

THE EFFECTS OF BIOFEEDBACK PLUS PROGRESSIVE RELAXATION ON THE
EMOTIONAL WELL-BEING OF COLLEGE STUDENTS

by

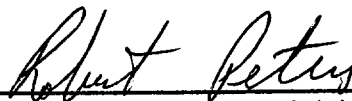
Scott Stoltz

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Investigation Adviser

The Graduate College
University of Wisconsin-Stout
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The Graduate College
University of Wisconsin-Stout
Menomonie, WI 54751

ABSTRACT

Writer	Stoltz Last Name	Scott First Name	W Initial
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The Effects of Biofeedback Plus Progressive Relaxation on the Emotional Well-
Title

Being of College Students

Vocational Rehabilitation Graduate Major	Robert Peters, Ph.D. Research Advisor	5/2000 Month/Year	53 No. of Pages
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APA

Name of Style Manual Used in this Study

This causal-comparative study examined the effects of biofeedback plus progressive relaxation training on the emotional well-being of college students.

A undergraduate/graduate class (Course 459-509: Introduction to Biofeedback) required students to take approximately ten weekly Biofeedback hook-ups and ten weeks of daily Progressive Relaxation training. The students in this class were invited to voluntarily take pre and post tests on psychological measurements to see if any change had taken place over the course of the semester. The instruments used were the State-Trait Anxiety Inventory (STAI) and the Profile of Mood States (POMS).

Fourteen of the twenty-two students in the course volunteered to participate in the study. The data from the pretests at the beginning of the semester were compared to the data from the posttests at the end of the semester. The statistical analysis used was a "t" test comparison at the .05 significance level. The dependent scales used in this study were State/trait anxiety (two separate parts) and the POMS, which consisted of tension-anxiety, depression-dejection, anger-hostility, vigor-activity, fatigue-inertia, confusion-bewilderment, and POMS total.

Six of the nine scales examined proved to be statistically significant beyond the .05 level. These included state anxiety, trait anxiety, depression-dejection, vigor-activity, confusion-bewilderment, and the POMS total. These results indicated that biofeedback combined with progressive relaxation have positive effects on the emotional well-being of college students.

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CHAPTER I

Introduction

This study will investigate the use of biofeedback and progressive relaxation with college students. Biofeedback and progressive relaxation are techniques that can be beneficial in the treatment of many common disorders faced by people around the world. The cost of treatment is often far less than more traditional methods. The implementation of biofeedback and progressive relaxation in hospital or other treatment settings could lower the costs to patients and health care insurers. For example, these treatments can reduce the need of patients for expensive medications and therapy, as well as increase the recovery rates.

Biofeedback

Biofeedback can be defined many ways and by the many aspects involved in using it. The Grolier Encyclopedia (1998) defines biofeedback as follows:

Biofeedback is a method for learned control of physiological responses of the body. These responses can be either in the voluntary system, such as skeletal musculature, or in the involuntary, or autonomic, nervous system, such as heart rate, vascular responses (frequently indirectly measured as temperature), and sympathetic discharges (measured by the electrical skin response). (p.1)

Over the years, biofeedback has provided individuals relief from a variety of ailments. A general list of disorders treated with biofeedback is as follows:

- 1) Anxiety Disorders
- 2) Asthma

- 3) Attention Deficit and Hyperactivity Disorder
- 4) Epilepsy
- 5) Essential Hypertension
- 6) Headache: Migraine and Tension
- 7) Incontinence: Fecal and Urinary
- 8) Irritable Bowel
- 9) Motion Sickness
- 10) Myofacial Pain
- 11) Neuromuscular Disorders
- 12) Raynaud's disease
- 13) Rheumatic Arthritis Pain (Grolier Encyclopedia, 1998, p. 2).

Recently, the Association for Applied Psychophysiology and Biofeedback (AAPB) has stated that "eighty percent of individuals with essential hypertension who underwent biofeedback training in one study reduced their prescription medications or no longer needed them at all, even after years of taking medication" (1998, p.2). In another study, 90 percent of children under 12 with various sleeping problems recovered in the first two months of biofeedback treatment (AAPB, 1998). Biofeedback is an important method of treatment that has been constantly overlooked and doubted in the past. Biofeedback can be effective for reducing both the occurrence and severity of tension and migraine headaches (Cobb, 1995). Cobb (1995) also states that when coupled with counseling, biofeedback reduces significantly the suffering from chronic anxiety and panic attacks.

Progressive Relaxation

Progressive relaxation is also an overlooked method of treatment for various disorders. Holroyd and Penzien (1994) define progressive relaxation as “sequentially tensing and then relaxing the major muscle groups throughout the entire body while attending to the feelings associated with both the tension and relaxation” (p. 67). The individual using progressive relaxation learns to contrast the sensations of tension and release for therapeutic value. The sessions are short in length at first, but gradually build to a period of up to sixty minutes. Individuals may use progressive relaxation in the privacy of their own home with the aid of a commercial relaxation audio guide, eliminating the need for expensive professional settings for treatment.

Stress in College Students

A study by Goldman and Wong (1997) states that college students face high amounts of stress throughout their college years. The high amounts of stress affects both self esteem and self perception in negative ways and this stress can often cause students to be secluded and withdrawn, drastically affecting their social lives. The subjects in this study consisted of 168 male and female college students, who participated in the Neemann-Harter Self Perception Profile. This instrument consists of eight sub scales which include intellectual ability, scholastic competence, job competence, appearance, social acceptance, close friendships, finding humor in one’s life and a measure of global self esteem (Goldman and Wong, 1997). The results of the study concluded with male and female students having similar results regarding five of the eight areas measured. The three areas

with the greatest difference in results were close friendships, the ability to find humor in one's life and appearance (Goldman and Wong, 1997). This study also indicated female participants scored lower on the measure of social acceptance. Overall, the results indicate that stress is negatively associated with self perceptions for college students. For example, this impacts various social and/or emotional aspects of their lives.

A study done by See and Czerlinsky (1990) discussed the use of progressive relaxation and biofeedback that assisted college students with relaxation. The study indicated that when biofeedback is combined with progressive relaxation it produces positive results on a variety of psychological scales. The instruments used were the State-Trait Anxiety Inventory (STAI) and the Profile of Mood States (POMS). When combined, biofeedback and progressive relaxation can lead to significantly lowered amounts of stress. They also state that there is a definite need for research in the fields of biofeedback and progressive relaxation due to the limited availability of empirical data, where any further research will make a valuable contribution to the data base. Therefore, the research hypothesis for this study is that biofeedback plus progressive relaxation will positively effect the emotional well-being of college students as measured by standardized self report inventories.

Statement of Problem

College students face various forms of stress that can lead to decreased levels of self esteem and self perception (Goldman and Wong, 1997). Biofeedback and progressive relaxation are obtainable treatments that can reduce the effects of encountered stress.

The purpose of this causal-comparative study is to provide data about the effects of biofeedback plus progressive relaxation on the emotional well-being of college students. This study utilizes a null hypothesis that is stated as follows: For students treated with biofeedback and progressive relaxation there will be no statistically significant difference between pretest and posttest scores as measured by the State-Trait Anxiety Inventory (STAI) and the Profile of Mood States (POMS).

Definition of Terms

- 1) Biofeedback: A method of learned control of physiological responses of the body.
- 2) Progressive Relaxation: Sequentially tensing and then relaxing the major muscle groups throughout the entire body while attending to the feelings associated with both the tension and relaxation.
- 3) Profile of Mood States (POMS): This inventory measures six mood or affective states: tension-anxiety, depression-dejection, anger-hostility, vigor-activity, fatigue-inertia and confusion-bewilderment.
- 4) State-Trait Anxiety Inventory (STAI): This instrument includes 40 items that assess current felt (state) anxiety and generally felt (trait) anxiety.

CHAPTER II

Literature Review

Introduction

A review of the literature will briefly cover the history of biofeedback and closely related topics. Biofeedback treatment options will be discussed and how they relate to common ailments, and then the overall biofeedback process will be examined. In addition, progressive relaxation will be summarized and then compared and contrasted with biofeedback procedures.

History of Biofeedback

Biofeedback is a controversial treatment that can be traced back to the beginning of this century, however until the 1950's little attention had been given to the scientific principles involved in using it in clinical settings. O'Hare (1998) states that within the last eight to ten years biofeedback has been commonly used in almost every practice of psychology, psychiatry, and physical rehabilitation therapy. O'Hare (1998) also points out that in the last 60 years, psychophysiological research has investigated the relationship between emotional states and physiological states. He goes on to discuss how within the past few decades attempts have been made to affect emotional states and states of consciousness through biofeedback.

In the 1950s, Neal E. Miller was one of the pioneering psychologists who provided some of the earliest data to support the feasibility of biofeedback (Grolier Encyclopedia, 1998). These early studies were primarily done on animals, but were gradually attempted on humans. These early studies also involved the joining of

psychological practices with physiological methods, which were used on patients with medical problems. The findings from these early studies laid the foundation for an increased awareness and need for biofeedback.

Orne (1979), as cited in *A Brief History of Biofeedback* (1999), used a system similar to biofeedback. He assisted children learning to speak using the feedback response to speech acquisition. Children learn to speak by imitating sounds they have heard. Orne states the children listen closely to a sound they produce and try to compare to the original sounds made by others. Biofeedback training is considered a feedback system or a method of trial and error supplied with information determining response in an attempt to reach a defined goal (Orne, 1979). This system agreed with Miller's philosophy of using psychological and physiological methods to examine problems utilizing special instrumentation.

Additional researchers examined the basic principles of biofeedback, including vasodilation or increased blood flow. Razran (1961), cited in *A Brief History of Biofeedback* (1999), reviewed the work of other Russian researchers in the late 1950's and discovered ... "vasodilatation of the arm was found to be conditionable using electric shock as negative reinforcement. Other studies soon followed, attempting to specifically examine this relationship with a variety of autonomic responses" (p. 1). This data seemed to increase interest in the field of biofeedback.

Heart rate is often monitored with the use of biofeedback. It's beginnings stem from the work of Shearn in 1962. He used negative reinforcement ... "to increase heartbeat acceleration, giving human subjects a schedule of shocks at

regular intervals, and delaying them when the target heartbeat was achieved" (A Brief History of Biofeedback, 1999, p.2). The study utilized a yoked-control group to determine the effects of the electric shocks. The participants in this study monitored a timer which counted down the time until the shock and reset if the target heart rate was achieved, therefore delaying the shock. The sessions were performed by giving the yoked-control group the same number of shocks as the experimental group, along with the same number of delays without noting heart rate. A total of five sessions were performed. Shearn (1962), as cited in A Brief History of Biofeedback (1999), discovered the following:

The operant condition group showed a significant increase in the percentage of accelerations across sessions, while the yoked-control group showed a decrease across sessions. Shearn also found respiratory changes to be a confounding variable. He also reported that respiration rate was significantly greater for the operant condition group. He suggested that reinforcing cardiac and respiratory responses independently may be able to resolve the problem and measure the two variables separately. (p. 2)

Sargent, Green and Walters (1973), as cited in A Brief History of Biofeedback (1999), discovered increasing hand temperature relative to midforehead temperature reduced pain due to migraine headaches, which increased study in this area. In 1975, Keefe pursued this idea and developed an analog meter encoded with both auditory and visual feedback (A Brief History of Biofeedback, 1999). The system measured high differences in high pitched sounds with an increase in the analog meter. Conversely, low differences were measured

with low pitched sounds with a decrease in the analog meter. Participants were baselined for readings prior to session and worked toward a goal higher or lower than the original reading. The results of the study indicated changes in skin temperature could occur with the use of biofeedback.

Shmavonian (1998) points out that biofeedback can be used to relieve various health problems by controlling certain biological responses. The health problems that may be controlled include: headaches, chronically taut muscles related to accidents or sports injuries, asthma, high blood pressure, and heart arrhythmias. Other health problems that may be controlled by biofeedback that are not as commonly treated include (O'hare, 1998): Raynaud's syndrome, test anxiety, seizure activity, stomach acidity, incontinence, and elimination of subvocal reading. Shmavonian (1998) states that ... "autonomic and disease specificity and the patient's psychological state must be considered before treatment can begin....learning to relax certain muscles may be somewhat useful in many disorders but may not be the most effective treatment" (p.1).

Biofeedback Techniques

Biofeedback is relatively easy to use and requires little training to master relaxation techniques that are commonly used together. For example, progressive relaxation techniques are often paired with biofeedback and will be discussed later in this chapter. Shmavonian (1998) explains the format used in a basic biofeedback session:

After the desired mode of treatment has been determined for a given disorder, the patient is connected to a computer or an equivalent instrument

by a polygraph, and the response is presented back to the patient in either a binary or an analog fashion. In the binary approach, a threshold is set, and whenever the patient crosses that threshold, a light or music indicates that the patient is succeeding. In the analog approach the patient monitors the actual numbers in electrical units that represent bodily states such as heart rate, temperature, or vasculature. The two techniques can be combined.

(p.1)

The two most commonly used types of biofeedback are electromyograph (EMG) and temperature readings. With EMG readings, three electrodes are placed at the specific part of the body to be measured and the electric activity of the skin is measured. The electric activity of the neurons is caused by the individual moving the muscles in the area being measured. The constriction of the muscle causes increased neural activity and relaxation of the muscle causes decreased neural activity. When using temperature readings, a thermometer is attached to the individual's finger and the temperature is monitored by the biofeedback instrument.

Mittelman and Wolff (1943), as cited by O'hare (1998), discovered individuals experiencing negative emotional stress of various kinds will experience a lowering of the temperature in the finger. The readings of EMG biofeedback will be lower with the more relaxation the individual experiences and the readings of temperature biofeedback will be higher with increased relaxation.

Biofeedback is not limited to the two examples listed above. Heart rate, respiration, and electroencephalograph (EEG) readings are also used. Heart rate is measured in beats per minute where stress may raise the number of beats per

minute and depression may lower the number of beats per minute (Wall, 1997).

Heart rate is obtained by attaching a sensor on the individual's finger or ear.

Respiration is measured by breaths per minute and becomes faster, shallower, and uneven when an individual becomes stressed (Wall, 1997). Respiration is received through a gauge worn around the chest area. The EEG readings are the most

complex with the least amount of information known in this area. These readings are obtained by placing two electrodes on either side of the forehead in the temple

region. These EEG readings consist of various bandwidths which include: Theta (4-7Hertz), Alpha (8-12 Hertz), Beta (13-20 Hertz), and Gamma (21-Up) (Wall, 1997).

The individual using EEG training acquires the ability to distinguish between each bandwidth and learns what behaviors belong to each of the four listed above. Wall (1997) explains:

generally, beta and gamma are useful for directed activity and getting things done; alpha is useful in situations where relaxed vigilance is called for (such as meditation); and theta is useful for creative, day-dreamy generation of imagery (theta is sometimes called the gateway to the unconscious). (p.4)

In 1969, Joe Kamiya was one of the first researchers to experiment with the study of brain waves, or more precisely the study of alpha brain waves (A Brief History of Biofeedback, 1999). He constructed a machine that emitted a tone when alpha brain waves were present. The participants in the study learned to control their alpha waves, either by suppressing them (keeping the tone off) or enhancing them (keeping the tone on). Other findings, listed in A Brief History of Biofeedback, included:

...that the participants, after they had been trained to both enhance and suppress alpha, reported a preference for the high alpha state. Participants described a general mental relaxation, or calming state, and Kamiya reported that it seemed to be associated with meditation. In spite of, or perhaps because of, the fact that the report was more subjective than objective, a trend of biofeedback studies involving relaxation began to develop. (p. 4)

This study helped lay the foundation for further research leading to modern day EEG machines.

Advantages

There are many advantages to the use of biofeedback for both the patient and the practitioner. For the patient, the cost is relatively low when compared to the price of traditional stress management alternatives. Schwartz (1995) points out that practitioners can provide biofeedback treatment at no more cost than other therapies available. Schwartz (1995) lists seven advantages for the patient that participates in biofeedback therapy. They are as follows:

- 1) Increased awareness of psychophysiological activity, reactivity, and recovery from arousal.
- 2) Increased self-efficacy and confidence in their psychophysiological self-regulation ability.
- 3) Learning to use the relationships between thoughts and behavior and physiologic functioning.
- 4) Developing psychophysiological self-regulation often unlearnable without this information and these procedures and often learning it faster.

- 5) Acceptance of therapies for those persons who resist psychotherapies.
- 6) Increased interest in developing and applying psychophysiological self-regulation with a fresh approach.
- 7) Provision of safe, effective, and cost efficient nonpharmacological therapies. (p. xviii)

There are also advantages for the practitioners (Schwartz, 1995):

- 1) A valuable source of diagnostic and therapeutic information.
- 2) Assessment and documentation of psychophysiological functioning that affects symptoms, including reactivity to stimulation and recovery after stimulation.
- 3) Assessment and documentation of psychophysiological changes within and across sessions.
- 4) Enhanced professional interest in and confidence for providing psychophysiological self-regulatory therapies. (p.xix)

Disadvantages

There have been relatively few disadvantages associated with biofeedback throughout the years. It is considered less invasive and less expensive than many other methods. The worst that can be said of it is that some patients do not benefit from treatment.

Past Findings and Results

Wenck, Leu and D'Amato (1996) completed a study of biofeedback among a large sample of children in a public school setting. After administering an IPAT Anxiety Test to 7th and 8th graders, 150 of them were selected to participate in the

study and were randomly assigned to biofeedback treatment and control groups. The treatment groups attended sessions of biofeedback training, which measured skin temperature and muscle tension, biweekly for twelve consecutive weeks. After completion of the sessions, the Spielberger State-Trait Anxiety Inventory was given to both treatment and control groups. The biofeedback groups showed lower state and trait anxiety scores than did the control groups (Wenck, Lew and D'Amato, 1996). The authors noted this study found that biofeedback reduced both state and trait anxiety levels while utilizing skin temperature and muscle tension strategies.

In order to study the usefulness of home practice in biofeedback treatment of migraine headaches, Gauthier, Cote and French (1994) examined a sample of 17 female migraine headache sufferers, who were randomly selected into two groups of thermal biofeedback: home practice and non-home practice. A headache diary, or index, and a medication index were used in outcome measures over a five week time period. Twelve sessions occurred with two sessions per week for a total of six weeks. Sessions were approximately 40 minutes long, and included the use of skin (finger) thermometers. Subsequent to these training sessions, the home practice group practiced their biofeedback techniques at home on a daily basis, and whenever they thought they were close to experiencing a migraine headache. The non-home practice group did not use any biofeedback mechanisms in a home setting. Analysis showed that the home practice group reduced headache activity and the need for medication, while those who had no home practice did not (Gauthier, Cote and French, 1994).

In a study of 524 medical and psychiatric patients who received biofeedback and relaxation training (Olson, 1988), it was found that 75% reported “maximum, significant, or moderate improvement” in conditions such as tension, anxiety, chronic pain, headaches and cervical strain. There was a significant improvement associated with an increased number of training sessions up to a maximum of ten. The subjects in this study by a two to one margin rated the relaxation training as more helpful than the biofeedback training.

Progressive Relaxation

As cited by Forbes and Pekala (1993), Lichstein described progressive relaxation as “probably the most commonly practiced relaxation technique and involves the progressive tensing and relaxing of the different muscle groups of the body and focuses on the kinesthetic effects associated with muscle tension/relaxation” (p.19). It is used to induce nerve-muscle relaxation and was developed by Edmund Jacobson in the late thirties (Greenburg, 1990). Since the development of progressive relaxation, it has been used to treat various ailments. It has been found that relaxation of the skeletal muscles causes relaxation of the smooth muscles, which in turn leads to relaxation of the cardiovascular and gastrointestinal systems (Greenburg, 1990). This finding indicates a link between relaxation of the voluntary muscles, which leads to relaxation of the involuntary muscles.

Progressive relaxation basically works by tensing and relaxing a specified muscle group. This experience provides an overall sense of release in the area of focus. For example, if an individual is experiencing aches, pains or stiffness

progressive relaxation may be a beneficial option. The individual usually stretches out on the floor with body supported; pillows are optional. Isometric squeezes are performed on individual muscle groups. Greenburg (1990) believes that these treatments are most effective.

More specifically, progressive relaxation works because there is a relationship between muscle tension and emotional tension (Epstein, 1998). He goes on to state there is a connection between tension and infertility. "When you feel emotionally distraught, you automatically tense your muscles. Your muscle tension is a cause of the headaches and backaches or infertility, as well as a clue about how you are responding to your infertility" (Epstein, 1998, p.1). Progressive relaxation is not the usual method couples seeking to overcome infertility chose to use, but may be helpful in abbreviated forms without using the usual half hour to forty-five minute long session (Epstein, 1998).

There are five features that are critical when using progressive relaxation. They are as follows:

- 1) Place: Find a quiet room where you can work undisturbed.
- 2) Position: To learn progressive relaxation, all parts of your body must be comfortably supported. Find a bed, couch or a recliner.
- 3) Clothing: Wear loose clothing.
- 4) Time: Designate about thirty minutes daily. Try to schedule a fixed time every day so you won't forget to do your progressive relaxation.
- 5) Focus: Try to focus on the particular sensations that come from letting go of tension. (Epstein, 1998, p.1)

Progressive Relaxation Procedure

There are many different methods of progressive relaxation, each varying in length and technique. This technique can be used to relax the whole body or focus on specified muscle areas. As seen in Greenburg's Stress Management (1990) book, a brief relaxation activity of the arms is as follows:

Settle back as comfortably as you can and let yourself relax to the best of your ability.

Now, as you relax, clench your right fist.

Clench it tighter and tighter, and study the tension as you do so.

Keep it clenched and feel the tension in your right hand, fist and forearm.

Now relax. . .

Let the fingers of your right hand become loose. . .

Observe the contrast in your feelings.

Now let yourself go and try to become more relaxed all over (p.186).

This exercise continues on for about 3-4 minutes, or until the individual experiences a deeper sense of relaxation. A standard progressive relaxation audio tape can take up to thirty to forty-five minutes to cover all of the remaining muscle groups of the body.

Ailments treated by biofeedback discussed earlier may also be relieved by progressive relaxation. Reduction of such ailments include headaches (tension and migraine) and backaches. Individuals that experience an overall feeling of stress or anxiety often turn to progressive relaxation for relief as well. On the other hand, individuals that experience excess amounts of muscle tension may actually lead to

headaches, backaches, or pain in the shoulders and neck (Greenburg, 1990). With practice, the individual using progressive relaxation learns the appropriate level of activity that is suitable and successful for them.

A related article on the effects of progressive relaxation versus biofeedback-assisted relaxation with college students found that when these procedures were combined there was an improvement in the psychological well-being of subjects. See and Czerlinsky (1990) performed this particular study for the purpose of contributing information that would help professionals make decisions on the use of biofeedback and relaxation, as there had been some confusion regarding the value of both procedures. These researchers sought to find significant differences in the psychological adjustment of college students who took an eight week course in either progressive relaxation training or progressive relaxation training combined with biofeedback training.

Participants in this study consisted of 22 women and 11 men ranging in age from 19 to 24 years of age who were randomly assigned to receive either of the treatments. Instruments used by See and Czerlinsky (1990) in this particular study included the State-Trait Anxiety Inventory (STAI) and the Profile of Mood States (POMS). These instruments will be described in greater detail in the methodology section of this proposal. Equipment used was a portable EMG machine, along with two portable thermal units.

Two types of biofeedback used in this study were EMG and thermal. While participants became familiar with these procedures, they chose different feedback combinations for each of their sessions. Those in the relaxation classes were led

by an audio tape or instructor. In the statistical analysis, the dependent variables consisted of the change in pre-post scores on the STAI and POMS. Overall, See and Czerlinsky (1990) found that biofeedback was effective among the college student population who had participated in the study. Both techniques combined together were the most effective. However, no statistically significant benefits were found when only progressive relaxation training was used alone.

In 1998, Greeff and Conradie reported on a study on the effectiveness of progressive relaxation training on chronic alcoholic men in therapy who experienced disruptive sleep patterns due to insomnia. Twenty-two of the men studied were randomly divided into 2 groups: test and control. All men completed an initial baseline survey and sleep diary, followed by a posttreatment survey. A licensed psychologist administered progressive relaxation to test participants for one hour at a time, five days a week for two weeks. The exercises included tensing and relaxing of various muscles while simultaneously concentrating and focusing on feelings associated with tension and relaxation. The results indicated that the sleep patterns were overall improved in the test group, with no changes in the sleep patterns of the control group.

Forbes and Pekala (1993) reported on a study involving the psychophysiological effects of stress management techniques. They hypothesized that progressive relaxation, when used as a stress reducer, should provide relatively quick effects when dealing with those who experience psychophysiological arousal, and that deep abdominal breathing lowers stress levels as well (1993). The study sample included 231 nursing students, who were analyzed by skin

thermometers, pulse rates, and the Harvard Group Scale of Hypnotic Susceptibility. Participants were split into ten groups for two sessions, one week apart. In one session, the participants were given the skin thermometer to hold, along with a pulse rate check. In the second session, they practiced deep abdominal breathing and basic hypnosis. All participants completed the Harvard Group Scale of Hypnotic Susceptibility. The study found that the hypnotic susceptibility of the participants did not affect psychophysiological levels or progressive relaxation, but both hypnosis and progressive relaxation did have stress reducing agents (Forbes and Pekala, 1993). Abdominal breathing, however, had immediate results on skin temperature.

Goldman and Wong (1997) indicate college students face high amounts of stress that affect self esteem and self perception in negative ways, which can lead to social withdrawal and seclusion which affect their social lives. Stress is not only limited to college students but it adversely affects the lives of millions of others annually. Biofeedback and progressive relaxation may be effective tools to successfully reduce the amounts of anxiety or stress felt by college students and others.

As indicated in the previous review of the literature, the beneficial qualities of biofeedback have been explored over the past several decades. Researchers have indicated biofeedback has positive effects on psychological activity and awareness, as well as increased self-efficacy and confidence.

Progressive relaxation has also been explored since the late thirties. Results and findings indicate reductions in ailments such as headaches and backaches,

and also an overall relief in anxiety or stress. Progressive relaxation and biofeedback may be simple and obtainable methods for people to cope with these problems.

CHAPTER III

Methodology

Subjects

The subjects for this study were 22 college students enrolled in a 16 week biofeedback class offered at the University of Wisconsin-Stout during spring semester of 1998. There were 19 undergraduates and 3 graduate students. Participants consisted of 14 female and 8 male students. Ages ranged from 18 to 33 years. Of the 22 students in the class, 14 voluntarily provided the usable pre and post test scores utilized in this study.

Instruments

There were two psychometric instruments utilized for the pre and posttreatment data collection:

1) State-Trait Anxiety Inventory (STAI) (Spielberger, Gorsuch, & Lushene, 1983).

This instrument includes 40 items that assess current felt (state) anxiety and generally felt (trait) anxiety (Appendix A). Katkin (1978), as cited by See and Czerlinsky (1990), states in *The Eighth Mental Measurements Yearbook*, "In summary, it appears that the STAI is an excellent choice for the clinical psychologist or personality researcher looking for an easy-to-administer, easy-to-score, reliable (.83 to .92) and valid (.80) index of either individual differences in transitory experience of anxiety" (p. 549).

2) Profile of Mood States (POMS) (McNair, Lorr, and & Droppelman, 1971). This inventory measures six mood or affective states: tension-anxiety, depression-dejection, anger-hostility, vigor-activity, fatigue-inertia, and confusion-bewilderment.

The POMS is a 65-item 5-point rating scale (Appendix B). Eichman (1978), as cited by See and Czerlinsky (1990), states in *The Eighth Mental Measurements Yearbook*, "In brief, POMS appears to be optimally reliable (.84 to .95) and sensitive to change. It appears to be a valid measure of mood states, and it is simple and easy to use" (p.549).

Equipment

The equipment used in this study were two thermal units and one EMG machine. The EMG machine was a Cyborg J33 Muscle Trainer and the thermal machines were Cyborg J42 Feedback Thermometers.

Setting

The environment in which the biofeedback took place was a quiet, dimly lit seminar room with three large recliner chairs. Up to three students could participate in the laboratory session at a time. The role of the graduate technician was to hook the students up to the machines for the half hour session and administer the feedback sheet following the session. The students completed the progressive relaxation training in their own residence or place of choice.

Procedure

The procedure for this study involved the use of biofeedback and progressive relaxation. The students of the biofeedback course completed 10 biofeedback sessions as part of the class requirement. Each session was 20 to 30 minutes in length, and the student was given the choice of which of the three biofeedback machines he / she would use for the session. After the completion of each session,

the student completed a reaction form (Appendix C) about the positive or negative aspects of the session. This data was monitored over the course of the semester.

The students were also required to complete 10 progressive relaxation sessions. These sessions were completed by the student in their home with the aid of progressive relaxation tapes. The logs (Appendix D) enabled the student to describe their progressive relaxation session, along with any personal feelings involved. The data was reviewed continually throughout the semester.

The students were administered the POMS and the STAI prior to starting either the biofeedback or progressive relaxation on the first day of class. After the completion of the semester, the students were again administered the POMS and STAI to determine the effects of the biofeedback sessions plus progressive relaxation techniques on their emotional well-being. The pre and post test scores of the STAI and the POMS were then compared to determine if there were any treatment effects.

Analysis of Data

The dependent variables in this study consisted of the following nine scales: State/trait anxiety (two separate parts) and the POMS, which consisted of tension-anxiety, depression-dejection, anger-hostility, vigor-activity, fatigue-inertia, confusion-bewilderment, and POMS total. The statistical analysis will be a simple "t" test comparison of the pre and posttest scores on the nine dependent variable scales. The .05 level of statistical significance will be utilized.

CHAPTER IV

Results

The purpose of this causal / comparative study was to provide data about the effects of biofeedback plus progressive relaxation on the emotional well-being of college students. This study used a null hypothesis that was stated as follows: For students treated with biofeedback and progressive relaxation there will be no statistically significant difference between pretest and posttest scores as measured by the State-Trait Anxiety Inventory (STAI) and the Profile of Mood States (POMS).

This chapter presents the findings from the statistical comparison of the pre and posttest scores of the 14 subjects who provided usable data. Data observations are presented in table format. A brief data analysis follows each table.

Table 1

Comparison of Pre and Posttest State Anxiety Scores

Variable	Number of pairs	Corr	2-tail Sig	Mean	SD	SE of Mean
Pre-State				41.4286	11.434	3.056
Post-State	14	.741	.002	34.4286	12.264	3.278
Paired Differences						
Mean	SD	SE of Mean	t-value	df	2-tail Sig	
7.0000	8.557	2.287	3.06	13	.009	
95% CI (2.059, 11.941)						

The "T" test for paired samples indicate a t-value of 3.06. On the 2-tail test, this represents a level of significance of .009.

Table 2

Comparison of Pre and Posttest Trait Anxiety Scores

Variable	Number of pairs	Corr	2-tail Sig	Mean	SD	SE of Mean
Pre-Trait				39.0714	10.247	2.739
Post-Trait	14	.626	.017	34.6429	8.670	2.317
Paired Differences						
Mean	SD	SE of Mean	t-value	df	2-tail Sig	
4.4286	8.299	2.218	2.00	13	.067	
95% CI (-.363, 9.220)						

The "T" test for paired samples indicate a t-value of 2.00. On the 2-tail test, this represents a level of significance of .067.

Table 3

Comparison of Pre and Posttest Tension-Anxiety Scores

Variable	Number of pairs	Corr	2-tail Sig	Mean	SD	SE of Mean
Pre-Tension				11.4545	5.716	1.723
Post-Tension	11	.873	.000	9.7273	7.044	2.124
Paired Differences						
Mean	SD	SE of Mean	t-value	df	2-tail Sig	
1.727	3.467	1.045	1.65	10	.129	
95% CI (-.602, 4.056)						

The "T" test for paired samples indicate a t-value of 1.65. On the 2-tail test, this represents a level of significance of .129.

Table 4

Comparison of Pre and Posttest Depression-Dejection Scores

Variable	Number of pairs	Corr	2-tail Sig	Mean	SD	SE of Mean
Pre-Depression	11	.913	.000	12.090	11.167	3.367
Post-Depression				7.8182	10.572	3.188
Paired Differences						
Mean	SD	SE of Mean	t-value	df	2-tail Sig	
4.2727	4.563	1.376	3.11	10	.011	
95% CI (1.207, 7.338)						

The "T" test for paired samples indicate a t-value of 3.11. On the 2-tail test, this represents a level of significance of .011.

Table 5

Comparison of Pre and Posttest Anger-Hostility Scores

Variable	Number of pairs	Corr	2-tail Sig	Mean	SD	SE of Mean
Pre-Anger	11	.797	.003	11.0909	9.386	2.830
Post-Anger				8.6364	8.617	2.598
Paired Differences						
Mean	SD	SE of Mean	t-value	df	2-tail Sig	
2.4545	5.786	1.744	1.41	10	.190	
95% CI (-1.432, 6.341)						

The "T" test for paired samples indicate a t-value of 1.41. On the 2-tail test, this represents a level of significance of .190.

Table 6

Comparison of Pre and Posttest Vigor-Activity Scores

Variable	Number of pairs	Corr	2-tail Sig	Mean	SD	SE of Mean
Pre-Vigor	11	.708	.015	15.6364	7.243	2.184
Post-Vigor				19.6364	7.145	2.154
Paired Differences						
Mean	SD	SE of Mean	t-value	df	2-tail Sig	
-4.0000	5.495	1.657	-2.41	10	.036	
95% CI (-7.692, -.308)						

The "T" test for paired samples indicate a t-value of -2.41. On the 2-tail test, this represents a level of significance of .036.

Table 7

Comparison of Pre and Posttest Fatigue-Inertia Scores

Variable	Number of pairs	Corr	2-tail Sig	Mean	SD	SE of Mean
Pre-Fatigue	11	.866	.001	11.6364	6.423	1.937
Post-Fatigue				9.8182	6.853	2.066
Paired Differences						
Mean	SD	SE of Mean	t-value	df	2-tail Sig	
1.8182	3.459	1.043	1.74	10	.112	
95% CI (-.506, 4.142)						

The "T" test for paired samples indicate a t-value of 1.74. On the 2-tail test, this represents a level of significance of .112.

Table 8

Comparison of Pre and Posttest Confusion-Bewilderment Scores

Variable	Number of pairs	Corr	2-tail Sig	Mean	SD	SE of Mean
Pre-Confusion				9.0909	3.986	1.202
	11	.787	.004			
Post-Confusion				6.1818	5.474	1.650

Paired Differences

Mean	SD	SE of Mean	t-value	df	2-tail Sig
2.9091	3.390	1.022	2.85	10	.017
95% CI (.632, 5.186)					

The "T" test for paired samples indicate a t-value of 2.85. On the 2-tail test, this represents a level of significance of .017.

Table 9

Comparison of Pre and Posttest Totals

Variable	Number of pairs	Corr	2-tail Sig	Mean	SD	SE of Mean
Total				39.7273	35.327	10.652
	11	.964	.000			
Total				24.3636	42.528	12.823

Paired Differences

Mean	SD	SE of Mean	t-value	df	2-tail Sig
15.3636	12.604	3.800	4.04	10	.002
95% CI (6.896,23.831)					

The "T" test for paired samples indicate a t-value of 4.04. On the 2-tail test, this represents a level of significance of .002.

CHAPTER V

Conclusions

Introduction

The purpose of this study was to determine the effects of biofeedback plus progressive relaxation on the well-being of college students. The results indicate that when the above methods are used cooperatively, they have a positive effect on a variety of indices of psychological health. This study adds to the existing foundation of knowledge that biofeedback combined with progressive relaxation are beneficial to the well-being of college students.

Discussion

This study compared the results of pre and posttest score findings from two standardized psychometric instruments. The following comparisons proved to be statistically significant beyond the .05 level, thereby rejecting the null hypothesis of this study.

State Anxiety. The comparison of the pre and posttest State anxiety scores had a t-value of 3.06 with a significance of .009 on the 2-tail test. This evidence shows that the combined methods of biofeedback and progressive relaxation produced a statistically significant reduction in state anxiety (anxiety felt at that point in time) between the beginning session and the final session.

Trait Anxiety. The comparison of the pre and posttest Trait anxiety scores were close to significant, or slightly above the .05 significance used for this study. The data for this comparison stated a t-value of 2.00 with a significance of .067 on

the 2-tail test. The subjects showed a decrease, although not statistically significant, in the predicted direction on trait anxiety (anxiety felt on a daily basis).

Depression-Dejection. The comparison of pre and posttest Depression-Dejection scores on the POMS revealed a t-value of 3.11 with a .011 significance on the 2-tail test. The subjects had a significant reduction in the amount of depression or dejection felt in their lives following the sessions.

Vigor-Activity. Subjects demonstrated an increase in the comparison of the pre and posttest data on the POMS Vigor-Activity scores. This had a t-value of -2.41 with a significance of .036 on the 2-tail test. These scores show an increase in motivation and willingness to perform tasks.

Confusion-Bewilderment. The pre and posttest data of the comparison of Confusion-Bewilderment on the POMS showed a t-value of 2.85 with a significance of .017 on the 2-tail test. The subjects also demonstrated a reduction in the amount of confusion and bewilderment felt after the treatment sessions.

POMS Totals. The total comparison of the pre and posttests proved to be the most statistically significant information. The totals had a t-value of 4.04 with a .002 significance on the 2-tail test. This clearly represents a difference between the students' emotional well-being before and after the sessions. The findings from this study indicate that biofeedback plus progressive relaxation have a positive effect on the emotional well-being or psychological welfare of college students.

This study coincides with the results of similar studies. A study by See and Czerlinsky (1990) indicated biofeedback plus progressive relaxation was an effective agent for therapeutic change. They concluded this combination was

superior to relaxation training alone. Wenck, Lew and D'Amato (1996) utilized the STAI to measure pre and posttest for students who received biweekly biofeedback sessions for twelve weeks. The results indicated the treatment group showed lower state and trait anxiety scores when compared to the control group, who received no treatment at all. These studies seem to further reinforce the positive attributes of the methods utilized in this study.

Other literature in this field also reinforces the results of this study. Several researchers (Forbes and Pekala 1993, Greenburg 1998, O'Hare 1998, Schwartz 1995, Shmavonian 1998, Wall 1997) point out the advantages and beneficial qualities of biofeedback and progressive relaxation. In addition to reducing symptoms of anxiety and stress, biofeedback can be used to relieve various health problems by controlling certain biological responses. These would include headaches, chronically taut muscles related to sports injuries, asthma, high blood pressure and heart arrhythmias (Shmavonian, 1998). Other less commonly treated health problems include: Raynaud's Syndrome, test anxiety, seizure activity, stomach acidity, incontinence and elimination of subvocal reading (O'Hare, 1998). This indicates that biofeedback is not limited to use in the clinical setting on the commonly treated anxiety and stress disorders, but is widely used as an inexpensive tool for many other therapeutic treatments.

Progressive relaxation is also an inexpensive tool that may be used to relieve ailments treated with biofeedback. Greenburg (1998) points out progressive relaxation can be used to reduce muscle tension, which often causes headaches, backaches or pain in the shoulders. Other research has indicated that progressive

relaxation lowers stress levels through deep abdominal breathing. Forbes and Pekala (1993) found that progressive relaxation had stress reducing agents when used with students. They also indicate deep breathing reduced stress and had the immediate result of increased skin temperature.

Limitations and Recommendations

There are several obvious limitations in this study. One limitation of this study was the size of the sample or the number of students who completed both the pre and posttests. Only twenty-two students were enrolled in the biofeedback course and fifteen chose to participate in all the aspects of the study. One of the fifteen subjects had such extreme scores that they were dropped from the analysis leaving only fourteen subjects with complete pre and post data. The small sample size makes it difficult to generalize the results to a larger student population or to imply that biofeedback plus progressive relaxation will have a positive effect on the well-being of all college students. This does not suggest that the findings of this study are invalid, simply that a larger sample would have had more statistical power and credibility.

This study had only one treatment group and was limited to subjects that received biofeedback combined with progressive relaxation training. The scope of this study could be broadened to include other groups for comparison. A similar study may be helpful that includes groups that receive treatment of biofeedback or progressive relaxation alone. A study of this nature would allow the researcher to compare the results to the above study and draw more thorough conclusions about

the effects of both the stress reduction treatments combined versus one or the other used alone.

Another limitation of this study was the lack of a control group so the results could not be compared to those who did not receive either biofeedback or progressive relaxation treatments. A group of subjects who took the pre and posttest without any treatments may have provided a baseline for comparison. This may have been an indicator of the emotional well-being of a subject without the influence of any outside or additional factors that may decrease the amount of experienced stress and/or anxiety.

This study was relatively short in duration. The pre and posttest were sixteen weeks apart, where the subjects emotional state may not have changed significantly in that time frame. A longer study would allow the researcher to obtain a broader data base and more extensive results. A longitudinal study of a year or more may provide more reliable data.

The length of the biofeedback sessions were pre-determined by the instructor of the course. The length of the progressive relaxation treatments were also dictated by the length of the relaxation tape that was utilized by each subject. The subjects may have increased results with a session length tailored to their needs, where one subject requires longer sessions and one shorter sessions depending on personal opinions and psychological factors.

The long-term effectiveness of the biofeedback and progressive relaxation treatments is undetermined. The results of this study indicated the subjects experienced reduced levels stress/anxiety levels, but the researcher does not have

means of knowing the lasting effects of the treatments. A follow-up instrument could be used to determine these long-term effects.

Summary

The results of this study support the hypothesis that biofeedback plus progressive relaxation has a positive effect on the well-being of college students. The findings demonstrated statistically significant information to contribute to the data base in this area. The subjects benefited from inexpensive and relatively easy methods of anxiety and stress reduction. Biofeedback and progressive relaxation are not widely known tools to the college student population and may be very helpful to deal with the stressors of their academic career. These methods do not have to be limited to the population listed above and have many universal qualities and can be used in many different settings.

The areas where the results were significant may be beneficial to many others in this country. For example, this study demonstrated biofeedback plus progressive relaxation reduced the amounts of anxiety, depression-dejection, confusion-bewilderment and increased vigor-activity. Anxiety is a problem that disrupts the lives of millions of individuals each year. Millions of others face the difficulties of depression and/or confusion. Biofeedback and progressive relaxation may be simple and obtainable methods for people to cope with these problems. Lack of initiative and drive is another hindrance in the lives of people in this country. The results demonstrated that biofeedback and progressive relaxation may provide motivation for a percentage of this population by increasing their vigor-activity level.

Goldman and Wong (1997) discuss how college students face high amounts of stress throughout the college years, which affects self esteem and self perception in negative ways. This can also cause students to be socially withdrawn, thereby drastically impacting their social lives.

Biofeedback and/or progressive relaxation may be promising alternatives to combat the difficulties faced during the college years. It is recommended that college faculty and health professionals become more aware of the benefits of these modalities so that they may convey this message to the campus community. This would encourage more students to take advantage of these simple and effective health practices.

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Appendix A

State-Trait Interest Inventory

SELF-EVALUATION QUESTIONNAIRE

Developed by Charles D. Spielberger
in collaboration with
R. L. Gorsuch, R. Lushene, P. R. Vagg, and G. A. Jacobs

STAI Form Y-1

Name _____ Date _____ S _____
Age _____ Sex: M _____ F _____ T _____

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

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

NOT AT ALL
MODERATELY
SOMEWHAT
VERY MUCH SO



SELF-EVALUATION QUESTIONNAIRE

STAI Form Y-2

Name _____ Date _____

DIRECTIONS: A number of statements which people have used to describe themselves are given below. Read each statement and then blacken in the appropriate circle to the right of the statement to indicate how you *generally* feel. There are no right or wrong answers. Do not spend too much time on any one statement but give the answer which seems to describe how you generally feel.

ALMOST NEVER
SOMETIMES
OFTEN
ALMOST ALWAYS

- 21. I feel pleasant ① ② ③ ④
- 22. I feel nervous and restless ① ② ③ ④
- 23. I feel satisfied with myself ① ② ③ ④
- 24. I wish I could be as happy as others seem to be ① ② ③ ④
- 25. I feel like a failure ① ② ③ ④
- 26. I feel rested ① ② ③ ④
- 27. I am "calm, cool, and collected" ① ② ③ ④
- 28. I feel that difficulties are piling up so that I cannot overcome them ① ② ③ ④
- 29. I worry too much over something that really doesn't matter ① ② ③ ④
- 30. I am happy ① ② ③ ④
- 31. I have disturbing thoughts ① ② ③ ④
- 32. I lack self-confidence ① ② ③ ④
- 33. I feel secure ① ② ③ ④
- 34. I make decisions easily ① ② ③ ④
- 35. I feel inadequate ① ② ③ ④
- 36. I am content ① ② ③ ④
- 37. Some unimportant thought runs through my mind and bothers me ① ② ③ ④
- 38. I take disappointments so keenly that I can't put them out of my mind ① ② ③ ④
- 39. I am a steady person ① ② ③ ④
- 40. I get in a state of tension or turmoil as I think over my recent concerns and interests ① ② ③ ④

Appendix B

Profile of Mood States

Appendix C

Biofeedback Laboratory Report

BIOFEEDBACK LABORATORY REPORT

Name: _____

Date: _____

Type of Biofeedback Used: _____ Thermal

_____ EMG

_____ GSR

Length of Session(s): _____

Biofeedback readings: _____ High

_____ Low

Briefly describe the feelings you had during biofeedback. How did it compare to previous sessions ?

What self-talk, images, or visualizations did you use?

Did you experience any distractions? sleepy, hungry, cold, headache, noisy surroundings, unpleasant biofeedback signals, etc.

Describe any adverse or unpleasant reactions of any kind that you experienced (physical or psychological).

Appendix D

Student Progressive Relaxation Logs

Monday Date:

Tuesday Date:

When/Where	Awareness & Control Noticed	When/Where	Awareness & Control Noticed
------------	-----------------------------	------------	-----------------------------

Wednesday Date:

Thursday Date:

When/Where	Awareness & Control Noticed	When/Where	Awareness & Control Noticed
------------	-----------------------------	------------	-----------------------------

Friday Date:

Saturday Date:

When/Where	Awareness & Control Noticed	When/Where	Awareness & Control Noticed
------------	-----------------------------	------------	-----------------------------

Sunday Date:

When/Where	Awareness & Control Noticed	
------------	-----------------------------	--