%, $n = 181$); exercise (27%, $n = 180$); and, talk to friends (25%, $n = 167$). Students were less likely to report: do task early (3%, $n = 18$); leave campus (2%, $n = 14$), or aggression (1%, $n = 9$).

Table 1

Frequency and Percentage of Stressors Reported by Students

Stressors	Frequency	%
Too much to do	249	38
Homework	226	34
Classes/school	178	27
Tests	152	23
Opposite sex	131	20
Lack of sleep	128	19
Lack of money	93	14
Work (job)	74	11
Inadequacy/Inferiority	74	11
Procrastination/play	71	11
Other	67	10
Health	65	10
Family	58	9
Late/miss class assignment	36	5
Unorganized	36	5
Roommate	32	5
Church	31	5
Extracurricular activities	28	4
Housing present/future	27	4
Adjustment	23	3
Friends	23	3
Meeting new people	19	3
Homesick	13	2
Transportation	12	2
Death	9	1
Registration	4	1
Orientation	0	0

Note. $N = *659$.

Table 2

Frequency and Percentage of Stress Symptoms Reported by Students

Stress Symptoms	Frequency	%
Feeling overwhelmed	239	36
Feeling anxious	232	35
Difficulty concentrating	193	29
Muscle tension/pain	183	28
Sleep problems	180	27
Headaches	133	20
Excessive worry	122	19
Fatigue	118	18
Feeling Depressed	112	17
Stomach/intestinal discomfort	104	16
Feeling irritable	88	13
Loss/increase of appetite	55	8
Forgetfulness	50	8
Indecisiveness	48	7
Feeling fearful	33	5
Other	10	2

Note. $N = *659$.

Table 3

Frequency and Percentage of Coping Strategies Reported by Students

Coping Strategies	Frequency	%
Pray	181	27
Exercise	180	27
Talk to friends	167	25
Talk to family	130	20
Sleep	125	19
Organize/prioritize	102	15
Ignore/procrastinate	99	15
Music	94	14
Relaxation techniques	85	13
One-day-at-a-time	84	13
Fun	69	10
Cry	63	10
Do task	60	9
Endure	58	9
Food	50	8
Relax	48	7
Do best and be satisfied	48	7
Read scriptures	47	7
Change attitude/motivate	34	5
Homework	30	5
Break/pace self	26	4
Seek info/tutoring/help	25	4
Other	21	3
Eternal perspective	19	3
Do task early	18	3
Leave campus	14	2
Aggression	9	1

Note: N = *659.

The sample size varies in the following analyses because some students returned to the lab and thus had more than one session.

Pre and Post Treatment Measures

Measurements of students' Electromyograph reading, skin temperature reading, and their self-report stress rating pre and post session were utilized in the data analysis.

Skin temperature instrument readings. A paired sample *t*-test was used to determine whether there was a difference in skin temperature readings from pre-session to post-session. The data revealed a significant difference ($t(887) = -13.06, p < .001$), indicating an increase in thermal skin temperature post-session, (pre-session, $M = 89.48$ degrees Fahrenheit, $SD = 4.35$; post-session, $M = 90.81$ degrees Fahrenheit, $SD = 4.17$). The average temperature change pre to post session was 1.34 degrees Fahrenheit, $SD = 3.05$.

Electromyograph instrument readings. In addition, a paired sample *t*-test was used to determine whether there was a difference in EMG micro volt readings from pre-session to post-session. The data revealed a significant difference ($t(874) = 15.78, p < .001$), indicating a decrease in EMG micro volt reading post-session, (pre-session, $M = 4.94$ micro volts, $SD = 4.29$; post-session, $M = 2.72$ micro volts, $SD = 2.30$). The average EMG change from pre to post session was 2.22 micro volts, $SD = 4.17$.

Student self-report stress ratings. Furthermore, a paired sample *t*-test was used to determine whether there was a difference in students' self-report stress ratings from pre-session to post-session. The data revealed a significant difference ($t(915) = 54.14, p < .001$), with students reporting lower stress ratings following the biofeedback and relaxation skills training, (pre-session, $M = 5.78, SD = 1.90$; post-session, $M = 2.56, SD = 1.62$). The average change in students' self-report stress rating from pre to post session was 3.22, $SD = 1.8$.

Discussion

Results from this study indicated that feeling overwhelmed, feeling anxious, and difficulty concentrating were the top three stress related symptoms students experienced. In addition, students rated having too much to do, homework, classes and school as being their top three stressors. Furthermore, students rated prayer, exercise, and talking to friends as being the top three coping strategies they utilize.

In addition, the data revealed significant differences on all three pre- and post- measures regarding skin temperature readings, EMG readings, and students' subjective self-report ratings of degree of stress. Specifically, students' skin temperature as measured in Fahrenheit increased, and their muscle tension as measured in micro volts decreased, indicating less physiological tension and anxiety at the end of the session. Furthermore, comparisons of students' self-report ratings of their degree of stress before and after the session indicated that they felt less stressed at the conclusion of the session.

Stressors

According to Girdano et al. (1997), a stressor is any condition or experience that causes the stress response. Girdano et al. elaborated further by saying that stressors can be physical, emotional, social, economical, or spiritual. According to this study, students rated having too much to do as their top stressor. In a study undertaken by Macan et al. (1990), students reported having insufficient time to accomplish all their tasks as a stressor. These two findings may support each other in that having too much to do and insufficient time in which to do what is necessary may cause students significant stress. Moreover, having too much to do may also be linked to, and lend support to the finding of this study that students rating feeling overwhelmed

as being their greatest stress symptoms. Indeed, it stands to reason that having too much to do may lead to feeling overwhelmed.

In addition, to having too much to do, students rated homework as being their second highest stressor. This supports research findings indicating that pressure to earn good grades, excessive homework, weekly tests and papers, and unclear assignments, are sources of stress to students (Kohn & Frazer, 1986).

Classes and school in general were rated by students as being their third highest stressor. This concurs with previous findings indicating that the primary sources of stress reported by college students are mainly related to their academic life (Hirsch & Ellis, 1996). Specifically, studies have revealed that pressure to earn good grades, excessive homework, weekly tests and papers, unclear assignments, and uncomfortable classrooms can cause students stress (Kohn & Frazer, 1986). Furthermore, receiving a lower grade than expected is another reported source of stress (Ross, Neibling & Teresa, 1999). In addition, attitudes of faculty members towards students and students' towards faculty also impact stress levels (Williams & Winkworth, 1974).

Symptoms

Results of this study indicated feeling overwhelmed as being the most problematic stress symptom for students (36%, $n = 239$). Research concerning the association between mental health and acute infectious illness has established the link between depression, anxiety, and feeling overwhelmed with developing such infections (Adams, et al., 2008). Furthermore, studies have shown that students reporting feeling overwhelmed may be more prone to upper respiratory infections (Hamrick, Cohen & Rodriguez, 2002), bronchitis, strep throat, ear infections, and sinus infections (Adams, *et al.*, 2008), for example. In annual surveys between 1985 and 1995,

the numbers of students reporting feeling overwhelmed increased (Sax, 1997). Hence, the findings from the current study are consistent with previous research.

In addition, students in this study reported feeling anxious as being their second most problematic stress related symptom. As previously mentioned, increases in stressful life events in college students has been associated with anxiety and depression. Meditation is an intervention which has been used successfully to treat anxiety (Kabat-Zinn, Massion, & Kristeller, 1992). Thus, meditation training may increase a student's ability to manage anxiety. In addition, anticipation of a stressful situation and its potential upsetting effects can lessen its emotional impact (Holman, Silver, & Waitzkin, 2000). Thus, performance rehearsal, or visualizing potentially stressful events in one's mind and rehearsing positive outcomes can be beneficial in reducing anxiety.

Difficulty concentrating was rated by students as being their third most problematic stress related symptom. This finding may be related to that of the students' fifth highest rated stress symptom, which was sleep problems, as well as to their sixth highest stressor, which was lack of sleep. Specifically, studies have shown that sleep deprivation negatively impacts students in a variety of ways: increased feelings of sleepiness during the day, difficulty paying attention in class, and adversely affecting their ability to perform on exams (Pilcher & Walters, 1997). Thus, difficulty concentrating may be as a result of insufficient or poor quality of sleep. By teaching students good sleep hygiene and relaxation techniques designed to assist in improving their quality of sleep, such as visualization, for example. Thus, students may wake up feeling more refreshed and alert and thus better able to concentrate during the day.

Coping Strategies

According to Folkman and Moskowitz (2004), coping is generally defined as the thoughts and behaviors used to manage the internal and external demands of situations that are appraised as stressful. Results from this study indicated that the three top coping strategies utilized by students were (a) pray, (b) exercise, and (c) talk to friends, respectively.

As mentioned earlier, mind-body medicine was defined as a set of interventions originating in both Western and non-Western paradigms directed at treating disease or preserving health, based on the inter-connection of mind and body. Interestingly, according to the Chantilly Report (1998), one of the interventions listed is prayer. According to Deckro, et al. (2002), one can consciously elicit the relaxation response by repeating a word, sound, prayer, phrase, or muscular activity while passively ignoring distracting thoughts. Thus, the feeling of relaxation elicited by praying may provide one explanation as to why students in this study reported prayer as being their top coping strategy. However, the fact that the college is a religiously-oriented one and that prayer and church attendance are important aspect of life to many students attending may provide another alternative explanation.

Studies have shown that internal religious orientation significantly predicts health-promoting behavior (Smith, 2000). Indeed, spirituality, religiosity, and core convictions have shown to be protective factors that increase resilience and serve to moderate the relationship between specific coping responses and attitudes. These have all shown to be effective in stress reduction (Dixon, 2003). Furthermore, levels of spirituality and religious conviction have also been shown to be positively correlated with positive affect (Dixon, 2003). Indeed, research supports a relationship between religious involvement and lower mortality (McCullough, Hoyt, Larson, Koenig & Thoresen, 2000).

Results of this study indicate exercise as being the second most utilized coping strategy engaged in by students. This supports studies such as Ragheb and McKinney's (1993), in which they reported that students engaged in various fitness activities to help reduce their stress. Results of cross-sectional and longitudinal studies have consistently indicated that aerobic exercise training has antidepressant and anxiety reducing effects. Moreover, these studies have linked exercise habits with protection against the harmful effects of stress on physical and mental health (Salmon, 2001).

In addition, findings from this study indicated that talking to friends was the third coping strategy most utilized by students. This supports research findings underscoring the value of good friends to help and individual feel connected and stay strong, and to help buffer the stress of negative events (Pressman, et al., 2005). Indeed, social support is a commonly reported coping strategy. Thus, enhancing social support is an effective means of reducing stress (Griffith, Steptoe & Cropley, 1999; Schonfeld, 2001; Wei & Sha, 2003).

Benefits of Biofeedback and Relaxation Training

Regular practice of relaxation reinforces what is learned during the session and facilitates generalization of the relaxation response. In this way individuals learn to heighten body awareness and reduce physiological arousal leading to more automatic relaxation (Andrasik, 1990). Thus, individuals are able to develop valuable self-regulation skills that help to relax the central nervous system, decrease sympathetic arousal, and help retrain the autonomic nervous system – producing homeostasis and supporting general health and well-being. For example, studies have indicated that nurses and nursing-students alike benefit from programs designed to enhance their self-care abilities (Baker, et al., 2005; Stark, Manning-Walsh & Vliem, 2005).

Furthermore, according to Taugis (2002), research has demonstrated that identifying the sources of stress and equipping participants with an understanding of stress management can have a positive influence. Because, stress management encompasses techniques intended to equip and individual with effective coping mechanisms for dealing with stressful thoughts, stressful events and stress-related symptoms, stress management training is an effective strategy that can be utilized to cope with, or alter an individual's response to stress.

Stress is inevitable. However, the degree of experienced stress can be modified in two ways: by changing the environment and/or the individual. Colleges can assist in this endeavor by increasing health education awareness and making interventions such as biofeedback and relaxation skills training available for their students. In this way colleges and other institutions can provide students with a proactive, holistic, prevention strategy with the potential to empower them to cope more effectively and become more efficient managers of their stress.

Overall, these findings provide support for the utility of biofeedback and relaxation skills training to help college students reduce physiological symptoms of stress and increase levels of relaxation. It therefore appears to be a feasible option for colleges and health care administrators to explore utilizing. College will continue to be a stressful time for students. However, stress-reduction exercises can mediate college students' stress (Lepore, Miles, & Levy 1997).

Limitations

Although the study supports the effectiveness of biofeedback and skills training to help students manage stress, it is important to point out some limitations. Firstly, the extent to which self-report data and recall of past behaviors provides an accurate understanding of an individual's experience of level of stress is debatable. For example, the current mood state of the student presenting at the lab may have influenced their self-report rating. Furthermore, the will to

believe, or the cognitive biases that help maintain self-esteem and promote harmonious social function should also be considered when interpreting self-ratings.

In addition, whether college students' stress is best measured objectively or subjectively can be argued in favor of either. This study utilized both measures believing in the relevance of both. Recognizing the power of the personal experience is fundamental to providing valuable insight into the link between the role of stress and its impact upon the individual's subjective experience of it. Thus, it was hoped that together, results of both measures would provide stronger evidence supporting the effectiveness (or not) of the intervention. According to Freze and Zapf (1999) one should study all the relevant issues of the stress process and in this way reflect more carefully on how such processes work.

Secondly, the largest proportion of students in this study (39%) came to the Biofeedback lab to fulfill a class assignment. Thus, many of them may not have been stressed in the first place. In addition, the sample had a higher proportion of females (64%) than males, and more seniors (28%) than other classes represented in this study.

Thirdly, as was previously mentioned the college at which the study took place has a religious orientation, thus, generalizability of the data to other populations may not be practical.

Implications for Future Research and Practice

First, future research could include focusing on the different years in school individually, to ascertain differences in symptoms, stressors, and coping strategies. Secondly, it may be beneficial to look at differences in stress symptoms, stressors, and coping strategies in terms of gender. Thirdly, future research may benefit from identifying which specific relaxation techniques students report as being most helpful for specific symptoms. In addition, monitoring longer term outcomes for sustainability to ascertain whether students continue to maintain

benefits. Furthermore, researchers could investigate the association between long term outcomes with regular practice.

Patrick et al. (1997) suggest that college students often enter college and university ill-prepared due to strains on secondary school systems, which compound the stressors experienced by students. In addition, declining job opportunities for graduating students also burden students with the additional stress and competition of obtaining high academic success prior to entering the labor force. Johnson-Saylor (1980) and Lipnickey (1986) postulate that educating young adults about the self-management of health maintenance and illness is beneficial from two standpoints, (1) altering unhealthy behaviors at a younger age and subsequently reducing accrued risks of disease (and enhancing health in the process), and (2) acquiring/developing behavioral techniques that will be applicable to all stages along the continuum. Interestingly, evidence exists that many students are not only concerned about their health, but feel vulnerable/susceptible concerning certain aspects of their health and in need of intervention (Boehm, et al., 1993).

University years represent a time of transition in which adolescents become adults and adopt life-long behaviors that can have either a positive or negative influence on health and well-being (Dawson et al., 2007). Thus, risk factor modification in young adults can not only enhance health but can lessen the risk of chronic illnesses later in life. Colleges and universities therefore, are important settings for reducing health-risk behaviors among many young adults. Furthermore, they are in a unique position to implement strategies to address these risk behaviors. Therefore, health educators at colleges and universities must advocate for the provision of appropriate services to help students develop healthy behaviors and lifestyles (Brener & Gowda, 2001) that can be carried into adulthood (Grace, Jackson & Weinstein, 1997).

There is growing evidence to support the use of preventative, as opposed to reactive coping strategies (Greenglass, 2002; Peacock, et al., 1993; Schwarzer & Renner, 2000).

According to Peacock et al. (1993) preventative coping involves developing resources to lessen the consequences of stressful events. In addition, Greenglass (2002) presents a similar coping strategy, namely, proactive coping. Proactive coping consists of efforts to develop general resources such as seeking appropriate information and practical help, for example, to manage demands. Biofeedback and relaxation skills training is a proactive, practical resource which students can utilize to help them avoid, alleviate, or cope with their stress.

This study supports those of authors who have previously demonstrated reductions in perceived psychological stress and physiological tension through the use of stress management strategies (Heaman, 1995; Johansson, 1991; Astin, 1997; Nicholson et al., 1989). Besides the physiological and other health benefits of biofeedback and relaxation training, by making such a resource available to students also serves to inform, educate and expand their knowledge regarding health care alternatives and options. Indeed, Eastern Virginia Medical School has been promoting biofeedback and the principles of applied psychophysiology to students for many years (Wickramasekera, 1988).

In conclusion, self-efficacy, or the inner conviction that one is able to make a positive difference, is supported by the modality of biofeedback and relaxation skills training. By learning control over a muscle, breathing pattern, brain wave, or other physiological process and thereby reducing or alleviating the severity of one's symptoms allows one to become an active participant in one's personal wellness. This study provides a reproducible, easily implemented, and low-cost intervention to prevent or counteract the impact of stress and empower students to become more self-efficacious in the management of their health and well-being.

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APPENDIX A: Intake Recording Form

INTAKE RECORDING FORM STRESS MANAGEMENT & BIOFEEDBACK LAB

NAME _____ E-MAIL _____ DATE _____

BYU ID# _____ PHONE _____ GENDER _____ CLASS ☐ F ☐ So ☐ Jr ☐ Sr ☐

1. What brings you to the lab today? ☐ Counselor Referral
☐ Physician Referral ☐ Class Assignment ☐ Other Reasons:
2. Are you meeting with a counselor? Yes No
3. Do you get adequate exercise? Yes No
4. Do you eat nutritional food each day? Yes No
5. Do you sleep well? Yes No
6. What do you usually do to reduce tension and stress when it occurs?
7. What regular commitments do you have in your life right now?
(job, church calling, marriage / children, volunteer, club, etc.)

<p>Overall, how stressed have you felt the past week?</p> <p>0 1 2 3 4 5 6 7 8 9 10</p> <p>not at all moderately extremely</p>	<p>What were your major stressors this past week? (choose up to three)</p> <ol style="list-style-type: none"> 1. homework 2. tests 3. opposite sex 4. classes / school 5. health 6. too much to do 7. adjustment 8. lack of sleep 9. friends 10. extracurricular activities 11. family 12. roommate 13. church 14. registration 15. work (job) 16. lack of money 17. homesick 18. orientation 19. late/miss class assignment 20. transportation 21. housing (present / future) 22. procrastination / play 23. meeting new people 24. unorganized 25. inadequacy / inferiority 26. death 27. other: 	<p>In what ways did you handle your stress this past week? (choose up to three)</p> <ol style="list-style-type: none"> 1. relaxation technique(s) 2. homework 3. talk to friends 4. sleep 5. pray 6. fun 7. organize / prioritize 8. do task 9. talk to family 10. ignore / procrastinate 11. seek info / tutoring / help 12. relax 13. change attitude / motivate 14. exercise 15. endure 16. cry 17. one-day-at-a-time 18. break / pace self 19. food 20. read scriptures 21. do task early 22. leave campus 23. music 24. eternal perspective 25. aggression 26. do best and be satisfied 27. other:
<p>Indicate the major stress symptoms (choose up to three) you experienced the past week and how severe they were on a 0-10 scale with 0 being "none" and 10 being "extreme."</p> <ol style="list-style-type: none"> a. _____ headaches b. _____ muscle tension / pain c. _____ stomach / intestinal discomfort d. _____ sleep problems e. _____ difficulty concentrating f. _____ loss / increase of appetite g. _____ forgetfulness h. _____ indecisiveness i. _____ feeling depressed j. _____ feeling anxious k. _____ feeling overwhelmed l. _____ feeling fearful m. _____ feeling irritable n. _____ excessive worry o. _____ fatigue p. _____ other: 		

APPENDIX B: Recording Form

NAME:

RELAXATION PAST WEEK		TODAY'S SESSION & WHAT WORKED												TAKE HOME			
		2	4	6	8	10	12	14	16	18	20						
DATE:																	
DATE:																	
TEM: G=	A=																
		ASSIGNMENT: NEXT TIME:															
DATE:																	
DATE:																	
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