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EFFECT OF ELECTROMYOGRAPHIC BIOFEEDBACK AND STRESS INOCULATION TRAINING UPON THE BLOOD PRESSURE AND ANXIETY LEVELS OF PRESERVICE TEACHERS

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has been accepted towards fulfillment of the requirements for

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EFFECT OF ELECTROMYOGRAPHIC BIOFEEDBACK AND STRESS INOCULATION TRAINING UPON THE BLOOD PRESSURE AND ANXIETY LEVELS OF PRESERVICE TEACHERS

By

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ABSTRACT

EFFECT OF ELECTROMYOGRAPHIC BIOFEEDBACK AND STRESS INOCULATION TRAINING UPON THE BLOOD PRESSURE AND ANXIETY LEVELS OF PRESERVICE TEACHERS

By

Patrick J. Lustman

The purpose of this study was to experimentally examine the efficacy of two treatments for reducing preservice teacher stress levels. One treatment was frontalis electromyographic biofeedback. A second treatment was stress inoculation, a form of cognitive behavior management. Subject change was quantified using four dependent measures. Changes in physiological stress levels were measured using systolic and diastolic blood pressure. The Taylor Manifest Anxiety Scale and the Teaching Anxiety Scale were used to measure changes in psychological stress levels.

Twenty-four senior teaching interns were randomly assigned to experimental (treatment) and control (no treatment) conditions in a pretest-posttest control groups design. A randomized levels design was utilized to compare the effects of treatments on subjects leveled according to their pretest stress scores on the Life Experiences Survey.

Data were analyzed using a multivariate analysis of variance (MANOVA). The MANOVA tested for differences in the means on a linear combination of psychological and physiological indices. Two univariate analyses of variance (ANOVAs) were also performed. These ANOVAs were used to analyze differences in the means, one on a linear combination of physiological measures (systolic and diastolic blood pressure) and another on a linear combination of the psychological measures (Taylor Manifest Anxiety Scale and Teaching Anxiety Scale). Four separate ANOVAs were also performed on each of these component dependent measures. Post hoc t-tests were performed to determine the directionality of differences.

The results of the overall MANOVA showed significant differences ($p = .027$) existed among the treatment means on the linear combination of all dependent measures.

The ANOVA on the physiological index (P) indicated significant differences ($p = .012$) existed among the means of the three treatment groups. The ANOVA on the psychological index (PS) was not statistically ($p = .09$) significant. The results of the overall MANOVA and the two ANOVAs on the indices suggest that the experimental treatments had a stronger effect on the physiological measures than the psychological measures.

Separate individual ANOVAs were performed on each dependent measure. Significant ($p = .007$) differences were found among the means of the three treatment conditions on

systolic blood pressure. No significant differences were found on diastolic blood pressure ($p = .12$), the Taylor Manifest Anxiety Scale ($p = .08$), and the Teaching Anxiety Scale ($p = .15$).

Results from the biofeedback versus stress inoculation t-test showed no statistically significant differences between the means on all dependent measures. Results from the biofeedback versus control t-test indicated that biofeedback was significantly better on both systolic ($p = .003$) and diastolic ($p = .001$) blood pressure. No statistically significant differences were found on either the Taylor Manifest Anxiety Scale or the Teaching Anxiety Scale. A third t-test showed that stress inoculation was significantly ($p = .08$) better than the control condition in reducing systolic blood pressure. No statistically significant differences were found on the remaining measures.

A combined examination of the statistically significant and nonsignificant findings (t-tests) revealed that subjects in both treatment conditions made important therapeutic changes. From pretest to posttest, there was a unanimous positive (i.e., healthful) change across <u>all</u> measures for both the biofeedback and stress inoculation treatment groups. During the same period, the control group evidenced a unanimous regressive change across <u>all</u> measures. The directional unanimity of these results provided partial evidence that the nonsignificant differences within the

treatment versus no-treatment t-test comparisons were meaningful differences.

Both biofeedback and stress inoculation were effective in reducing preservice teacher stress levels. However, neither treatment was significantly superior to the other. Biofeedback was a potent treatment for reducing pre-service intern blood pressure, both systolic and diastolic. Subjects also showed positive changes on the psychological instruments. Stress inoculation was a significantly effective treatment for reducing systolic blood pressure. Subjects in this group also evidenced positive changes on the remaining dependent measures. The results of this study support the continued use of both biofeedback and stress inoculation in the treatment and management of stress reactions.

To my brother John -

whose love sustains me,
whose memory inspires me,
and whom I miss deeply.

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CHAPTER I

STATEMENT OF THE PROBLEM AND REVIEW OF THE LITERATURE

Statement of the Problem

The effects of stress on teachers are currently the subject of considerable national attention. The educational journals contain numerous articles and case studies detailing the self-reports of stress-related health impairments in practicing teachers (Newell, 1979; Reed, 1979; Mace, 1979). Concern for the health and welfare of the professional teacher is reflected in the selection of "teacher stress" as the main focus of the 1979 meeting of the National Education Association.

In the fall of 1976, Instructor magazine conducted the first major study of teacher health. Ninety-eight percent (more than 9,000) of the teachers polled completed and returned this health questionnaire. They identified the area of stress and tension as the primary focal point of their health concerns. Moreover, the survey indicated that teachers perceived a causal connection between stress and illness. They stated that many of their inveterate health problems (e.g., nervous stomach, colitis, headaches, allergies, and colds) were stress-related.

Corroborating the aforementioned survey results, Sylwester (1977) states that teachers report stress as the worst problem they have to contend with. Also, Hunter (1977) indicates that teaching is one of the three most potentially stressful occupations. She adds that "The most effective stress prevention measure is excellent pre-service training . . . ." (p. 122).

The management of stress by preservice teachers was the focal point of this research. This investigation was designed to study the effects of stress management techniques in reducing stress experienced by this group during an actual student teaching internship. This internship experience presented preservice trainees with more intensive performance demands than they had previously experienced. Although their cooperating teacher (i.e., the inservice classroom teacher) was present in the classroom during this internship term, the student shared responsibility for classroom instruction and management. This internship further subjected these students to new forms of evaluation and expectations. They were assessed both professionally and interpersonally by their university field instructor, the cooperating teacher, other staff members, and administrators at their particular school. Finally, performance in student teaching is one critical variable upon which their employability hinges (Scheetz, 1980).

Because of their unique status, student teachers may in a sense be "doubly stressed." They are in an equivocal

situation where they may experience cognitive distress both when they reflect backward or project into the future. Firstly, they have not yet gained entry into the occupation for which they have trained. Secondly, they have not gained sufficient classroom experience to develop a mature sense of professional efficacy. Putnam (1980) has stated that these conditions increase the stress experienced by preservice teachers.

Fuller (1974) has also suggested that the distress experienced by this group is indeed unique. She factor analyzed 1,359 Teacher Concerns Statements (TCS) and from these data has posited the thesis that preservice teachers are distinctly preoccupied with themselves: their own comfort, competency, and achievement.

> Typescripts of preservice teachers' group counseling sessions, individual interviews and surveys of their problems and satisfactions showed neophytes mentioning most often concerns about their ability to control the class, their content mastery, supervisors' evaluation of them, working conditions and liking by pupils. Much less frequently mentioned by preservice teachers were concerns about pupil needs and pupil gain. (p. 1)

Finally, Singh (1972) has presented evidence which suggests that student teachers experience more anxiety than their inservice counterparts.

This research was concerned with the effects of stress and stress management procedures on student teachers. Specifically, the purpose of this investigation was to investigate the efficacy of two treatments for reducing

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preservice teacher stress levels. One treatment was frontalis electromyographic (EMG) biofeedback. A second treatment was stress inoculation, a form of cognitive behavior management.

Using the above-mentioned treatments, 24 preservice teachers were trained to reduce their existing stress levels. These student teachers also learned to identify and self-control their physiological reactivity to future stressful teaching encounters. The effectiveness of these treatments was measured by comparing four pre- and post-treatment measures (systolic blood pressure, diastolic blood pressure, Taylor Manifest Anxiety Scale, and the Teaching Anxiety Scale) in the treatment groups with a control group.

Definitions

Stress is a very misunderstood concept. Everyone talks about it and indeed everyone has it. However, there is no single agreed-upon definition in existence (Cox, 1978). While both professional and laypersons understand its general usage, very few individuals can give a precise account of its meaning. In an attempt to clarify the concept, three models of stress will be discussed in the next sections. These models are the stimulus-based model, the response-based model, and the transactional model.

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Stimulus-Based Model of Stress

Stimulus-based definitions conceptualize stress in terms of the stimulus characteristics present in the environment which are perceived as arousing or upsetting. The model is sometimes referred to as the engineering model, and is also the most frequently employed (i.e., popular) conception of stress. It is represented diagrammatically in Figure 1.1.

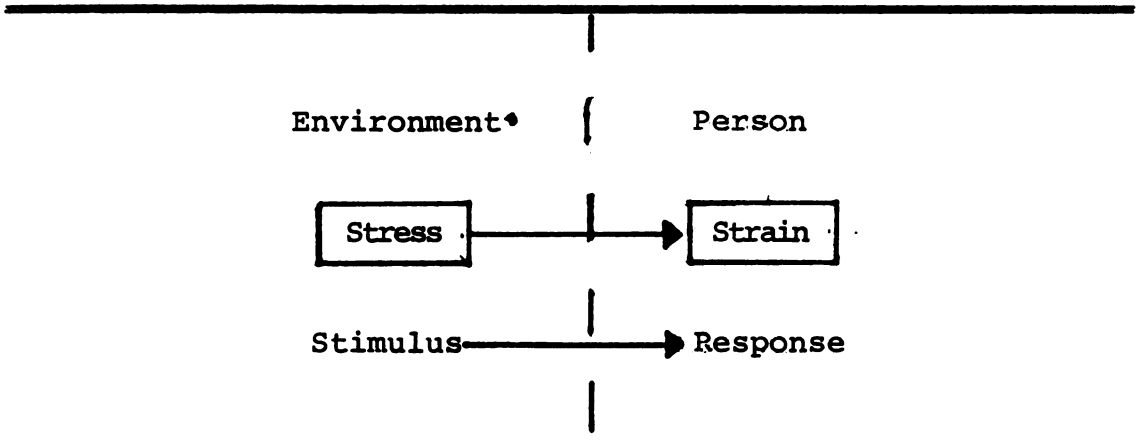


Figure 1.1.—Stimulus-Based (Engineering) Model of Stress (Cox, 1978)

In this model external stresses (e.g., marital problems, loss of a loved one) are viewed as the stimuli which cause a stress reaction, or strain, within an individual. The model has been likened to Hooke's Law of Elasticity.

> The law states that if the strain produced by a given stress falls within the 'elastic limit' of the material, when the stress is removed the material will simply return to its original condition. If, however, the strain passes beyond the elastic limit then some permanent damage will result. (Cox, 1978, p. 13)

In this conception, stress is generally treated as an independent variable for study and attempts are made to discover which environmental stimuli are indicative of stress.

Response-Based Model of Stress

Response-based definitions of stress concentrate on the specification of a particular response or pattern of responses which indicate that an individual has been subject to a disturbing environment. This response/response pattern is then viewed as the stress or, at least, the observable and measurable component of stress. Stress is here perceived as a dependent variable for study and as a response to stressors present in the environment.
Hans Selye's discovery of the General Adaptation Syndrome is primarily responsible for the close association of response-based definitions with physiological models of stress. The response-based model is represented diagrammatically in Figure 1.2.

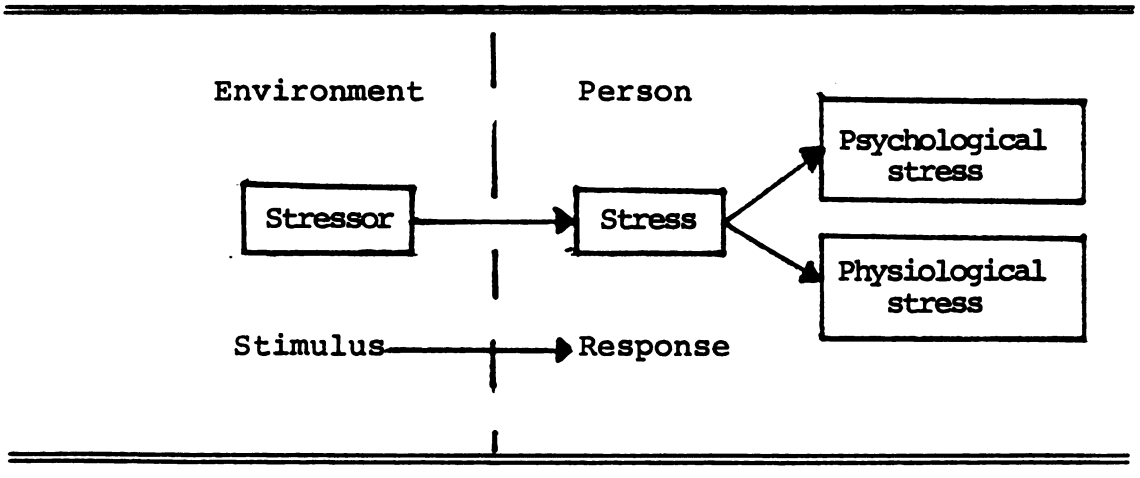


Figure 1.2.—Response-Based Model of Stress (Cox, 1978).

Transactional Model of Stress

The transactional model of stress (Cox & Mackay, 1976) provides a comprehensive approach to conceptualizing stress. It combines elements from the two previous definitions and highlights the importance of cognitive appraisals in determining stress reactions. It emphasizes that stress is an individual perceptual phenomenon having its origin in psychological processes. This model is represented diagrammatically in Figure 1.3.

Cox and MacKay (1976) state that demand can be both externally and internally generated. Psychological and physiological needs (and their fulfillment) represent internally generated demands. External demands are those which are rooted in a person's environment.

> Stress may be said to arise when there is an imbalance between the perceived demand and the person's perception of his capability to meet that demand. It is essential to realize that the important balance or imbalance is not between demand and actual capability, but between perceived demand and perceived capability. What is important for man is his cognitive appraisal of the potentially stressful situation and of his ability to cope. (Cox, 1978, p. 18)

Synthesis

The transactional model of stress provided the theoretical/conceptual framework for this research. In terms of this model, the cognitive treatment group's approach to reducing stress was most direct. Subjects in this group practiced adaptive/stress-reducing cognitive appraisals of their teaching situation. This procedure was

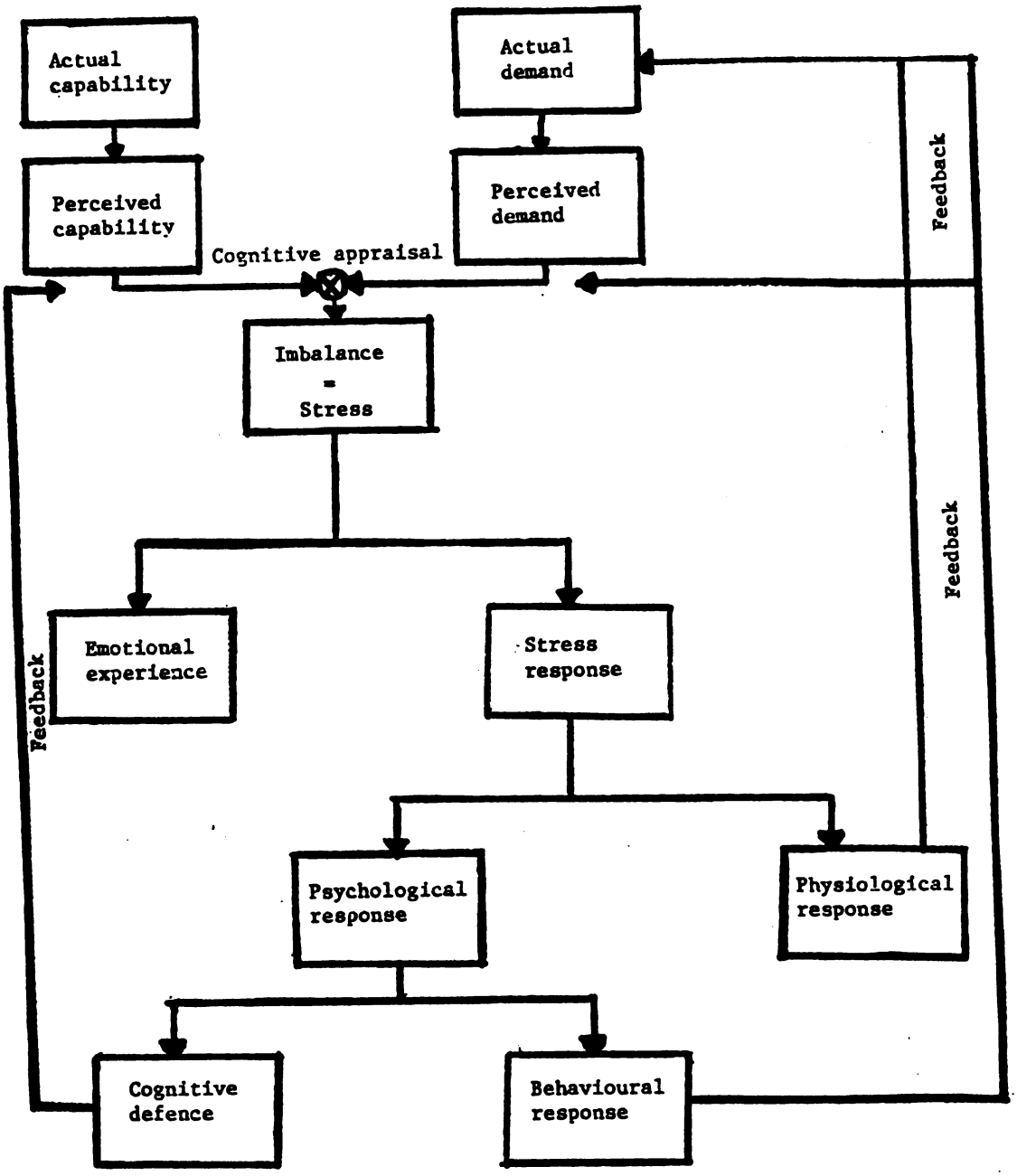


Fig. 1.3.--Transactional Model of Stress

intended to reduce the imbalance between the interns' perceived demands of the teaching situation and their perception of their capability to meet those demands. According to the transactional model, reducing this imbalance would reduce the intern's stress level.

The transactional model also provided the conceptual framework for the biofeedback treatment. Subjects in this treatment learned a relaxation response which should directly reduce their physiological stress level. Mastery of this response should then increase the subject's sense of control in stressful situations. In turn, this increased sense of efficacy would favorably alter the interns' perception of the demands of teaching and their perception of their ability to meet those demands. The end result is, again, a reduction in stress level.

Review of the Literature

The Psychophysiology of Stress and Illness

Research has unequivocally shown that chronic stress reactions can damage an individual's physical and emotional well-being. Stress-related disorders are currently the primary cause of death and disease within western civilization (Pelletier, 1977). Various respiratory and cardiovascular disorders, cancer, and arthritis are all consistently preceded by prolonged stress reactions. Furthermore, stress is seen as a contributing factor in migraine headaches, hypertension (or high blood pressure),

arteriosclerosis, bronchitis, emphysema, and peptic ulcers. Finally, life stresses have also been linked causatively with schizophrenia, depression, and sexual dysfunction (Gunderson & Rahe, 1974).

To some extent everyone operates under stress, since both pleasant and unpleasant experiences can trigger the physiological stress response. It is common knowledge that both positive experiences (e.g., a successful job interview, a well-received speech) and negative experiences (e.g., loss of a job, death of a family member) can have a "draining effect" on a person. Stress is thus not necessarily something to be avoided. Efficacy in one's daily activities is best accomplished by finding an optimum (i.e., non-pathogenic) level of stress. Selye (1974) emphasizes that stress is a necessary and desirable adjunct to living when he states, "Complete freedom from stress is death" (p. 20).

Various environmental, physical, and psychological stressors can deleteriously alter this optimal level of stress.

> The resulting imbalance creates a dysfunction in one or more psychological or physiological systems, which then move toward a state of hyper- occasionally hypo-activation. When this hyperactivity is prolonged, the affected individual becomes more vulnerable to negative life events such as job loss, personal injury, or other traumatic occurrences. Such triggers can precipitate a potentially deleterious level of neurophysiological stress into symptoms signaling the onset of a psychosomatic disorder. (Pelletier, 1977, p. 39-40)

Thus, once an individual perceives a certain stressor as severe, an intricate neurophysiological response ensues. When this response is chronic, the body's resistance level is lowered and stress disorders may be precipitated.

Clearly stress can be transformed into severe illness. Thus, before continuing, it is necessary to give a brief description of the body's physiological response to stressors. A detailed description can be found in the works of Hans Selye (1974, 1976) and Kenneth Pelletier (1977).

The Stress Response

The brain and neuroendocrine system are the principal entities involved in translating an individual's perception of a stressor into a physiological response. The subcortex, or lower portion of the brain houses the control center for the involuntary (autonomic) nervous system. This system is chiefly responsible for the body's activity during a stress response.

The diencephalon lies in the upper region of the subcortex and regulates emotional responses. One portion of the diencephalon is the hypothalamus, which plays a central role in translating nervous system impulses into hormonal responses during stress reactions. The hypothalamus governs all autonomic activity, controls hunger and body temperature, and, therefore, is an important homeostatic mechanism. However, of primary importance is the fact that the hypothalamus dictates the action of the hypophysis

(the pituitary gland) which in turn regulates adrenocortical activity.

The pituitary gland is the master gland, the center for the production of hormones which in turn affect the workings of the entire endocrine system. The secretions of the pituitary, preeminently adrenocorticotrophic hormone (ACTH), serve to facilitate stress-coping behaviors by temporarily increasing heart rate, blood circulation, and other adaptational mechanisms. Most important, in terms of understanding the stress response, is the fact that the ACTH released by the pituitary stimulates the action of the adrenal glands.

The adrenal glands have two distinct parts. The outer portion is the adrenal cortex and the inner part is the adrenal medulla. Hyperactivity of the adrenal glands (especially the adrenal cortex), caused by prolonged stress, frequently accounts for the onset of stress disorders.

During stres reactions, sympathetic nervous stimuli initially cause the adrenal medulla to secrete adrenaline and noradrenaline into the blood. These secretions, in combination with impulses from the hypothalamus, stimulate pituitary action. The ACTH secreted by the pituitary then causes the adrenal cortex to secrete its hormones. These hormones can be classed into two groups, glucocorticoids (e.g., cortisone and cortisol) and mineralocorticoids (e.g., deoxycorticosterone and aldosterone).

Cortical hormones are the key to understanding how stress causes physiological damage. An imbalance in these corticoids upsets the normal homeostatic functions of the body, especially the body's ability to resist disease. Furthermore, the corticoids associated with chronic stress can do irreparable kidney damage, precipitate arthritic conditions, and stimulate development of peptic ulcers in the stomach and intestine (Pelletier, 1977).

In summary, the stressor excites the hypothalamus, which in turn causes the pituitary gland to secrete ACTH into the blood. ACTH in turn causes the adrenal cortex to secrete corticoids. Increased levels of corticoids present over extended periods of time then disrupt homeostatic action and can induce "adaptational" diseases (Selye, 1974).

Stress Theory

Presently, illness is widely conceived as a complex interaction among social/environmental factors, physical and psychological stress, individual personality, and the failure of the individual to effectively manage life pressures (Pelletier, 1977). This conception of health has incurred strong resistance as historically medicine has approached mind and body as separate entities in the etiology of disease. In the next three sections research will be presented which focused attention on the complex

interaction of mind and body processes and influenced the movement toward more holistic conceptions of health and disease.

Early Research

Claude Bernard (1957) fathered the modern integrative approach to medicine by advancing the conception of the fixity of the "milieu interieur." The internal medium of living organisms does not exist simply to transport sustenance to the cells. Rather, "The constancy of the internal environment is the condition for free and independent life" (Bernard, 1878/1974, p. 84). Despite variations in the external environment, the internal environment (the milieu interieur) of an organism must remain steady. Fifty years later Cannon would be influenced by this idea and would extend Bernard's work.

Walter Cannon (1953) made a significant early contribution in advancing the interactive conception of mind, body, and disease. He proposed and developed the concept of homeostasis, the tendency to uniformity or stability in the body states of the organism. He showed that autonomic system reactions and a variety of bodily responses maintain homeostasis. Most important, in terms of its heuristic impact on stress research, was Cannon's main idea, "the fact that humoral substances can help to maintain the homeostatis of the body" (Selye, 1975, p. 99).

Cannon was the first to observe that emotional reactions are reflected in endocrine activity. Using an intestinal strip bioassay method, he observed elevated levels of adrenalin in a cat frightened by a barking dog (Cannon & de la Paz, 1911). This experiment led Cannon to the discovery that the sympathetic-adrenal medullary system was responsive in "fight or flight" reactions. Years later, many workers would confirm that this system was sensitive to psychological influences (Euler & Lunderberg, 1954; Frankenhaeuser, 1971).

Cannon (1953) used the phrase " fight or flight" in discussing adrenal reactions in emergency situations. He observed how the body prepared itself for immediate activity in acute situations by secreting catecholomines (i.e., adrenalines). Later work would show that exposure to frequent, prolonged fight or flight situations can be hazardous to personal health. Specifically, chemical reactions in these fight or flight situations can cause a drop in blood eosinophils and the production of stress ulcers (Selye, 1974). The dynamics of fight or flight physiology (or arousal physiology) have considerable relevance to the population of student teachers under investigation.

In discussing homeostatis and adaption, Brooks (1975) states:

> Adaptive reactions initiated by specific stimuli or environmental conditions have two possible objectives. They occur either to effect an adaptive change which permits a more successful adjustment to requirements or a change which preserves the essential constancies of body states despite changing circumstances. The adaptive responses which can be observed can be divided into at least two categories: the quickly occurring somewhat transient reactions which must be generated to meet the acute emergencies and the slower adjustments or changes of a more chronic nature. (p. 85)

Clearly, Cannon's interest was in the first of these categories. His work was focused primarily on the autonomic system and the actions of the adrenal medulla precipitated by emergency situations.

Influenced greatly by Cannon's work, Hans Selye (1936) chose to investigate the latter of these issues, i.e., changes associated with the chronic defense systems of the body. His research would lead him to the initial formulations of the General Adaptation Syndrome. Eventually, an entire theory of stress would evolve.

Selye's General Adaptation Syndrome

Without question, Hans Selye has been the seminal influence in the field of modern stress theory and research. In describing his impact Engel (1956) writes:

> In his theory of stress and the diseases of adaptation Professor Selye has presented a concept which is almost breathtaking in scope. It has elicited extravagant praise and critical condemnation. It has permeated medical thinking and influenced medical research in every land, probably more rapidly and more intensely than any other theory of disease ever proposed. (p. 106)

Selye's imaginative concepts have continued to inspire research in many fields, especially endocrinology and psychology.

Stress is commonly conceived as simple nervous tension. It is also conventionally thought of as environmental stimuli or external forces that act on an organism. Selye (1974) rejected these notions, preferring to label these external stimuli as "stressors." Selye conceives of stress as a physiological response within an organism.

Selye (1974) also defines stress as the "nonspecific response of the body to any demand made upon it" (p. 14). This definition evolved from Selye's experiments in which he found that a triad of morphological changes--(1) adrenal cortical enlargement, (2) atrophy of the thymus gland and other lymphatic structures, (3) the appearance of ulcers in the stomach and duodenal lining--could be elicited by a variety of stimului. Heat, cold, infection, insulin, X-rays, and mechanical trauma are some of these discriminative stimuli. In addition to the noted morphological changes, Selye (1950) indicated that the pituitary-adrenal cortical system was stimulated. This would prove immensely important in understanding the genesis of stress-related disorders.

Selye came to believe that this response triad was a non-specific physiological response to virtually all noxious stimuli or, simply, "an experimental replica of the 'syndrome of just being sick'" (1974, p. 25). In a 1936

paper titled, "A Syndrome Produced by Diverse Nocuous Agents," this phenomenon was labeled the "general adaptation syndrome." This syndrome (G.A.S.) has also been referred to as the "biological stress syndrome" (Selye, 1974, p. 26).

Selye (1936) found that, with continued exposure to the eliciting stimuli, the G.A.S. divided itself into three sequential stages: "the alarm reaction," "the stage of resistance," and "the stage of exhaustion." Scharrer and Scharrer (1963) have summarized this sequence of responses to the stressor:

> (1) alarm, in which the body goes into a state of shock with falling temperature, irregular blood sugar levels, and depression of nervous functions, (2) defense, during which the organism tends to reverse the changes which occurred during the initial alarm reaction, develops an increasing resistance to the stressor and adapts itself to a new situation, e.g., acclimation to a cold environment; and (3) exhaustion, when the adaptation acquired during the preceding stage is lost for one reason or another. (p. 167)

The important conclusion that Selye (1974) draws from these observations is that the body has a finite amount of "adaptation energy" (p. 26). Like a machine in constant use, the body's homeostatic capacities are subject to eventual breakdown. Chronic exposure to stressors lowers one's resistance, exhaustion eventually ensues, and susceptibility to disease is increased.

Two of Selye's major and most controversial conceptual contributions bear re-emphasis. First, he clearly detailed <u>stress</u> as an orchestrated intra-individual physiological

response, preferring the term stressor for external forces impinging on an individual. Second, Selye identified the stress response as physiologically nonspecific.

> The concept that stress is elicited by a wide variety of different agents or by 'any demand' --is not only the key premise upon which Selye's stress theory rests but is also of basic importance in distinguishing Selye's concept of stress from earlier views. (Mason, 1975b, p. 12)

Modern Stress Research

Selye's belief that the adrenal cortical system was stimulated during the G.A.S. response triad was initially received with considerable skepticism. One reason for this reaction was that during his early investigations the existing measurement techniques were somewhat crude. Selye's early claims were based on "relatively indirect morphological indices of adrenal cortical activity" (Mason, 1975c, p. 23). Eventually, reliable biochemical methods for measuring adrenal-cortical activity were developed. The most important of these was the Nelson-Samuels' (1952) chromotographic method for the measurement of plasma 17-hydroxycorticosteroid (17-OHCS) levels.

Using these precise methods of quantitative analysis, research consistently showed excessive adrenal-cortical (17-OHCS) activity in stressful life situations. Bliss and his co-workers (1956) investigated 17-OHCS levels in medical students taking final exams, relatives of emergency room patients, and the response of subjects in artificial

laboratory settings designed to elicit emotional reactions. They found that these arousing situations yielded consistent increases in plasma and urinary 17-OHCS levels.

Many other research efforts yielded identical results. Marked increases in corticosteroid activity were discovered in long-range bomber crews (Marchbanks, Hale, & Ellis, 1963), oarsmen prior to competition (Renold, Quigley, Kennard, & Thorn, 1951), students taking final examinations (Jensen & Ek, 1962; Melick, 1960; Venning, Dyrenfurth, & Beck, 1957), patients on the first day of hospital admission (Mason, Sachar, Fishman, Hamburg, & Handlon, 1965), combat troops in Korea (Elmadjian, 1955), and subjects placed in various novel situations (Mason & Brady, 1964; Davis, Morill, Fawcett, Upton, Bondy, & Spiro, 1962). In summary, a large literature has clearly established that the pituitary-adrenal cortical system responds with striking sensitivity to an extensive array of psychosocial influences.

In addition to elevated corticoid levels, many of these researchers also noted a marked degree of eosinopenia in their subjects. Eosinopenia is a deficiency of eosinophil cells in the blood. Although the specific mechanisms are not clear, current researchers believe that this stress-induced condition may decrease the body's ability to resist disease (Selye, 1976b; Pelletier, 1977).

Some data continued to support the relative non-specific reactivity of the pituitary-adrenal cortical system. Researchers reported heightened corticoid activity in patients undergoing various surgical traumas (Newsome & Rose, 1971; Allen, Kendall, McGilvra, Lamorena, & Castro, 1974), subjects experiencing acute cold exposure (Wilson, Hedner, Laurell, Nosslin, Rerup, & Rosengren, 1970; Wilkerson, Raven, Bolduan, & Horvath, 1974), victims of severe burns (Wise, Margraf, & Ballinger, 1972; Bane, McCaa, McCaa, Read, Turney, & Turner, 1974), and finally, subjects exposed to various sound frequencies (Arguelles, Ibeas, Ottone, & Chekherdemian, 1962). Many researchers felt these investigations offered conclusive evidence supporting the nonspecific eliciting of Selye's G.A.S. Nevertheless, as research continued it became increasingly clear that emotional stimuli were among the most powerful elicitors of pituitary-adrenal cortical activity (Mason, 1975a). Mason and other investigators emphasized the difficulty in sorting out the confounding influence of emotional arousal in the above experiments.

Symington, Currie, Curran, and Davidson (1955) reported that patients who had been conscious during the period of a fatal condition displayed elevated adrenal-cortical levels. At variance was their finding that patients who remained unconscious during the same period exhibited normal adrenal-cortical levels. Gray, Ramsey, Vill rreal, and Krakaner (1956) also reported that

anesthesia alone did not heighten adrenal-cortical activity. Data from these and similar experiments created considerable speculation regarding the extent to which emotional arousal dictated the activity of the "non-specific" response triad.

John Mason and his colleagues have re-evaluated Selye's concepts of absolute nonspecificity. Two of the "nonspecific" stimuli they examined were fasting and exposure to heat (Mason, 1971). Mason discovered that monkeys fasting under controlled conditions (i.e., isolated from feeding monkeys and giving non-nutritive pellets at feeding time) showed no 17-OHCS elevations. Those who were not isolated and whose feeding was simply ceased showed marked 17-OHCS increases. Also, monkeys exposed to gradual (i.e., 1 degree Fahrenheit per hour) temperature increase showed no 17-OHCS elevation, whereas those exposed to sudden temperature increase (i.e., 70-85 degrees Fahrenheit) exhibited 17-OHCS elevations. In these and two other experiments (cold exposure and hemorrhage), Mason has demonstrated that by controlling for psychologically arousing variables he could alter the nonspecificity of the adrenal-cortical response. Mason suggests:

> The 'primary mediator' underlying the pituitary-adrenal cortical response to diverse 'stressors' of earlier stress research may simply be the psychological apparatus involved in emotional or arousal reactions to threatening or unpleasant factors in the life situation as a whole. (p. 329)

Mason has thus shown that endocrine responses can be affected by cognitive processes. Lazarus (1975) has gone so far as to state that the primary mediator of Selye's Biological Stress Syndrome may be cognitive, i.e., "Cognitive appraisal of harm via cerebrally controlled processes is necessary to initiate the body's defensive adrenal cortical response" (p. 229). Currently, there is considerable agreement that cognitive processes mediate an individual's adaptive responses to environmental conditions and dictate, to some degree, one's emotional and somatic states (see Meichenbaum, 1976; Meichenbaum, Turk, & Burnstein, 1975).

Selye, too, seems in agreement with this cognitive position when he states that some stressors are harmful (frustration over time) while others are pleasant and even necessary (enjoyment of one's job). In fact, Selye recently stated, "It is especially true that, in our life events, the stressor effects depend not so much upon what we do or what happens to us, but on the way we take it" (1978, p. 8).

Stress and Disease (Specific)

As noted previously, stress is currently viewed as a primary causal agent in the development of various diseases. However, stress is indeed a curious and subtle phenomenon. Its effects often go unnoticed, not unlike those of cigarette smoking or essential hypertension.

Unfortunately, those affected may become aware only after the onset of ill health. Nevertheless, research indicates that stressful reactions experienced over time contribute to the development of various cardiovascular disorders, gastrointestinal malfunctions, cancer, dermatological problems, sexual dysfunctions, and a multitude of other mental and physical problems.

Gastrointestinal Stress Disorders

Gastric and duodenal ulcers are so clearly understood to be stress-related that they are often referred to simply as "stress ulcers." Stress is known to cause an increase in the gastric secretion (hydrochloric acid) in the stomach, which subsequently erodes the stomach lining (Mahl & Brody, 1954). In a large-subject study of air traffic controllers (an acknowledged high-stress occupation), 32.5 percent exhibited gastric or duodenal ulcers (Grayson, 1972).

Ulcerative colitis is an inflammatory disease of the colon marked by bleeding intestinal ulcerations. Emotional tension has long been regarded as significant in the etiology of the disorder. Data from one study suggest that colitis patients could not express anger or hostility directly (Engel, 1955). In adults, onset of the disorder is generally associated with stressful life situations in the family or job. In children, frustrated aggressive emotions are prominent (Selye, 1976b).

Cardiovascular Stress Disorders

Hypertension affects 15 percent of United States adults and is listed as the primary cause of death in 60,000 cases per year (Pelletier, 1977). It is a state of abnormally high blood pressure with electrocardiographic evidence of cardio-arterial disturbance affecting primarily the left ventricle. Research evidence suggests a stress-induced overproduction of adrenal corticoids may cause hypertensive disease (Rosecrans, Watzman, & Buckley, 1966). Patients with essential hypertension exhibit increased plasma 17-OHCS levels (Demura, 1962).

Arteriosclerosis is the number one killer in the United States today, costing 600,000 lives per year (Pelletier, 1977). Affected arteries gradually narrow and harden as fat deposits accumulate within arterial walls. In many cases, hypertension leads to arteriosclerosis which then results in premature cardiovascular death.

The pioneering work of Friedman and Rosenman (1959) has clearly illustrated the role of psychogenic stressors in the etiology of heart disease. They have delineated two personality types (A and B), one type being six times more likely to succumb to coronary artery disease than the other type. They emphasize that the coronary-prone Type A individual is exposed to greater and more frequent stresses than the Type B individual (Friedman & Rosenman, 1974).

> The coronary prone-behavior pattern, called Type A, is characterized primarily by excessive drive, aggressiveness, ambition, involvement in competitive activities, frequent vocational deadlines, pressure for vocational productivity, an enhanced sense of time urgency and restless motor mannerisms and staccato style of verbal response. The converse, low coronary-risk behavior pattern, called Type B, is characterized by the relative absence of this interplay of psychological traits and situational pressures. The Type B subject is more relaxed and easy going, seldom becomes impatient and takes more time to enjoy avocational pursuits. He is not easily irritated and works steadily, but without a feeling of being driven by a lack of time. He is not preoccupied with social achievement, and is less competitive in his occupational and avocational pursuits. He moves and speaks in a slower and more smoothly modulated style. (Jenkins, Rosenman, & Friedman, 1967, p. 371)

In summary, numerous variables play a contributing role in the development of cardiovascular disease. These factors include age, sex, diet, heredity, smoking, and various blood factors. Nevertheless, psychogenic stressors rank among the strongest causative agents in the development of high blood pressure, arteriosclerosis, and congestive heart failure or cardiac infarction (Selye, 1976b). In fact, psychogenic stress may play an even more important causative role than is currently ascribed to it. Friedman and Rosenman (1974) have reflected on the measurement problems involved.

> Emotional stress of any variety, because of its resistance to precise measurement, has been shamefully neglected by quantitatively oriented cardiac researchers. (pp. 168-169)

Stress and Cancer

Cancer accounts for approximately 175,000 deaths per year, and that figure rises annually. It is clearly established that prolonged localized stress, such as that of pipe smoking, can lead to cancer development at the place of irritation. More speculative research suggests that psychogenic stress is involved in the onset of cancerous growths. Solomon (1969) indicates that stress inhibits the body's immunological capabilities, specifically lowering the production of T-lymphocytes and eosinophil cells. Amkraut, Solomon, Kasper, and Purdue (1973) add:

> We have shown such suppressive effect on anti-body formation and have also reported stress-induced increases in tumor size, which are probably a consequence of immunosuppression. (p. 667)

Since cancer is a failure of the body to destroy mutant cells, the decreased production of the above antibodies may increase one's vulnerability to cancer.

Stress and Neuropsychiatric Disorders

As mentioned previously, cognitive processes are thought to be the primary mediators of stress-induced derangements of the G.A.S. Psychosomatic illness is in large part dictated by our perceptions of, and subsequent ruminations regarding, stressful life occurrences. Psychogenic factors in disease have already been given considerable attention. However, they also play a role in

the onset of upper respiratory disorders, migraine headaches, arthritis, and other inflammatory diseases.

Over 10 million persons in the United States are affected by either bronchitis, emphysema, or asthma. The involuntary muscle spasms (which decrease air conductance) associated with most respiratory ailments have always been linked to emotional stress mediated by the autonomic nervous system (Mathe & Knapp, 1971). Asthmatics often suffer attacks immediately after stressful events (Miklich, Rewey, Weiss, & Kolton, 1973). These attacks cause carbon dioxide to be trapped in the lungs, resulting in an asthmatic's inability to breathe. Glucocorticoid administrations have been used effectively to treat bronchial asthma (Jack, 1974), and this provides further evidence that these disorders are abnormal G.A.S. (stress) responses.

Migraine, or vascular headaches, often involve a narrowing of the cartoid artery, which delivers blood from the heart to the head. Certain personality configurations, age, diet, alcohol and various other variables can play a role in the development of this condition. However, research implicates emotional stress as a primary precipitant of migraine and tension headaches (Pelletier, 1977).

Fifty million persons in the United States are affected by arthritis (Pelletier, 1977). In fact, it is the single most frequent cause of disability. While

heredity may predispose an individual to this disorder, psychologic stress often precipitates the condition via a malfunction in immunological processes (Hendrie, Paraskevas, Baragar, & Adamson, 1971). In effect, the body overreacts to infection; antibodies attack healthy and infectious cells alike, and painful inflammation and even tissue damage can result.

This concludes a review of the relationship between stress and the major health problems of our society. However, stress also plays a role in the development of schizophrenia (Serban, 1975), depression (Gallemore & Wilson, 1971), alcoholism (Miller, Hersen, Eisler, & Hilsman, 1974), diabetes (Koch & Molnar, 1974), oral and dental diseases (Lefer, 1971), ocular diseases (Cohen & Hajioff, 1972), and various dermatological conditions (Kraus, 1970). Finally, and most important, all of these stress-induced conditions are, in varying degrees, amenable to preventive measures. One can favorably alter the probabilities of incurring these stress disorders through mastery and employment of the treatments to be investigated within this research project.

Stress in Preservice Teachers

Student teachers experience stress from a variety of sources. They are thrust into a new and demanding social-interpersonal situation characterized by as yet unstable relationships and expectancies. They are also increasingly

aware of the stressors they will experience as working teachers and of the disturbing rate of teachers experiencing "burnout." "Burnout" refers to "a syndrome of emotional exhaustion and cynicism that occurs frequently among individuals who do 'people work' of some kind" (Maslach, 1979, p. 2).

Although the stimuli are essentially identical, research (Fuller, 1969; Fuller, Parsons, & Watkins, 1974) suggests that the stress experienced by student teachers is markedly different from the stress experienced by practicing teachers. These findings induced researchers to examine the ways that preservice trainees construct their cognitive appraisals of student teaching. Summarizing the results of 15 studies with student teachers, Coates and Thoresen (1976) reported that cognitive stressors centered around:

> (a) their ability to maintain discipline in the classroom, (b) students' liking of them, (c) their knowledge of subject matter, (d) what to do in case they make mistakes or run out of material, and (3) how to relate personally to other faculty members, the school system and parents. (p. 164)

Continuous evaluations create considerable performance demands for the student. Sorenson and Halpert (1968) reported that relationships with cooperating teachers and university field instructors were a major source of stress. Yee (1968) relates that relationships within this triad (student intern-teacher-university field instructor) were

initially characterized by a high degree of collaboration, but at the conclusion of student teaching all three individuals were reporting more numerous negative feelings about one another.

One approach to the understanding of preservice teacher stress is to examine it from the perspective of arousal theory. This theory is virtually identical to the "fight or flight" mechanisms which Cannon (1914) formulated more than 60 years ago. Arousal theory is based upon the observation that:

> When obviously threatening situations occur (you meet a grizzly bear on a narrow mountain path) the body responds by mobilizing its resources. The muscles tense, ready to flee or freeze; the viscera respond in such a way as to ensure emergency functioning, i.e., the heart rate and blood pressure increase to give emergency supplies of oxygen to tissues, the gut stops, the blood pools where it is needed, and so the skin blanches, secretions dry up, etc. All of these physiological responses are dramatic and obvious. (Brown, 1978, pp. 33-34)

While the threatening stimuli posed by student teaching are less obvious, the cognitive appraisal of threat via cerebral mechanisms elicits many of the same body changes. The student who is generally apprehensive about the teaching task will exhibit higher levels of muscle tension, and heart rate and blood pressure may increase (Brown, 1978). These changes can be recorded biomedically, although persons are generally unaware of this physiological "bracing."

One distressing feature of the teaching situation is its inescapability. Neither fighting nor fleeing are

generally exercisable options to reduce stress. If a teacher were to flee the classroom, the result would likely be more stressing than the precipitating event. Likewise, fighting is also generally unavailable to teachers as a stress-reducing behavior. Therefore, if teaching elicits a G.A.S.-like stress response from a teacher, it could conceivably exist for extended periods. Prolonged, unabated stress responses can lead to the diseases of adaptation discussed in earlier sections

Fuller and Manning (1973) have stated that the rigorous evaluations of student teaching can be particularly stressful when student teachers are not also taught appropriate tension-reducing techniques. Programs like the Fulton Project (Gilroy & Moody, 1976) have been designed specifically to help students successfully manage the stress associated with student teaching. Nevertheless, programs reporting true experimental (Campbell & Stanley, 1963) success at reducing student teacher stress are virtually non-existent.

Researchers report conflicting results from attempts to reduce teacher stress using group counseling or relaxation-based treatments. Giblin (1972) reports no differences (Anxiety Differential) between desensitization and control groups. Using a group counseling technique, Eder (1971) was not effective in reducing the stress levels (State-Trait Anxiety Inventory) of 44 student teachers. Dolar (1972) tested the effects of desensitization on

self-reports of situational anxiety. Seventy-two female student teachers were randomly assigned to one of five groups: behavioral skill training and desensitization, behavioral skill training and relaxation training, behavioral skill training and no-contact control, desensitization and non-behavioral skills, and a no-contact control. A trend analysis of the intratherapy ratings revealed the combined desensitization and behavioral skills training as significantly more effective than the other treatment combinations in reducing self-reported anxiety. Results from studies with practicing teachers also report conflicting results (Susskind, Franks, & Lonoff, 1969; Treese, 1972; Hendricks, Thoresen, & Coates, 1975).

The treatments employed within this research project are part of a promising new technology of stress management. EMG biofeedback has been strongly effective in reducing the arousal responses of persons in a variety of environmental settings and interpersonal situations. Stress inoculation training (Meichenbaum, 1975) and cognitive coping procedures (Novaco, 1976) have likewise been effective in managing arousal and reducing maladaptive autonomic activity. Finally, this research involved application of the knowledge that treatment effects can be enhanced when subjects are taught to apply their learned relaxation skills in actual stress-inducing situations (Goldfried, 1971).

The published literature on teacher stress contains primarily anecdotal information and individual case studies. As noted, experimental studies examining the effectiveness of various treatments for reducing stress are scarce. Of those studies that have been done, many investigators report no statistically significant differences between treatment and control subjects in ability to reduce subject stress levels. Furthermore, in most of these experimental studies only paper-and-pencil instruments are used to evaluate treatment outcomes. Experimental studies using both physiological and psychological measures to evaluate the effectiveness of stress-reducing treatments are rare. The use of multiple outcomes, especially physiological measures, is important in stress research since hyperactivity of certain autonomic processes contributes to the onset of a variety of "stress-related" disorders.

In this study a true experimental design (with random assignment) was employed to examine the efficacy of two treatments for reducing preservice teacher stress levels. Subject change was quantified using two physiological measures (systolic and diastolic blood pressure) and two psychological measures (Taylor Manifest Anxiety Scale and Teaching Anxiety Scale).

CHAPTER II

PROCEDURES

Population

Research subjects were drawn from a population of first-term seniors at Michigan State University. This population consisted partially of students who had declared themselves education majors. Elementary education majors are a subset of this population and were selected for investigation in this project. This population was delimited by selecting only students engaged in their senior teaching internship. These individuals were primarily 20 and 21 years old, Caucasian, and female.

Sample

The sample for this research project consisted of all 24 senior interns (i.e., those engaged in third-year internships) in the Toward Excellence in Elementary Education (EEE) program at Michigan State University. This group was comprised of 23 females and 1 male. In the EEE program (see Appendix F) students are placed in classrooms in the beginning of their sophomore year. Thus, although this was not the first teaching experienced by these students, it was to date their most demanding internship task. During the senior internship, EEE students are expected to share

instructional responsibilities with the cooperating teacher. These responsibilities include instructional design and implementation in the content areas of reading, mathematics, social studies, science, physical education, and language arts. This program's developmental approach of graded exposure of students to the eventual in-vivo teaching condition helps inhibit the artificially inflated stress levels of subjects exposed to novel situations (Mason, 1968; Mason & Brady, 1964).

The focus of this study involved 24 senior undergraduate Michigan State University students currently engaged in student teaching experience. Although the sample was rather specific and not randomly selected, the results can be generalized to a somewhat larger population. The Cornfield-Tukey bridge argument (Cornfield & Tukey, 1956) offers a rule for extending the sphere of individuals to which the findings can be generalized. By carefully defining the characteristics of the population studied, the argument can be made that the research findings can then be extended to other groups or individuals (with similar characteristics) at other points in time. Thus, findings from this study may assist students (including psychology interns, medical and veterinary interns, social work interns, etc.) in stress-inducing educational or internship settings. The findings may be further generalized, cautiously, to practicing teachers, especially those teachers experiencing "teacher stress."

Instrumentation

This study involved the use of five measures, two physiological indices and three standardized psychological instruments, to assess research outcomes. The Life Experiences Survey (Sarason, Johnson, & Siegel, 1978) was used to establish stress level (high, medium, or low) as the blocking variable. Two additional standardized instruments--the Teaching Anxiety Scale (Parsons, 1973) and the Taylor Manifest Anxiety Scale (Taylor, 1953)--, and two physiological measures--systolic blood pressure and diastolic blood pressure--were used on a pre- and posttest basis to evaluate treatment outcomes. These standardized instruments are attached, respectively, as Appendices A, B, and C.

Life Experiences Survey (LES)

This instrument alleviates certain inadequacies of previous life stress measures, e.g., the Schedule of Recent Experiences (SRE; Holmes & Rahe, 1967). Unlike the SRE, the format of the LES allows for separate appraisal of positive and negative life experiences and also individualized ratings of the impact of these events.

The LES yielded three scores: a positive change score, a negative change score, and a total change score. Blocks were established based on a subject's negative change score. Research by Vinokur and Selzer (1975) and Mueller, Edwards, and Yarvis (1977) indicates that measures of negative life change are more predictive of

stress-related variables (e.g., depression, suicidal proclivity, anxiety, aggression, and paranoia) than total change instruments like the SRE.

The standardization data for the LES were generated by 345 undergraduates at the University of Washington, a population similar to that investigated in this research. Although overall test-retest reliability is moderate, this shortcoming is not crucial, especially within the context of this project. First, this study used the LES to block subjects, not to generate pre- and posttest differences. Second, an instrument designed to actually reflect the impact of life changes is bound to evidence the experiences of the five- to six-week test-retest period. It would seem wrong to suggest that all variability reflects error. Validity has been demonstrated by showing significant correlations with the Psychological Screening Inventory (Lanyon, 1973), the Beck Depression Scale (Beck, 1967), and the Internal-External Locus of Control Scale (Rotter, 1966).

Teaching Anxiety Scale (TCHAS)

The Teaching Anxiety Scale (Parsons, 1973) measures anxiety specific to the job of teaching. The TCHAS was originally standardized using undergraduate student teachers. The alpha coefficients of internal consistency for the TCHAS range from .87 to .94. Test-retest reliability shows correlations of .60 to .95. These correlations suggested that the TCHAS had good reliability and could be used to evaluate pretest and posttest

differences within the treatment groups. Lastly, the TCHAS has been shown to correlate significantly with other standard measures of anxiety, thus providing evidence of its validity.

Parsons (1973) states that the high coefficients of internal consistency and the sensitivity of the TCHAS to intervening teacher training suggest that the instrument is measuring the unitary variable of teaching anxiety. She adds that 76 to 86 percent of what the TCHAS measures is independent of what is measured by the Taylor Manifest Anxiety Scale (Taylor, 1953). Thus, the TCHAS provided this research with a means of testing the comparative effectiveness of biofeedback and stress inoculation at reducing the acute stress-related anxiety produced by the student teaching experience.

Taylor Manifest Anxiety Scale (TMAS)

The Taylor Manifest Anxiety Scale (Taylor, 1953) consists of items drawn from the Minnesota Multiphasic Personality Inventory (MMPI) and judged by clinicians to be revealing of manifest anxiety. The subjects are asked to indicate whether each of the 50 items is true or false about them. A person's score is based on the total number of items marked so as to indicate the presence of anxiety.

The TMAS was standardized on 1,971 students in introductory psychology at the State University of Iowa between 1948 and 1951. The difference between the means for males and females is reported as not significant. The scale was

later administered to 683 airmen at Lackland Air Force Base and 201 students at Northwestern University night school. Results from these studies did not differ from those of the original standardization sample.

Test-retest reliability coefficients range from .89 (three-week interval) to .82 (five-week interval), indicating the instrument possesses high reliability. Evidence for the validity of the test is offered by showing that scores on the TMAS correlate significantly with the anxiety items on the MMPI. Since its development in 1953, numerous studies have demonstrated the usefulness of the TMAS as a measure of anxiety.

Gaudry and Spielberger (1971) state that the TMAS is a measure of general "trait" or predisposition to experience anxiety. In the scale questions, the TMAS uses words such as "frequently," "often," "usually," and "hardly ever." Subjects do not report their emotional state as it exists at a single instance in time. Thus, the TMAS provided this research with a means of testing the comparative effectiveness of biofeedback and stress inoculation at reducing chronic stress-related anxiety.

Blood Pressure

Blood pressure is the propelling force within the blood vessels and is expressed as a fraction, with systolic pressure as the numerator and diastolic pressure as the denominator. Both measures are calibrated in millimeters of mercury.

> Systolic Pressure is the larger number and corresponds to the period of heart contraction during which the blood is forced out of the heart. Diastolic pressure is the smaller number and corresponds to the dilation period of the heart, during which the ventricles are filling with blood prior to the next systolic contraction. (Pelletier, 1977, p. 161)

Benson (1976, 1978) has indicated that blood pressure is a good measure to determine whether or not the treatments used in this research are related to a physiologic change. Since blood pressure, especially systolic pressure, is a somewhat labile measure (Brown, 1978), an average of four readings was used to establish a pretest index and an additional four for the posttest index. A Baumanometer stand-by mercury sphygmomanometer with cuff and stethescope were used to measure blood pressure.

Treatments

This project was an experimental study involving measurement of the degree to which two stress management procedures were effective in reducing the stress levels (systolic and diastolic blood pressure, Teaching Anxiety Scale, Taylor Manifest Anxiety Scale) of student teachers. Within the study there were three groups: two treatment groups and a control group. Group one received treatment via biofeedback training supplemented by autosuggestion phrases; group two underwent treatment consisting of stress inoculation training. The third group served as a control for the experiment. This group had pre- and posttest measures taken but received no treatment during the intervening period.

Biofeedback

Biofeedback is a process in which an individual learns to regulate physiological responses which are not normally under voluntary control. It can also be used to re-educate voluntary physiological responses which dysfunction as a result of trauma. Blanchard and Epstein (1978) have stated that biofeedback is comprised essentially of three operations: (1) detection and amplification; (2) conversion, and (3) feeding back to the subject. The electronic equipment used is described in Appendices G and H.

The detection and amplification operation focuses on a particular biological response. This study measured the level of electrical activity in the frontalis muscle. This process is referred to as electromyographic (EMG) biofeedback. The goal of EMG biofeedback is to heighten proprioceptive awareness of the mechanisms of muscle flexure and to develop voluntary control over "involuntary" muscle activity. Many clinicians have used this attainment of musculoskeletal control in the treatment of stress-related disorders.

The conversion operation consists of transforming the detected and amplified biological response into a feedback mode that is readily understood by the individual. This study converted a subject's physiological responses into easily processed auditory signals and visual displays. The third operation, feeding back to the subject, refers to the immediate communication to the subject of his/her current

physiological state. This operation enables a person to gain control over various biological processes and create in himself/herself a non-stressed physiological state.

Green, Walter, Green, and Murphy (1969) have emphasized the importance of the process of passive volition in achieving a relaxed state using biofeedback. In order to facilitate these passive processes, subjects slowly repeated autosuggestion phrases while receiving EMG biofeedback. Phrases such as "I feel relaxed and warm," "My hand feels heavy," "My arm feels warm and relaxed," and "I feel calm and relaxed," aided in generalizing voluntary muscle training (EMG) to an autonomic response (general relaxation). A complete list (from Brown, 1978) of the autosuggestion phrases used in this investigation is attached as Appendix D.

EMG biofeedback has been used successfully in the treatment of many of the stress disorders identified earlier. Budzynski, Stoyva, and Adler (1970) report favorable outcomes using frontalis EMG feedback in the treatment of tension headaches. Raskin, Johnson, and Rodestredt (1973) found frontalis EMG feedback more effective than psychotherapy in reducing anxiety symptoms involving muscle tension. Additional research indicates EMG biofeedback has been effective in treating hypertension (Shoemaker & Tasto, 1975), peptic ulcers (Beaty, 1976), stuttering (Lanyon, Barrington, & Newman, 1976), and chronic anxiety (Canter, Kondo, & Knotts, 1975). Finally, because EMG

biofeedback induces a general state of relaxation and increased somatic control, it can be used preventively to decrease the likelihood of the onset of the aforementioned conditions.

Stress Inoculation Training

As detailed in the review of the literature, current thinking emphasizes the forceful influence of cognitive variables in the experience and management of stress reactions. McGrath (1970) made this point cogently when, introducing a conference on stress, he stated:

> The subject's emotional experience and to some extent physiological and performance measures are in part a function of the perceptions, expectations, or cognitive appraisals which the individual makes of the (stressing) situation. (p. 76)

Stress inoculation training (Meichenbaum, 1975) is a self-instructional form of behavior therapy. As implied by the medical term "inoculation," a subject's resistance to stress is increased by exposure to graduated stimuli strong enough to excite defenses, yet not so strong as to overcome them. Essentially, subjects are taught a set of cognitively based skills which enables them to manage stressful situations.

> Operationally, the stress-inoculation training involves three phases. The first phase, educational in nature, is designed to provide the subject with an explanatory scheme for understanding the nature of his response to stressful events. From a conceptual framework a number of behavioral and cognitive coping skills are offered for the subject to rehearse during the

> second phase of training. During the third phase the subject is given an opportunity to practice his coping skills during exposure to a variety of stressors. (Meichenbaum, 1976, p. 3)

After the subject had a conception of how self-generated cognitions mediate a stress reaction, the first phase of treatment continued. The subject then learned to view the stress reaction not as a simple "fight or flight" response, but as a complex response having three distinct phases: preparing for a stressor, confronting or handling a stressor, and reinforcing oneself for having coped. Each subject in this treatment generated an individually tailored list of cognitions appropriate to each phase of dealing with stressors. During phase two (Rehearsal phase) of treatment, subjects rehearsed and mastered these stress-reducing cognitions. In phase three (Application training) subjects implemented and practiced these coping skills during stressful teaching situations.

Basically, then, stress inoculation involved "discussing the nature of emotions and stress reactions, rehearsing coping skills, and testing these skills under actual stress conditions" (Meichenbaum, 1975, p. 5). This technique has been used effectively to manage anger reactions in policemen (Novaco, 1977), reduce interpersonal anxiety (Meichenbaum, Gilmore, & Fedoravicius, 1971), increase tolerance to pain (Turk, 1975), and alleviate phobic reactions (Meichenbaum & Cameron, 1973).

Control Group

Eight of the senior interns were randomly assigned to the no-treatment control condition. For the purpose of comparison, these individuals were measured at pre- and posttest in a manner identical to the biofeedback and stress inoculation conditions. However, these individuals received no training during the course of the investigation. After the research was completed, stress management training was made available to these control subjects.

Research Design

Random Assignment

The research literature suggests that one's perception of control over environmental events (Johnson & Sarason, in press), sensation-seeking status (Smith, Johnson, & Sarason, 1978), and degree of psychosocial assets (Nuckolls, Cassel, & Kaplan, 1972) may all moderate an individual's response to stressful life events. Initial differences in these moderator variables could confound the interpretability of the dependent variables. Therefore, in this study the technique of random assignment was employed in order to control for any initial differences.

A systematic random assignment of subjects to treatments was applied to insure the equality of sample size across the independent variables. Random assignment allows the investigator to assume that there are no systematic initial differences between treatment groups. Furthermore,

random assignment strengthens the interpretability of the research comparisons by fostering the development of internally valid experiment

Design

Campbell and Stanley (1963) have identified "three true experimental designs" (p. 13). These designs control for all factors which jeopardize the internal validity of an experiment. They generate an unbiased estimate of treatment main effects and, therefore, allow an investigator the most powerful position possible from which to argue that treatments alone (in this case biofeedback or stress inoculation) produced the effects (reduction in stress levels) observed within the research. One of these designs, the pretest/posttest control group design, provided the basic evaluative structure for this research project.

Using two independent variables, each having three levels, a 3 x 3 factorial design was generated. One independent variable, treatment, consisted of biofeedback, stress inoculation, and a control group. The second independent variable was stress level--either high, medium, or low--as dictated by the LES data.

More specifically, a randomized levels design (Cox, 1958) was utilized to compare the effects of treatments on subjects leveled according to their pretest stress scores (LES). The randomized levels design increases the overall experimental precision of the research and incorporates into

the design itself a test for the external validity (i.e., the generalizability) of each treatment. Moreover, the leveling of subjects according to their pretest stress level served to homogenize the sample, reducing the magnitude of the population variance within treatment-by-level combinations. The magnitude of this variance is the expected value of the denominator of the F test. Thus, lowering the value of this variance increases the statistical power of the analysis of variance (Porter & Chibucos, 1973; Cox, 1957).

Subjects were divided equally into one of three levels (high, medium, low) according to the ranking of the LES scores. Subjects were then randomly assigned from each level to one of three groups. Treatments (either biofeedback, stress inoculation, or no-treatment control) were then randomly assigned to these three groups.

The pictorial representation of the design, replicated for each of the four dependent variables, is shown in Figure 2.1.

Data Analysis

Data were analyzed using a multivariate analysis of variance (MANOVA). This procedure combined each subject's scores on the dependent measures to form a linear combination. The linear combination was then used as the dependent measure in the analysis procedure. This analysis then provided tests for differences in the means--among

Stress Level	Biofeedback	Stress Inoculation	Control
High	n = 2	n = 3	n = 3
Medium	n = 3	n = 2	n = 3
Low	n = 3	n = 3	n = 2

Figure 2.1.--Randomized Level Design Used to Test Hypotheses

treatments, levels of stress, and treatment-by-level interactions--on the linear combination of dependent measures. The alpha level was set at .05 for all analyses.

The two physiological dependent measures (systolic and diastolic blood pressure) were combined into a physiological index (P). The two psychological dependent measures (Taylor-Manifest Anxiety Scale and Teaching Anxiety Scale) were combined into a psychological index (PS). The overall MANOVA, then, was based upon a linear combination of physiological and psychological indices. This MANOVA also produced univariate analyses of variance (ANOVAs) for each dependent index (P and PS).

Harris (1975) indicates that the appropriate follow-up to a statistically significant MANOVA is to perform univariate ANOVAs on each dependent measure. Since P and PS were each combinations of two dependent measures, additional univariate ANOVAs were used to analyze differences on all component dependent measures. Since neither MANOVAs nor ANOVAs determine directionality of differences with

more than two treatments, post hoc t-tests were used where significant overall differences existed.

Hypotheses

The null hypotheses evaluated for each dependent measure in this study were as follows:

1. Linear Combination of Physiological and Psychological Indices

   Hypothesis 1: There is no difference among the means of the three treatment groups as measured by a linear combination of the physiological and psychological indices.

   Hypothesis 2: There is no difference among the means of the three stress levels as measured by a linear combination of the physiological and psychological indices.

   Hypothesis 3: There is no difference in the means of the interactions among treatment groups and stress levels as measured by a linear combination of the physiological and psychological indices.

2. Linear Combination of the Physiological Measures (P)

   Hypothesis 4: There is no difference among the means of the three treatment groups as measured by a linear combination of the physiological measures.

   Hypothesis 5: There is no difference among the means of the three stress levels as measured by a linear combination of the physiological measures.

   Hypothesis 6: There is no difference in the means of the interactions among treatment groups and stress levels as measured by a linear combination of the physiological measures.

3. Linear Combination of Psychological Measures (PS)

   Hypothesis 7: There is no difference among the means of the three treatment groups as measured by a linear combination of the psychological measures.

Hypothesis 8: There is no difference among the means of the three stress levels as measured by a linear combination of the psychological measures.

Hypothesis 9: There is no difference in the means of the interactions among treatment groups and stress levels as measured by a linear combination of the psychological measures.

Project Time Line

On September 4, 1979, the 24 subjects met with the research team to have the study explained to them. At that time, consent forms were signed and pretesting commenced. Subjects were administered the LES, the TCHAS, and the TMAS. The researchers also began taking blood pressure on that date. On September 5th and 6th, blood pressure readings were taken on all subjects approximately two times per day. On the basis of scores on the LES, subjects were blocked according to stress levels. These subjects were then randomly assigned to one of three experimental groups.

For a period of five weeks, subjects assigned to either biofeedback or stress inoculation underwent that specific stress reduction treatment. Subjects received treatment two times per week and at least one of these sessions was conducted within the school setting. Better than 90 percent of the treatment sessions were conducted within actual school settings. During this five-week treatment period, control subjects received no treatment and proceeded with their normal teaching assignments.

Treatment was administered by two doctoral students in counseling who had completed all work for their degree except for the dissertation. Both these researchers had extensive clinical experience. During the research project these clinicians had their work supervised by either Dr. Bob B. Winborn or Dr. Dozier Thornton. Both supervisors are consulting psychologists in the State of Michigan.

Posttesting began during the last week of treatment and was conducted in a manner identical to the gathering of the pretest measures.

After the paper-and-pencil pretest instruments were administered, a strike by the Lansing school teachers occurred. This delayed the continuance of the research project for five weeks. Furthermore, it is believed that random assignment controlled for the confounding that this event may have presented.

CHAPTER III

RESULTS

Chapter III contains the statistical analyses of the results of the study. These results are presented under the four main areas addressed by the analysis procedures. The first area includes a formal testing of the nine hypotheses which were investigated in this study. The second area includes data analysis of all the component dependent measures employed in the study. Exploration of the directionality of significant differences via further data analysis constitutes a third section. The fourth area includes explorational studies of the data undertaken to determine if any systematic trends were present. In a closing section the results presented in Chapter III are summarized.

Hypothesis Testing

Overall Multivariate Analysis of Variance

The alpha level was set at .05 for the analysis of the data for each hypothesis. The multivariate analysis of variance (MANOVA) tested for differences among the means of the treatment groups, stress levels, and the interactions among treatment groups and stress levels on a linear combination of the psychophysiological indices. The calculated

F-values, their probabilities of occurrence, and the degrees of freedom used for the calculations are presented in Table 3.1.

Table 3.1.--Summary of the Overall Multivariate Analysis of Variance

Source of Variation	Degrees of Freedom	F-value	p
Treatment	(4,28)	3.20594	.02752*
Level	(4,28)	.48177	.74887
Treatment X Level	(8,28)	1.17016	.35104

*p $\leq$ .05

Results of the tests of the first three reported null hypotheses stated in Chapter II are reported in Table 3.1 of the multivariate analysis. These hypotheses are:

Hypothesis 1: There is no difference among the means of the three treatment groups as measured by a linear combination of the physiological and psychological indices.

Hypotheses 2: There is no difference among the means of the three stress levels as measured by a linear combination of the physiological and psychological indices.

Hypotheses 3: There is no difference in the means of the interactions among treatment groups and stress levels as measured by a linear combination of the physiological and psychological indices.

As shown in Table 3.1, Null Hypothesis 1 is rejected. There are significant differences among the means of the three experimental treatments. On the other hand, Hypotheses 2 and 3 cannot be rejected.

Univariate Analysis of Variance on the Physiological Index

Two univariate analyses of variance (ANOVAs) approximated from the Wilks' Lambda statistic (1932) were performed, one on the physiological index (P) and one on the psychological index (PS). The univariate analysis of P was used to examine whether differences existed among treatment groups, levels of stress, and the interactions among treatment groups and stress levels on a linear combination of the physiological measures. The calculated F-values, their probabilities of occurrence, and the degrees of freedom used for the calculations are displayed in Table 3.2.

Table 3.2.--Summary of the Analysis of Variance on the Physiological Index

Source of Variation	Mean Square	Degrees of Freedom	F-value	p
Treatment	126.927	2	5.88404	.01299*
Level	7.950	2	.36858	.69781
Treatment X Level	20.810	4	.96473	.45523
Error	21.571	15		

*p < .05

Results of the tests of Null Hypotheses 4, 5, and 6 stated in Chapter II are reported in Table 3.2. These hypotheses are:

Hypothesis 4: There is no difference among the means of the three treatment groups as measured by a linear combination of the physiological measures.

Hypothesis 5: There is no difference among the means of the three stress levels as measured by a linear combination of the physiological measures.

Hypothesis 6: There is no difference in the means of the interactions among treatment groups and stress levels as measured by a linear combination of the physiological measures.

As shown in Table 3.2, Null Hypothesis 4 is rejected. There are significant differences present among the means of the three experimental treatments on P. On the other hand, Hypotheses 5 and 6 cannot be rejected.

Univariate Analysis of Variance on the Psychological Index

Wilks' lambda statistic (1932) produced a univariate analysis of variance on PS from the linear combination used in the overall multivariate analysis. This ANOVA of PS was used to examine whether differences existed among treatment groups, levels of stress, and the interactions among treatment groups and stress levels, on a linear combination of the psychological measures. The calculated F-values, their probabilities of occurrence, and the

degrees of freedom used for the calculations are shown in Table 3.3.

Table 3.3.--Summary of the Analysis of Variance on the Psychological Index

Source of Variation	Mean Square	Degrees of Freedom	F-value	p
Treatment	174.760	2	2.80990	.09195
Level	43.378	2	.69747	.51329
Treatment X Level	97.511	4	1.56785	.23382
Error	62.194	15		

Results of the tests of Null Hypothesis 7, 8, and 9 stated in Chapter II are reported in Table 3.3. These hypotheses are:

Hypothesis 7: There is no difference among the means of the three treatment groups as measured by a linear combination of the psychological measures.

Hypothesis 8: There is no difference among the means of the three stress levels as measured by a linear combination of the psychological measures.

Hypothesis 9: There is no difference in the means of the interactions among treatment groups and stress levels as measured by a linear combination of the psychological measures.

As shown in Table 3.3, Null Hypotheses 7, 8, and 9 cannot be rejected through the ANOVA on PS. Hypothesis 7--

stating no difference among the means of the treatment groups on PS--had, however, a probability level of .09. This means that only nine times in 100 would this difference between treatment means have occurred due to random error.

ANOVAs on all Dependent Measures

The analysis of the data produced by the MANOVA approximated two univariate ANOVAs, one on the physiological index (P), and one on the psychological index (PS). P was formed by combining measures of diastolic and systolic blood pressure into one physiological index. Likewise, PS was formed by combining scores on the Taylor-Manifest Anxiety Scale and the Teaching Anxiety Scale into one psychological index. Since the indices were developed by a combination of dependent measures, further analysis procedures were employed to determine differences among the means of the treatments, levels, and treatment-by-level interactions, as measured by each original dependent variable. The following four sections include the results of separate ANOVAs on each dependent variable: diastolic blood pressure, systolic blood pressure, the Taylor Manifest Anxiety Scale, and the Teaching Anxiety Scale. The alpha level was set at .05 for all analyses.

Analysis of Variance on Systolic Blood Pressure

The analysis of variance tested for differences among the means of the treatment groups, stress levels, and the

interactions among treatment groups and stress levels, as measured by systolic blood pressure. Exhibited in Table 3.4 are the F-values, their probabilities of occurrence, and the degrees of freedom used for the calculations.

Table 3.4.--Summary of the Analysis of Variance for Systolic Blood Pressure

Source of Variation	Mean Square	Degrees of Freedom	F-value	p
Treatment	182.281	2	6.89734	.00751*
Level	2.202	2	.08335	.92045
Treatment X Level	25.474	4	.96391	.45563
Error	26.427	15		

*p<.05

As indicated in Table 3.4, there are significant differences among the means of the three treatment groups on systolic blood pressure. There were no significant differences in the means of stress levels and the interactions among treatment groups and stress levels, as measured by systolic blood pressure.

Analysis of Variance on Diastolic Blood Pressure

The analysis of variance tested for differences among the means of the treatment groups, stress levels, and the interactions among treatment groups and stress levels, as measured by diastolic blood pressure. The calculated F-values, their probabilities of occurrence, and the degrees of freedom used for the calculations, are presented in Table 3.5.

Table 3.5.--Summary of the Analysis of Variance for Diastolic Blood Pressure

Source of Variation	Mean Square	Degrees of Freedom	F-value	p
Treatment	82.976	2	2.39413	.12521
Level	23.718	2	.68436	.51948
Treatment X Level	18.490	4	.53350	.71322
Error	34.658	15		

As indicated in Table 3.5, there are no significant differences among the means of treatments, levels, and treatment-by-level interactions, as measured by diastolic blood pressure.

Analysis of Variance on the Taylor Manifest Anxiety Scale

The analysis of variance tested for differences among the means of the treatment groups, stress levels, and the interactions among treatment groups and stress levels, as

measured by the Taylor-Manifest Anxiety Scale. The F-values, degrees of freedom, and probability of occurrence figures for this analysis are reported in Table 3.6.

Figure 3.6.--Summary of the Analysis of Variance for the Taylor-Manifest Anxiety Scale

Sources of Variation	Mean Square	Degrees of Freedom	F-value	p
Treatment	45.125	2	2.99282	.08059
Level	19.430	2	1.28869	.30446
Treatment X Level	30.180	4	2.00166	.14598
Error	15.077	15		

As reported in Table 3.6, there are no significant differences among the means of treatments, levels, and treatment-by-level interactions as measured by the Taylor Manifest Anxiety Scale. The test for differences among the means of the treatment groups on this measure had a probability level of .08. This implies that only eight times in 100 would this difference between treatment means have occurred due to random error.

Analysis of Variance on the Teaching Anxiety Scale

The analysis of variance tested for differences among the means of the treatment groups, stress levels, and the interactions among treatment groups and stress levels, as measured by the Teaching Anxiety Scale. The calculated F-values, their probabilities of occurrence, and the degrees

of freedom used for the calculations are presented in Table 3.7.

Table 3.7.--Summary of the Analysis of Variance for the Teaching Anxiety Scale

Sources of Variation	Mean Square	Degrees of Freedom	F-value	p
Treatment	402.166	2	2.08845	.15843
Level	76.817	2	.39891	.67796
Treatment X Level	206.622	4	1.07299	.40424
Error	192.566	15		

As indicated in Table 3.7, there are no significant differences among the means of treatments, levels, and treatment-by-level combinations, as measured by the Teaching Anxiety Scale.

Post Hoc t-Tests

Neither MANOVAs nor ANOVAs determine directionality of differences with more than two treatments (Harris, 1975). Therefore, a series of post hoc t-tests comparisons between treatments (biofeedback versus stress inoculation, biofeedback versus control, and stress inoculation versus control), were used to further determine the exact nature of the relationship among dependent measures. In Tables 3.8, 3.9, and 3.10, a minus sign associated with the mean of a treatment group on a particular dependent measure indicates

a decrease in the mean score (from pre- to posttest) for that treatment group on that particular dependent measure. A summary of the differences between the means of the biofeedback treatment and the stress inoculation treatment is reported in Table 3.8.

According to Hays (1973), multiple comparisons increase the probabilities that one or more of the t-tests will be significant due to random error. In order to control this inflation of error, alpha was set at .05 divided by three (for the three post hoc comparisons), or .017.

As indicated in Table 3.8, there are no significant differences between the means of the biofeedback and stress inoculation treatments on all dependent measures. However, both treatment groups lowered their mean score across all dependent measures from pre- to posttest.

The means, t-values, probabilities of occurrence, and degrees of freedom used in determining the differences between the means of the biofeedback treatment and the no-treatment control on all dependent measures are reported in Table 3.9.

As indicated in Table 3.9, there are significant differences between the means of the biofeedback treatment and the no-treatment control on both systolic and diastolic blood pressure. The biofeedback group evidenced statistically significant reductions in systolic and diastolic blood pressure as compared to the changes evidenced by the control group. Moreover, from pretest to posttest the

Table 3.8.--Post hoc t-Tests between the Biofeedback and Stress Inoculation Treatments on all Dependent Measures

Dependent Measure	Mean	Degrees of Freedom	t-value	p
Systolic Blood Pressure				
Biofeedback	-6.5625	14	-.63	.538
Stress Inoculation	-5.0000			
Diastolic Blood Pressure				
Biofeedback	-3.5000	14	.01	.993
Stress Inoculation	-3.5312			
Taylor-Manifest Anxiety Scale				
Biofeedback	-2.6250	14	.68	.510
Stress Inoculation	-4.0000			
Teaching Anxiety Scale				
Biofeedback	-9.6250	14	-.20	.847
Stress Inoculation	-8.6250			

Table 3.9.--Post hoc t-Tests between the Biofeedback Treatment and the No-Treatment Control on all Dependent Measures

Dependent Measure	Mean	Degrees of Freedom	t-value	p
Systolic Blood Pressure				
Biofeedback	-6.5625	14	-3.64	.003*
Control	2.3750			
Diastolic Blood Pressure				
Biofeedback	-3.5000	14	-4.07	.001*
Control	2.0625			
Taylor-Manifest Anxiety Scale				
Biofeedback	-2.6250	14	-1.54	.146
Control	.6250			
Teaching Anxiety Scale			(-1.837)	
Biofeedback	-9.6250	14	-1.72	.108
Control	3.1250			

*p ≤ .017

biofeedback treatment group lowered its mean score across all dependent measures, while the control group raised its mean score across all dependent measures.

The means, t-values, probabilities of occurrence, and degrees of freedom used in determining the differences between the means of the stress inoculation treatment and the no-treatment control on all dependent measures are reported in Table 3.10.

As shown in Table 3.10, there are significant differences between the means of the stress inoculation treatment and the no-treatment control on systolic blood pressure. The stress inoculation group did significantly ($p = .008$) better than the control on systolic blood pressure. Moreover, from pretest to posttest the stress inoculation treatment group lowered its mean score across all dependent measures, while the control group raised its mean score across all dependent measures.

Trends in the Data

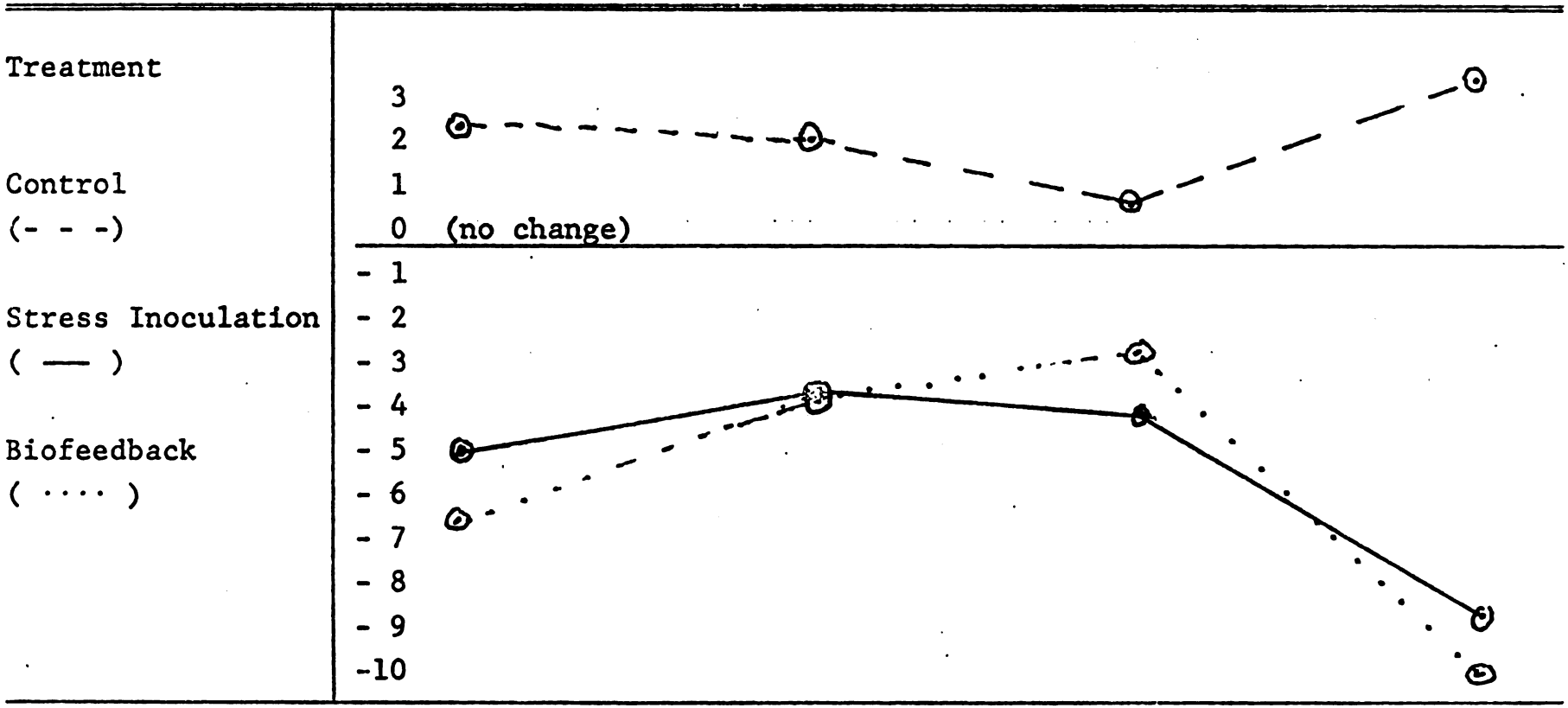
As stated in Chapter I, very few true experimental (Campbell & Stanley, 1963) studies have reported success at reducing preservice teacher stress levels. Therefore, it seems important to report both statistically significant differences and meaningful, although statistically non-significant, differences that appear as systematic differences among treatments. These systematic differences are reported in Table 3.11, a graphic illustration of the

Table 3.10.--Post hoc t-Tests between the Stress Inoculation Treatment and the No-Treatment Control on all Dependent Measures

Dependent Measure	Mean	Degrees of Freedom	t-value	p
Systolic Blood Pressure				
Stress Inoculation	-5.0000	14	-3.06	.008*
Control	2.3750			
Diastolic Blood Pressure				
Stress Inoculation	-3.5312	14	-1.77	.115
Control	2.0625			
Taylor Manifest Anxiety Scale				
Stress Inoculation	-4.0000	14	-2.03	.061
Control	.6250			
Teaching Anxiety Scale				
Stress Inoculation	-8.6250	14	-1.55	.143
Control	3.1250			

*p ≤ .017

Table 3.11.--Summary of the Pretreatment to Posttreatment Changes in the Means of Biofeedback, Stress Inoculation, and Control, on all Dependent Measures



pretreatment to posttreatment changes in the means of the three experimental treatments on all dependent measures.

As indicated in Table 3.11, both the biofeedback and stress inoculation groups evidenced pre- to posttreatment reductions in their means across all dependent measures. On the other hand, the control group means rose from pre- to posttreatment across all dependent measures.

Summary of Results

1. Overall MANOVA - Significant differences were found among the means of the three treatments on a linear combination of physiological and psychological indices. No significant differences were found in the means of the three stress levels, and the interactions among treatment groups and stress levels, on a linear combination of the psychological and physiological indices.

2. ANOVA on Physiological Index - Significant differences were found among the means of the three treatment groups on the physiological index. No significant differences were found in the means of the three stress levels, and the interactions among treatment groups and stress levels, on the physiological index (P).

3. ANOVA on Psychological Index - No significant differences were found in the means of the three treatment groups, the three stress levels, and the interactions among treatment groups and the three stress levels, on the psychological index (PS). The test for differences among

the means of the treatment groups on this index had a probability level of .09.

4. ANOVA on Systolic Blood Pressure - Significant differences were found among the means of the three treatment groups on systolic blood pressure. There were no significant differences in the means of the three stress levels, and the interactions among treatment groups and stress levels, on systolic blood pressure.

5. ANOVA on Diastolic Blood Pressure - No significant differences were found among the means of treatments, levels, and treatment-by-level interactions, on diastolic blood pressure.

6. ANOVA on Taylor Manifest Anxiety Scale - No significant differences were found among the means of treatments, levels, and treatment-by-level interactions, on the Taylor Manifest Anxiety Scale. The test for differences among the means of the treatment groups on this measure had a probability level of .08.

7. ANOVA on Teaching Anxiety Scale - No significant differences were found among the means of treatments, levels, and treatment-by-level interactions, on the Teaching Anxiety Scale.

8. Biofeedback versus Stress Inoculation - No significant differences were found between the means of the biofeedback and stress inoculation treatments on all dependent measures.

9. Biofeedback versus Control - The biofeedback treatment group did significantly better than the control group on systolic ($p = .003$) and diastolic ($p = .001$) blood pressure.

10. Stress Inoculation versus Control - The stress inoculation treatment group did significantly better than the control group on systolic ($p = .008$) blood pressure. The test for differences in the means of these groups on the Taylor Manifest Anxiety Scale had a probability level of .06.

11. Trends - From pre- to posttest, both the biofeedback and stress inoculation groups lowered their means scores on all dependent measures. During the same period, the control group means rose across all dependent measures.

CHAPTER IV

SUMMARY AND CONCLUSIONS

Summary

The purpose of this study was to experimentally examine the efficacy of two treatments for reducing preservice teacher stress levels. One treatment was electromyographic (EMG) biofeedback. A second treatment was stress inoculation (Meichenbaum, 1976), a form of cognitive behavior management. Subject change was quantified using two physiological measures (systolic and diastolic blood pressure) and two psychological measures (Taylor Manifest Anxiety Scale and Teaching Anxiety Scale).

The published literature in the area of preservice and inservice teacher stress has contained primarily anecdotal descriptions and individual case studies. Experimental research studies involving attempts to reduce the stress levels of these groups have resulted in mixed results. Also, the evaluation of these studies was based primarily on change in subject responses to standardized paper and pencil instruments.

In research investigations of non-teaching populations it had been reported that both biofeedback and stress inoculation were effective in reducing stress. Biofeedback had been

used, primarily, to treat the physiological effects of prolonged stress reactions, e.g., hypertension (Shoemaker & Tasto, 1975) and peptic ulcer (Beaty, 1976). Stress inoculation had been employed mainly with individuals experiencing the psychological effects of stress, e.g., anxiety (Meichenbaum, Gilmore, and Fedoravicius, 1971) and phobic reactions (Meichenbaum & Cameron, 1973).

Twenty-four senior teaching interns in the Excellence in Elementary Education (EEE) program at Michigan State University were randomly assigned to experimental (treatment) and control (no treatment) conditions in a pretest-posttest control groups design (Campbell & Stanley, 1963). This design provided the evaluative structure necessary to assess the effects of the three treatment conditions. All subjects volunteered for the study, and there was no attrition.

Subject change was assessed using four measures. Change in physiological stress level was measured using systolic and diastolic blood pressure. The Taylor Manifest Anxiety Scale and the Teaching Anxiety Scale were used to measure change in psychological stress level.

A multivariate analysis of variance (MANOVA) was used to statistically analyze the data. The MANOVA tested for differences in the means--of treatment groups, stress levels, and interactions among treatment groups and stress levels--on a linear combination of the psychological and physiological indices (Hypotheses 1, 2, and 3). Two univariate analyses of variance (ANOVAs), approximated by

Wilks' Lambda statistic (1932), were performed, one on the physiological index (P), and one on the psychological index (PS). These ANOVAs were used to analyze differences in the means--of treatment groups, stress levels, and the interactions among treatment groups and stress levels--on a linear combination of the physiological measures (Hypotheses 4, 5, and 6) and on a linear combination of the psychological measures (Hypotheses 7, 8, and 9).

The results of the data analysis (MANOVA) indicated that there were significant differences among the means of the three treatment groups on a linear combination of the physiological and psychological indices. Supplementary analyses revealed that most of the statistically significant differences occurred on the physiological (i.e., blood pressure) measures. These analyses also showed that both biofeedback and stress inoculation were more effective than a no-treatment control in reducing preservice intern stress levels across all dependent measures. However, no statistically significant differences were found between the means of the biofeedback and stress inoculation treatments on all dependent measures.

Limitations

Limitations of the research are considered prior to presenting the discussion and conclusions which can be drawn from the findings. A comprehensive discussion of the limitations places the conclusions in proper perspective and helps to suggest directions for future research.

The research used a pretest-posttest control group design with random assignment of subjects to treatment groups. These conditions are generally thought to control for all threats to internal validity (Campbell & Stanley, 1963). Questions dealing with external validity are not as well defined, however, and are dealt with individually.

Testing-by-Treatment Interaction

Pretesting is commonly considered a liability to external validity since generalizations are most often directed at unpretested groups. Pretesting limits generalizability to the extent that a subject responds differently to the experimental treatments as a result of being somehow changed or sensitized by the administration of the pretest.

There are several reasons why this argument has limited applicability to this study's pretest stimuli and, subsequently, to the research conclusions. Two of the dependent measures (systolic and diastolic blood pressure) are normally considered autonomic, i.e., involuntary responses. To the extent that this is true, sensitization of the subject to treatment is unlikely and, therefore, not a relevant concern. Questions asked by many of the subjects revealed they were not even aware of what blood pressure readings indicated. Similarly, the Taylor Manifest Anxiety is thought to measure chronic anxiety, and many of the questions deal with autonomic responses (e.g., "I blush frequently."). This test is also not likely to alter a subject's response to treatment.

The Teaching Anxiety Scale may have sensitized subjects to the stress inoculation treatment. Many of the items on that instrument are typical of the situations which were examined and then reappraised within the cognitive training sessions. Therefore, care must be exercised in logically generalizing the results of the stress inoculation training beyond the research sample.

Selection-by-Treatment Interaction

The sample for this research project consisted of all 24 senior interns in the Excellence in Elementary Education (EEE) program at Michigan State University. This group was comprised of 23 females and one male. Since the subjects in this study were not randomly selected from a larger population of preservice teacher interns, it is not possible to argue that the results from this study can be statistically generalized beyond the research sample. It is possible that an unknown selection factor or factors may have been operating in this specific group which interacted with treatment, thus producing results peculiar to this specific group. It is not known to what extent such factors influenced the results. Any logical generalizations of the results beyond the research sample must be made with caution.

Although the sample was not randomly selected, it is possible to cautiously generalize beyond this particular group. The Cornfield-Tukey bridge argument (Cornfield & Tukey, 1956) offers a rule for extending the sphere of persons to which the findings can be generalized. By

carefully defining the characteristics of the sample studied, the argument can be made that the research findings can then be extended to other groups or individuals (with similar characteristics) at other points in time. Thus, this sample is assumed to be representative of a larger population to which the results may be applied. The Cornfield-Tukey bridge argument is frequently used in generalizing results from educational research.

All 24 senior EEE interns voluntarily participated in the study. Participation was viewed as an adjunct element of the internship and, as such, had no impact on the determination of the subjects' internship grades. Nonetheless, the use of volunteers introduces a sampling bias and limits the generalizability of the results to volunteers from the same population.

Another selection-related limitation was the number of subjects (N = 24) used in the study. This became increasingly problematic since the total sample was divided into several subsamples. In fact, some of the statistically significant relationships were identified for subgroup samples having an N of 8 subjects. Again, care must be exercised in generalizing these findings.

Using a small sample increases the chances that uncontrolled variables will interact among measures and subjects in a non-random way (Isaac & Michael, 1977). A large sample would have tempered this concern for confounding and increased the probabilities of detecting

statistically significant differences. This was particularly significant since the results of the tests for differences among the means of the three treatment groups (for the MANOVA and all six ANOVAs) all had p-values less than or equal to .16.

Small samples do have some advantages over large samples which are relevant to the findings of this study. Isaac and Michael (1977) state that samples with N's between 10 and 30 have many useful advantages:

> Samples of this size are large enough to test the null hypothesis, yet small enough to overlook weak treatment effects. Remembering that statistically significant findings for any relevant variable appear simply by increasing the sample size toward the universe, such findings are not apt to be educationally significant since the variable in question is too diluted to make a practical difference. (p. 69)

Thus, differences among the means of treatment groups in small sample studies are more likely, if statistically significant, to also be meaningfully significant.

A final selection-related limitation was the nonrepresentativeness of the research sample with regard to sex and race distribution. The research sample consisted of 23 Caucasian females and one Caucasian male. This may not be a severe limitation in generalizations to elementary student interns or elementary student teachers. However, this skewness in regard to the sex and race distributions is not necessarily characteristic of students in other internship settings (counseling, medicine, psychology, etc.), nor

teaching settings generally. Therefore, logical generalizations of the research findings to such groups must be made with a proper amount of prudence.

Reactive Effects of Experimental Procedures

Providing treatment to students in the actual school where they were interning was a format that was planned and executed specifically to prevent a reactive arrangements effect. Subjects were removed from class twice weekly for 45 minutes, during which time treatment was administered. During this period the regular classroom teacher assumed responsibility for instruction.

Subjects were informed that they were involved in a research study and were aware that the goal of treatment was to increase their self-control in "stressful" situations. It is not known to what extent this knowledge influenced subjects' reactions to treatment. Moreover, while Campbell & Stanley (1963) argue that this experimental arrangement most often hampers generalization, Goldman (1976) disagrees. He feels that open, contractual relationships between researcher and subject reduce artificiality, thereby increasing the applicability of the findings.

One final condition may have produced a reactive arrangements effect. The content of the stress inoculation treatment was in some measure related to the content measured by the Teaching Anxiety Scale at posttest.

A reactive arrangements effect existed to the extent that there was an obvious connection between the experimental treatment and the posttest content (Campbell & Stanley, 1963). However, the stress inoculation treatment was not significantly different from other treatments on this measure.

Design

As employed in the study, the pretest-posttest control group design did not provide a duration of effects measure beyond the posttest. Therefore, there is no way of determining if, or how long, the benefits (e.g., reductions in blood pressure and anxiety level) realized by the subjects in the biofeedback and stress inoculation conditions would continue past the posttest. This is a serious limitation of the study. Any attempt to logically generalize beyond the time period (five weeks) in which the experiment was conducted must be done cautiously.

Discussion of Results

The overall MANOVA procedure combined each subject's scores on the dependent measures to form a linear combination. This linear combination was then used as the dependent measure in the analysis procedure. Significant differences were found among the means of the three treatment conditions on this linear combination of measures.

The results of this overall MANOVA provide forceful evidence ($p = .027$) that the experimental treatments caused

differences in the subjects' scores on a linear combination of all the dependent measures. One reason this result is so persuasive is that the test for differences (among the means) provided by the MANOVA is a most precise one. Standardizing and then combining the scores on all measures reduces the impact of a very strong effect on any one particular measure. This reduces the probability that a significant difference will occur on the overall MANOVA due to random errors of measurement on any one particular dependent measure.

The results of the ANOVA on the physiological index (a linear combination of systolic and diastolic blood pressure) indicated significant differences existed among the means of the three treatment groups on this index. From this it can be concluded that the experimental treatments had a statistically significant effect on the subjects' blood pressures. The directionality of these differences cannot be inferred from the analysis of variance procedure.

The results of the ANOVA on the psychological index (Taylor Manifest Anxiety Scale and Teaching Anxiety Scale) indicated that no statistically significant differences were present among the means of the three treatment groups on this index. However, this significance test had a probability level of .09, suggesting that only nine times in 100 would this difference among the means have occurred because of random error.

The results of the overall MANOVA and the two ANOVAs suggest that statistically significant differences among the means of the three treatment conditions were located, primarily, within the physiological dependent measures. Significant differences among the means of the three treatment conditions were found on P. While no significant ($p = .09$) differences among the means of the three treatments were found on PS, the effect was strong enough so that when P and PS were combined in the overall MANOVA, significant differences still existed ($p = .027$). Nonetheless, the experimental treatments had a stronger effect on the physiological measures than the psychological measures.

Separate individual ANOVAs were performed on each dependent measure. The results of the ANOVAs on systolic and diastolic blood pressure showed significant differences among the means of the three treatment groups on systolic blood pressure ($p = .007$). No statistically significant differences among the means were found for diastolic blood pressure ($p = .12$). Thus, the experimental treatments had a stronger effect on systolic blood pressure than diastolic blood pressure.

As was stated in Chapter II, systolic blood pressure is a more reactive measure than diastolic blood pressure, showing greater situational fluctuations. Diastolic blood pressure is more representative of the constant pressure present within the body and is less reactive to situational influences and more resistant to change (Benson, 1976).

A researcher expects, therefore, that treatments effect greater and more rapid changes in systolic blood pressure than in diastolic blood pressure. The results of this study are consistent with that knowledge, as treatments had a greater impact upon systolic blood pressure.

The results of two separate ANOVAs indicated that no statistically significant differences existed among the means of the three treatment groups on either the Taylor Manifest Anxiety Scale or the Teaching Anxiety Scale. The p-values were, respectively, .08 and .15. Thus, while neither of these tests was statistically significant, both results suggest that the experimental treatments did cause differences among the means of the three treatment groups on these measures. That important differences existed is further suggested by recalling that statistically significant differences existed among treatment conditions on the overall MANOVA, the linear combination of all four dependent measures.

No significant differences were found in the means of the three stress levels or the interactions among treatment groups and stress levels--on the overall MANOVA, the ANOVAs of P and PS, and the separate ANOVAs of the four dependent measures. There are several possible explanations for these results. One explanation is that treatments had a similar effect on subjects regardless of whether their stress level was high, medium, or low. Another possible explanation is that the Life Experiences Survey (LES) did

not discriminate adequately a subject's level of stress and was, therefore, an ineffective blocking variable.

This last explanation seems most plausible. Several subjects had a score of zero on the LES and, during administration of the pretest, other subjects said things such as, "I don't have any of these." Indeed, a number of the items on the LES (e.g., death of spouse, mortgage over $10,000, divorce) have a low probability of having occurred to these 20- and 21-year-old senior interns.

A series of post hoc t-tests were performed to determine the directionality of the differences among the three treatment conditions. Comparisons were made between (1) biofeedback versus stress inoculation, (2) biofeedback versus control, and (3) stress inoculation versus control.

Results from the first comparison showed no statistically significant differences between the means of the biofeedback condition and the stress inoculation condition on all dependent measures. However, from pretest to posttest, both treatment groups lowered their mean scores across all the dependent measures (see Table 3.8). The results of this t-test comparison indicate that while both treatments were effective, neither treatment was significantly more effective than the other in reducing the stress levels of the preservice intern sample.

The results from the second comparison indicated that the biofeedback treatment condition did significantly better than the no-treatment control on both systolic ($p = .003$)

and diastolic ($p = .001$) blood pressure. Remembering that systolic blood pressure is a somewhat labile measure and diastolic blood pressure a rather stabile measure, the reduction in diastolic blood pressure is strong evidence for the forcefulness of the biofeedback treatment. Normally, one would expect the interns' diastolic blood pressures to be rather resistant to change. Also, this finding is important in light of the fact that this age group is very young and healthy, with a low (116/69) mean pretest blood calculation (see Appendix I). In summary, these findings suggest that training in frontalis EMG biofeedback (two times per week for five consecutive weeks) induced not only short-term but also long-term (i.e., diastolic) reductions in blood pressure. Biofeedback was a strong and effective treatment for reducing preservice intern blood pressures.

The results from this second t-test comparison also indicated that there were no statistically significant differences between the biofeedback treatment condition and the no-treatment control condition on either the Taylor Manifest Anxiety Scale or the Teaching Anxiety Scale. However, the biofeedback treatment group lowered (from pre- to posttest) their mean scores while the control group concurrently raised their mean scores on both these measures. Moreover, from pretest to posttest, the biofeedback treatment group lowered its mean scores across all dependent measures while the control group exhibited increases in its mean scores across all dependent measures.

The third comparison focused on the difference between the means of the stress inoculation treatment condition and the no-treatment control condition. The results of this comparison showed that stress inoculation was significantly ($p = .08$) more effective than no treatment in reducing the systolic blood pressure of the preservice intern sample group. There were no statistically significant differences between the means of these two treatment groups on diastolic blood pressure. It would appear then, since systolic blood pressure is more situationally reactive than diastolic blood pressure, that stress inoculation is most effective at reducing an intern's situational physiological reactivity to stressful environmental conditions.

Although this third comparison found no statistically significant differences on diastolic blood pressure, the Taylor Manifest Anxiety, and the Teaching Anxiety Scale, directionally consistent differences were again revealed. From pretest to posttest, the stress inoculation treatment group lowered its mean scores across all these measures, while the control group raised its mean scores across all the dependent measures.

As was illustrated graphically in Table 3.11, both the biofeedback and stress inoculation groups demonstrated pre- to posttest reductions in their means across all the dependent measures. Over the same time period, the control group displayed increases in its mean scores across all the dependent measures. There is a remarkable consistency

in this graphic representation of both significant and nonsignificant differences. Simply stated, both the biofeedback and stress inoculation groups improved during the treatment period, while at the same time the control group regressed.

The issue of meaningful versus statistical differences is clearly applicable to the preceding discussion. Porter (1978) states that the significant statistical differences are those which are defined by the alpha level set apriori by the researcher. Meaningful differences are those which, while not statistically significant, are important to the researcher.

The nonsignificant differences in this study are meaningful for several reasons. Initially, all the statistically nonsignificant t-test differences (biofeedback versus control, stress inoculation versus control) had a p-value less than or equal to .15. This suggests that only 15 times in 100 would the degree of differences detected occur because of random error. Secondly, the unanimity of the directional changes graphically illustrated in Table 3.11 makes these nonsignificant differences meaningful. Thirdly, the statistical significance of the overall MANOVA (a linear combination of all dependent measures) suggests a directionally positive change on those measures shown as nonsignificant by subsequent statistical analyses. In short, the means of the stress inoculation and biofeedback conditions evidenced improvement across all measures.

The mean of the control condition evidenced regression across all measures. Lastly, Day (1980) used cognitive restructuring (a cognitive treatment similar to stress inoculation) to effect statistically significant reductions in the Teaching Anxiety Scale and the Trait Anxiety Scale in a group of inservice teachers. In summary, all these facts suggest that the statistically nonsignificant changes evidenced by the biofeedback and stress inoculation groups represent important and meaningful therapeutic changes.

Implications

There are several clear implications that can be drawn from this research. The purpose of the study was to experimentally examine the comparative effectiveness of frontalis EMG biofeedback training and stress inoculation training in the treatment of preservice teacher stress. Both treatments fared extremely well in the comparison and neither treatment was significantly superior to the other.

Biofeedback was a potent treatment for reducing preservice intern blood pressures. Subjects in this condition evidenced statistically significant reductions in their systolic and diastolic blood pressures. Subjects also showed positive changes on the psychological instruments. To a large degree, these data indicate that biofeedback is most useful in inducing a relaxed physiological state in preservice teaching interns. Also, the diastolic blood

pressure data suggest that biofeedback is useful in initiating a more permanent physiological relaxation effect in this population.

Stress inoculation was a significantly effective treatment for reducing the systolic blood pressure levels of preservice interns. Subjects in this group also evidenced positive, although not statistically significant, changes on the remaining dependent measures. Thus, this treatment helps preservice teachers gain more control over their situational physiological reactivity to stressful environmental conditions.

As discussed earlier, a combined examination of the statistically significant and nonsignificant findings (t-tests) revealed that subjects in both treatment conditions made important therapeutic changes. From pretest to posttest, there was a unanimous positive (i.e., healthful) change across all measures for both the biofeedback and stress inoculation treatment groups. During the same period the control group evidenced a unanimous regressive change across all measures. The directional unanimity of these results provided partial evidence that the nonsignificant differences within the treatment versus no-treatment t-test comparisons were meaningful differences. The results from this study show that both biofeedback and stress inoculation are effective in the treatment of preservice teacher stress. Neither treatment was superior to the other. To a certain degree, the results suggest that

a primarily somatic treatment (EMG biofeedback) impacts positively upon both physiological and psychological indicators of stress. Similarly, a cognitive treatment (stress inoculation) produced beneficial changes in both physiological and psychological measures of stress.

Sylwester (1977) reports that the worst problem teachers have to contend with is stress. Hunter (1977) suggests that the best preventive approach to the problem of teacher stress is excellent preservice training. The results from this study suggest that either biofeedback or stress inoculation (or both) can be integrated into preservice training to increase the trainees' ability to positively manage their physiological and psychological reactions to stressful environmental circumstances. Furthermore, these implications for training may possibly be generalized to other training settings where similarly stressful characteristics are present.

Suggestions for Future Research

Previous experimental research studies involving attempts to reduce the stress levels of preservice interns have resulted in, at best, mixed results. The results of this study showed that both biofeedback and stress inoculation were effective methods of helping these senior teaching interns manage their physiological and psychological reactivity to stressful environmental stimuli. These results are promising and may indicate that certain training techniques help students in stressful internship settings. However,

additional research is necessary to confirm these findings. Several specific areas are identified that seem to be of significance for such research:

1. In this research, significant beneficial changes were found in subjects who underwent treatment. This positive outcome and the fact that controlled experimental research on preservice teacher stress is relatively nonexistent, suggest that this study might be worth replicating.

2. Research is needed to determine the generalizability of these findings. Some suggestions for such research were implied in the limitations section of this chapter. Such studies might include larger and more heterogeneous (with respect to sex and race) samples. Also, a duration of effects measure might be incorporated into the research design to define more conclusively the relative durability of subject change. Finally, additional research might focus on similar populations of students (e.g., counselors, psychologists, social workers, doctors, nurses, etc.) involved in stressful internships.

3. Physiological measures other than blood pressure could be used. Biochemical measures, especially corticosteroids, provide the best single indicator of chronic stress reactions (Lazarus, 1978).

4. A behavioral measure (e.g., graded/rated performance in the internship) might be used and correlated with the stress measures. This would aid in determining whether reducing stress positively affects performance.

5. The results from this study showed biofeedback and stress inoculation were better than no treatment. Further studies might involve a weak-treatment control condition (e.g., supportive counseling) and/or a combined treatment condition (e.g., biofeedback and stress inoculation).

Conclusion

The published literature on preservice teacher stress includes few successful attempts to reduce the stress of these individuals (Coates & Thoresen, 1976). However, the results from this experimental study indicate that both frontalis EMG biofeedback and stress inoculation are forceful treatments for reducing preservice teacher stress. It is hoped that this study will prove valuable to others interested in increasing an individual's self control in the face of stressful environmental and intrapersonal demands.

APPENDICES

APPENDIX A

THE LIFE EXPERIENCES SURVEY

The Life Experiences Survey

Listed below are a number of events which sometimes bring about change in the lives of those who experience them and which necessitate social readjustment. *Please check those events which you have experienced in the recent past and indicate the time period during which you have experienced each event.* Be sure that all check marks are directly across from the items they correspond to.

Also, for each item checked below, *please indicate the extent to which you viewed the event as having either a positive or negative impact on your life* at the time the event occurred. That is, *indicate the type and extent of impact that the event had.* A rating of −3 would indicate an extremely negative impact. A rating of 0 suggests no impact either positive or negative. A rating of +3 would indicate an extremely positive impact.

Section 1

	0 to 6 mo	7 mo to 1 yr	extremely negative	moderately negative	somewhat negative	no impact	slightly positive	moderately positive	extremely positive
1. Marriage			−3	−2	−1	0	+1	+2	+3
2. Detention in jail or comparable institution			−3	−2	−1	0	+1	+2	+3
3. Death of spouse			−3	−2	−1	0	+1	+2	+3
4. Major change in sleeping habits (much more or much less sleep)			−3	−2	−1	0	+1	+2	+3

	0 to 6 mo	7 mo to 1 yr	extremely negative	moderately negative	somewhat negative	no impact	slightly positive	moderately positive	extremely positive
5. Death of close family member:									
a. mother			−3	−2	−1	0	+1	+2	+3
b. father			−3	−2	−1	0	+1	+2	+3
c. brother			−3	−2	−1	0	+1	+2	+3
d. sister			−3	−2	−1	0	+1	+2	+3
e. grandmother			−3	−2	−1	0	+1	+2	+3
f. grandfather			−3	−2	−1	0	+1	+2	+3
g. other (specify)			−3	−2	−1	0	+1	+2	+3
6. Major change in eating habits (much more or much less food intake)			−3	−2	−1	0	+1	+2	+3
7. Foreclosure on mortgage or loan			−3	−2	−1	0	+1	+2	+3
8. Death of close friend			−3	−2	−1	0	+1	+2	+3
9. Outstanding personal achievement			−3	−2	−1	0	+1	+2	+3
10. Minor law violations (traffic tickets, disturbing the peace, etc.)			−3	−2	−1	0	+1	+2	+3
11. *Male*: Wife/girlfriend's pregnancy			−3	−2	−1	0	+1	+2	+3
12. *Female*: Pregnancy			−3	−2	−1	0	+1	+2	+3
13. Changed work situation (different work responsibility, major change in working conditions, working hours, etc.)			−3	−2	−1	0	+1	+2	+3
14. New job			−3	−2	−1	0	+1	+2	+3
15. Serious illness or injury of close family member:									
a. father			−3	−2	−1	0	+1	+2	+3
b. mother			−3	−2	−1	0	+1	+2	+3
c. sister			−3	−2	−1	0	+1	+2	+3
d. brother			−3	−2	−1	0	+1	+2	+3
e. grandfather			−3	−2	−1	0	+1	+2	+3
f. grandmother			−3	−2	−1	0	+1	+2	+3
g. spouse			−3	−2	−1	0	+1	+2	+3
h. other (specify)			−3	−2	−1	0	+1	+2	+3
16. Sexual difficulties			−3	−2	−1	0	+1	+2	+3
17. Trouble with employer (in danger of losing job, being suspended, demoted, etc.)			−3	−2	−1	0	+1	+2	+3
18. Trouble with in-laws			−3	−2	−1	0	+1	+2	+3
19. Major change in financial status (a lot better off or a lot worse off)			−3	−2	−1	0	+1	+2	+3
20. Major change in closeness of family members (increased or decreased closeness)			−3	−2	−1	0	+1	+2	+3
21. Gaining a new family member (through birth, adoption, family member moving in, etc.)			−3	−2	−1	0	+1	+2	+3
22. Change of residence			−3	−2	−1	0	+1	+2	+3
23. Marital separation from mate (due to conflict)			−3	−2	−1	0	+1	+2	+3
24. Major change in church activities (increased or decreased attendance)			−3	−2	−1	0	+1	+2	+3

	0 to 6 mo	7 mo to 1 yr	extremely negative	moderately negative	somewhat negative	no impact	slightly positive	moderately positive	extremely positive
25. Marital reconcilation with mate			−3	−2	−1	0	+1	+2	+3
26. Major change in number of arguments with spouse (a lot more or a lot less arguments)			−3	−2	−1	0	+1	+2	+3
27. *Married male*: Change in wife's work outside the home (beginning work, ceasing work, changing to a new job, etc.)			−3	−2	−1	0	+1	+2	+3
28. *Married female*: Change in husband's work (loss of job, beginning new job, retirement, etc.)			−3	−2	−1	0	+1	+2	+3
29. Major change in usual type and/or amount of recreation			−3	−2	−1	0	+1	+2	+3
30. Borrowing more than $10,000 (buying home, business, etc.)			−3	−2	−1	0	+1	+2	+3
31. Borrowing less than $10,000 (buying car, TV, getting school loan, etc.)			−3	−2	−1	0	+1	+2	+3
32. Being fired from job			−3	−2	−1	0	+1	+2	+3
33. *Male*: Wife/girlfriend having abortion			−3	−2	−1	0	+1	+2	+3
34. *Female*: Having abortion			−3	−2	−1	0	+1	+2	+3
35. Major personal illness or injury			−3	−2	−1	0	+1	+2	+3
36. Major change in social activities, e.g., parties, movies, visiting (increased or decreased participation)			−3	−2	−1	0	+1	+2	+3
37. Major change in living conditions of family (building new home, remodeling, deterioration of home, neighborhood, etc.)			−3	−2	−1	0	+1	+2	+3
38. Divorce			−3	−2	−1	0	+1	+2	+3
39. Serious injury or illness of close friend			−3	−2	−1	0	+1	+2	+3
40. Retirement from work			−3	−2	−1	0	+1	+2	+3
41. Son or daughter leaving home (due to marriage, college, etc.)			−3	−2	−1	0	+1	+2	+3
42. Ending of formal schooling			−3	−2	−1	0	+1	+2	+3
43. Separation from spouse (due to work, travel, etc.)			−3	−2	−1	0	+1	+2	+3
44. Engagement			−3	−2	−1	0	+1	+2	+3
45. Breaking up with boyfriend/girlfriend			−3	−2	−1	0	+1	+2	+3
46. Leaving home for the first time			−3	−2	−1	0	+1	+2	+3
47. Reconciliation with boyfriend/girlfriend			−3	−2	−1	0	+1	+2	+3
Other recent experiences which have had an impact on your life. List and rate.									
48._____			−3	−2	−1	0	+1	+2	+3
49._____			−3	−2	−1	0	+1	+2	+3
50._____			−3	−2	−1	0	+1	+2	+3

	0 to 6 mo	7 mo to 1 yr	extremely negative	moderately negative	somewhat negative	no impact	slightly positive	moderately positive	extremely positive
Section 2: Student Only									
51. Beginning a new school experience at a higher academic level (college, graduate school, professional school, etc.)			−3	−2	−1	0	+1	+2	+3
52. Changing to a new school at same academic level (undergraduate, graduate, etc.)			−3	−2	−1	0	+1	+2	+3
53. Academic probation			−3	−2	−1	0	+1	+2	+3
54. Being dismissed from dormitory or other residence			−3	−2	−1	0	+1	+2	+3
55. Failing an important exam			−3	−2	−1	0	+1	+2	+3
56. Changing a major			−3	−2	−1	0	+1	+2	+3
57. Failing a course			−3	−2	−1	0	+1	+2	+3
58. Dropping a course			−3	−2	−1	0	+1	+2	+3
59. Joining a fraternity/sorority			−3	−2	−1	0	+1	+2	+3
60. Financial problems concerning school (in danger of not having sufficient money to continue)			−3	−2	−1	0	+1	+2	+3

Received June 23, 1977 ■

APPENDIX B

THE TEACHING ANXIETY SCALE

THE TEACHING ANXIETY SCALE (TCHAS (1) - 29)

FORM IA

Intern Teacher Questionnaire

Name: _____

Date: _____

Your answers will be kept strictly confidential. Your principals and teaching supervisors will not have access to this information.

Instructions: Please read each question carefully.
Answer every question, even if it seems vague to you or difficult to answer.
Mark an "x" in only one box for each question. Be sure the "x" falls well within the box and does not extend into another box.

Use the following scale for all questions:

(1) Never (2) Infrequently (3) Occasionally (4) Frequently (5) Always

		Never (1)	Infrequently (2)	Occasionally (3)	Frequently (4)	Always (5)
*1.	I feel calm and collected when I think about holding parent-teacher conferences.	☐	☐	☐	☐	☐
2.	If I have trouble answering a student's question, I find it difficult to concentrate on questions that follow.	☐	☐	☐	☐	☐
3.	I feel uncomfortable when I speak before a group.	☐	☐	☐	☐	☐
*4.	I feel calm when I am preparing lessons.	☐	☐	☐	☐	☐
5.	I'm worried whether I can be a good teacher.	☐	☐	☐	☐	☐
*6.	I feel sure I will find teaching a satisfying profession.	☐	☐	☐	☐	☐

		Never (1)	Infrequently (2)	Occasionally (3)	Frequently (4)	Always (5)
*7.	I would feel calm and collected if a student's parent observed in my classroom.	☐	☐	☐	☐	☐
8.	I feel inferior to other preservice teachers in my teacher preparation program.	☐	☐	☐	☐	☐
*9.	I feel that students will follow my instructions.	☐	☐	☐	☐	☐
*10.	I feel secure with regard to my ability to keep a class under control.	☐	☐	☐	☐	☐
11.	I'm less happy teaching than I thought I'd be.	☐	☐	☐	☐	☐
12.	I feel nervous when I am being observed by my college supervisor.	☐	☐	☐	☐	☐
*13.	I feel confident about my ability to improvise in the classroom.	☐	☐	☐	☐	☐
*14.	I feel other teachers think I'm very competent.	☐	☐	☐	☐	☐
15.	I feel panicky when a student asks me a question I can't answer.	☐	☐	☐	☐	☐
16.	I feel anxious because I don't know yet whether I really want to be a teacher.	☐	☐	☐	☐	☐
*17.	I feel better prepared for teaching than other preservice teachers in my teacher preparation program.	☐	☐	☐	☐	☐
18.	Lack of rapport with my students is one of my biggest worries.	☐	☐	☐	☐	☐
19.	I would feel anxious if the principal informed me he was coming to my class to observe.	☐	☐	☐	☐	☐

		Never (1)	Infrequently (2)	Occasionally (3)	Frequently (4)	Always (5)
*20.	I find it easy to speak up in the staff room.	☐	☐	☐	☐	☐
21.	I worry about being able to keep the students interested in what I teach them.	☐	☐	☐	☐	☐
*22.	I find it easy to admit to the class that I don't know the answer to a question a student asks.	☐	☐	☐	☐	☐
23.	Deciding how to present information in the classroom makes me feel uncertain.	☐	☐	☐	☐	☐
*24.	I feel I will have good recall of the things I know when I am in front of the class.	☐	☐	☐	☐	☐
*25.	I feel I am as competent in the classroom as other preservice teachers in my teacher preparation program.	☐	☐	☐	☐	☐
26.	I'm concerned about how to use my testing of students as a useful indication of how effectively I'm teaching them.	☐	☐	☐	☐	☐
27.	I'm worried that differences in background between my students and me prevent me from teaching effectively.	☐	☐	☐	☐	☐
*28.	I am certain that my own personal "hang-ups" do not hinder my teaching effectiveness.	☐	☐	☐	☐	☐
29.	I'm uncertain whether I can tell the difference between really seriously disturbed students and those who are merely "goofing off" in class.	☐	☐	☐	☐	☐

APPENDIX C

TAYLOR MANIFEST ANXIETY SCALE

TAYLOR MANIFEST ANXIETY SCALE

Instructions: Please circle the following items as either true(T) or false(F) as they apply to you.

T F 1. I do not tire quickly.

T F 2. I am troubled by attacks of nausea.

T F 3. I believe I am no more nervous than most others.

T F 4. I have very few headaches.

T F 5. I work under a great deal of tension.

T F 6. I cannot keep my mind on one thing.

T F 7. I worry over money and business.

T F 8. I frequently notice my hand shakes when I try to do something.

T F 9. I blush no more often than others.

T F 10. I have diarrhea once a month or more.

T F 11. I worry quite a bit over possible misfortunes.

T F 12. I practically never blush.

T F 13. I am often afraid that I am going to blush.

T F 14. I have nightmares every few nights.

T F 15. My hands and feet are usually warm enough.

T F 16. I sweat very easily even on cool days.

T F 17. Sometimes when embarrassed, I break out in a sweat which annoys me greatly.

T F 18. I hardly ever notice my heart pounding and I am seldom short of breath.

T F 19. I feel hungry almost all the time.

T F 20. I am very seldom troubled by constipation.

T F 21. I have a great deal of stomach trouble.

T F 22. I have had periods in which I lost sleep over worry.

T F 23. My sleep is fitful and disturbed.

T F 24. I dream frequently about things that are best kept to myself.

T F 25. I am easily embarrassed.

T F 26. I am more sensitive than most other people.

T F 27. I frequently find myself worrying about something.

T F 28. I wish I could be as happy as others seem to be.

T F 29. I am usually calm and not easily upset.

T F 30. I cry easily.

T F 31. I feel anxiety about something or someone almost all the time.

T F 32. I am happy most of the time.

T F 33. It makes me nervous to have to wait.

T F 34. I have periods of such great restlessness that I cannot sit long in a chair.

T F 35. Sometimes I become so excited that I find it hard to get to sleep.

T F 36. I have sometimes felt that difficulties were piling up so high that I could not overcome them.

T F 37. I must admit that I have at times been worried beyond reason over something that really did not matter.

T F 38. I have very few fears compared to my friends.

T F 39. I have been afraid of things or people that I know could not hurt me.

T F 40. I certainly feel useless at times.

T F 41. I find it hard to keep my mind on a task or job.

T F 42. I am unusually self-conscious.

T F 43. I am inclined to take things hard.

T F 44. I am a high strung person.

T F 45. Life is a strain for me much of the time.

T F 46. At times I think I am no good at all.

T F 47. I am certainly lacking in self-confidence.

T F 48. I sometimes feel that I am about to go to pieces.

T F 49. I shrink from facing a crisis or difficulty.

T F 50. I am entirely self-confident.

APPENDIX D

AUTOSUGGESTION TRAINING PHRASES

AUTOSUGGESTION TRAINING PHRASES

The eyes should be gently closed and quiet. Relax the body in the following manner, visualizing and feeling the relaxation of each part as you proceed. Repeat each formula two or three times.

Relaxation Phrases. "I feel quite quiet...I am beginning to feel quite relaxed...My feet feel heavy and relaxed... My ankles, my knees, and my hips, feel heavy, relaxed, and comfortable...My solar plexus, and the whole central portion of my body, feel relaxed and quiet...My hands, my arms, and my shoulders, feel heavy, relaxed, and comfortable...My neck, my jaws, and my forehead feel relaxed. They feel comfortable and smooth...My whole body feels quiet, heavy, comfortable, and relaxed." Continue visualizing and repeating the phrases silently for a minute or two.

Warmth Phrases. While you remain relaxed and quiet, with your eyes closed, visualize your hands and repeat each of the following formulas. Concentrate in a passive way, visualize the event, and then just let it happen. "I am quiet and relaxed...My arms and hands are heavy and warm... I feel quite quiet....My whole body is relaxed and my hands are warm, relaxed, and warm...My hands are warm...Warmth is flowing into my hands, they are warm...warm." Continue visualizing and repeating the warmth phrases silently for a minute or two.

Reverie Phrases. While you remain relaxed and quiet, with your eyes closed, repeat the following formulas. Again,

concentrate in a passive way, visualize the event, and then just let it happen. "My whole body feels quiet, comfortable, and relaxed...My mind is quiet...I withdraw my thoughts from the surroundings and I feel serene and still...My thoughts are turned inward and I am at ease...Deep within my mind I can visualize and experience myself as relaxed, comfortable, and still...I am alert, but in an easy, quiet, inward-turned way...My mind is calm and quiet...I feel an inward quietness." Continue using the phrases for a few minutes, allowing your attention, your thoughts, to remain turned inward.

Activation Phrases. The session is now concluded and the whole body is reactivated with a stretch and deep breath and the phrases: "I feel life and energy flowing through my legs, hips, solar plexus, chest, arms and hands, neck, head, and face...The energy makes me feel light and alive."

APPENDIX E

INFORMED CONSENT AGREEMENT STUDY ON STUDENT TEACHER STRESS

INFORMED CONSENT AGREEMENT
STUDY ON STUDENT TEACHER STRESS

I,_____have had the purpose of this project explained to me. I understand that the general purpose of the procedures to be employed in this project is to reduce existing stress levels in student teachers and further help these persons to manage their reactivity in future stressful encounters.

I understand that the personal information to be collected during the course of this project is essential to the project and this information is confidential and will not be released to anyone without my express written permission. I give the primary researcher, Patrick Lustman, permission to obtain any necessary information from my file and records. In any research report prepared subsequent to this project, I will not be identified by name, and other identifying information will be changed so as to protect my identity. I understand that I can stop participation in the study at any time during the study. This consent agreement will terminate March 1, 1980, but the terms of confidentiality are extended indefinitely.

Signed_____

Date_____

Witness_____

I certify that I have read this document, or had it read to me, prior to my signing it.

Signed_____

APPENDIX F

DESCRIPTION OF THE TOWARD EXCELLENCE IN ELEMENTARY EDUCATION PROGRAM (EEE)

Toward Excellence in Elementary Education Program (EEE)

The EEE program, an outgrowth of prior TTT and Teacher Corps programs, is a collaborative program effort between the Lansing Public Schools and Michigan State University. The 3-year-long education program emphasized consistent use of the instructional design and instructional processes of assessment, goal and objective setting, developing teaching strategies, and evaluation. Also stressed are the application of Piaget's notions of growth and development and a pupil management model built around the concepts of creating, maintaining and restoring optimal learning conditions. Throughout their program, interns are continually involved in public school teaching, community activities, interpersonal communication skill development, and integrated coursework. The courses provide an integration of content, teaching methods and university-supervised field experiences. Application of the content and teaching methods are applied in the lansing area urban and suburban public schools. The last year consists primarily of an internship, supervised by the program staff, in which the instructional processes, growth and development knowledge, management procedures and methodology are applied comprehensively for an extended period.

APPENDIX G

SPECIFICATIONS OF EMG EQUIPMENT

Technical Specifications of the J & J EMG Model M-55

Amplifer
Differential type, fully protected

Input noise: 0.2 uV RMS maximum
Common mode rejection greater than 100 db
60 H_2 notch filter, 40 db notch depth
60 H_2 normal mode rejection, 60 dg
Four bandpasses
Ten ranges: 1-1000 uV full scale
Input impedance: 10 megohms

Feedback

Meter: direct reading, uV RMS calibration better than 3%
Outputs: raw EMG, selected band EMG, rectified EMG, audio, meter signal

Controls

Range: 1, 2, 5, 10, 20, 50, 100, 200
500, 1000 uV full scale
Threshold: 0 to full meter scale

Inputs

Electrode test, electrode operate
Electrodes: (3) silver/silver chloride fully shielded, screw-on type

Power

Clinical: (4) size "D" flashlight cells

APPENDIX H

SPECIFICATIONS OF ELECTRONIC SCORE KEEPER

Technical Specifications of the J & J LGS-150 Digital Integrating Score-Keeper

Display

3 1/2 digit LED display, 0.5% accuracy

Count indicator: lights when integrating

Controls

Time Bse: .25s, 25, 4s, 8s, 15, 30s, 1m, 2m, 4m, 8m, 16m, 32m

Range and function: Temperature, threshold, microvolts: 1, 2, 5, 10, 20, 50, 100, 200, 500, 1000.

APPENDIX I

SUMMARY OF PRETEST AND POSTTEST MEANS AND STANDARD DEVIATIONS

Summary of the Pretest and Posttest Means for all Subjects across all Dependent Measures

Dependent Measure	Pretest Mean	Pretest Standard Deviation	Posttest Mean	Posttest Standard Deviation
Systolic Blood Pressure	116.77	6.61	113.7	7.30
Diastolic Blood Pressure	69.74	6.40	68.08	7.41
Taylor-Manifest Anxiety Scale	15.79	7.65	13.79	7.75
Teaching Anxiety Scale	66.29	13.45	61.25	12.60

Summary of the Pretest and Posttest Means for the Biofeedback Treatment Condition

Dependent Measure	Pretest Mean	Pretest Standard Deviation	Posttest Mean	Posttest Standard Deviation
Systolic Blood Pressure	114.87	6.63	108.31	7.42
Diastolic Blood Pressure	68.81	6.90	65.31	6.05
Taylor-Manifest Anxiety Scale	13.37	5.15	10.75	3.19
Teaching Anxiety Scale	65.00	11.00	55.37	11.35

Summary of the Pretest and Posttest Means for the Stress Inoculation Treatment Condition

Dependent Measure	Pretest Mean	Pretest Standard Deviation	Posttest Mean	Posttest Standard Deviation
Systolic Blood Pressure	118.06	6.52	113.06	5.46
Diastolic Blood Pressure	71.34	6.50	67.81	9.39
Taylor-Manifest Anxiety Scale	14.87	5.61	10.87	3.22
Teaching Anxiety Scale	69.75	11.39	61.12	5.93

Summary of the Pretest and Posttest Means for the No-Treatment Control Condition

	Pretest		Posttest	
Dependent Measure	Mean	Standard Deviation	Mean	Standard Deviation
Systolic Blood Pressure	117.37	7.12	119.75	3.86
Diastolic Blood Pressure	69.06	6.36	71.12	6.03
Taylor-Manifest Anxiety Scale	19.12	10.68	19.75	10.78
Teaching Anxiety Scale	64.12	17.97	67.25	16.65

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