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EFFECTS OF ELECTROMYOGRAPHIC BIOFEEDBACK TRAINING
ON LOCUS OF CONTROL AND ANXIETY OF
DEAF COLLEGE STUDENTS

by
Kay Marlene Seward

A Dissertation Submitted to the Faculty of the
DEPARTMENT OF REHABILITATION
In Partial Fulfillment of the Requirements
For the Degree of
DOCTOR OF PHILOSOPHY
In the Graduate College
THE UNIVERSITY OF ARIZONA

1983
As members of the Final Examination Committee, we certify that we have read the dissertation prepared by Kay Marlene Seward entitled EFFECTS OF ELECTROMYOGRAPHIC BIOFEEDBACK TRAINING ON LOCUS OF CONTROL AND ANXIETY OF DEAF COLLEGE STUDENTS and recommend that it be accepted as fulfilling the dissertation requirement for the Degree of Doctor of Philosophy.

Final approval and acceptance of this dissertation is contingent upon the candidate's submission of the final copy of the dissertation to the Graduate College.

I hereby certify that I have read this dissertation prepared under my direction and recommend that it be accepted as fulfilling the dissertation requirement.

Dissertation Director

Date
STATEMENT BY AUTHOR

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SIGNED: Kay Marlene Luard
Dedicated to my parents,

LOUIS AND EUNICE SEWARD
ACKNOWLEDGMENTS

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I wish to thank the students at the National Technical Institute for the Deaf who volunteered to be subjects in this study. Without their willingness to learn and to share themselves, this research could not have occurred.

I want to acknowledge the love and support of my family, James and Christa Savely, whose patience and understanding during the completion of this project deserves special recognition.
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ABSTRACT

This study investigated the effects of frontalis electromyographic biofeedback training on internality, externality, anxiety, and muscle tension of deaf college students. Student volunteers enrolled at a post-secondary institution providing support services for the deaf were randomly assigned to either an experimental group or a no-treatment control group. The experimental group consisted of 36 subjects (21 males, 15 females) and the control group included 34 subjects (18 males, 16 females).

Pretreatment and posttreatment baseline measures of the dependent variables of locus of control, anxiety, and electromyographic (EMG) levels were recorded using the Learning Styles Inventory (National Technical Institute for the Deaf at Rochester Institute of Technology, New York), A Test of Attitudes (F. J. Dowaliby, National Technical Institute for the Deaf at Rochester Institute of Technology, New York), and the Myosone 409 EMG Monitor/Data Processor (Bio-Logic Devices, Inc., Plainview, New York). The experimental group received six half-hour biofeedback sessions during a 3-week treatment phase. The control group was not seen during the treatment phase.

Results of analyses of covariance indicated that frontalis electromyographic biofeedback training had no significant effects on internality ($F = .009, p = .923$), externality ($F = .014, p = .905$), and anxiety ($F = .536, p = .467$). Significant differences ($F = 3.851$, \[ \text{ix} \]
were found between experimental and control groups on electromyographic levels.

Findings suggest that frontalis electromyographic biofeedback training can be used to reduce muscle tension in a deaf population. This has implications for the prevention and reduction of stress-related disorders. Further research is needed to determine the effects of a longer biofeedback training period on locus of control and anxiety.
CHAPTER 1
INTRODUCTION

Biofeedback has demonstrated that many physiological processes can be brought under conscious control. Over 50 major physical, psychological, and psychosomatic problems have been treated using biofeedback procedures with equal or greater success than using conventional modes of treatment (Brown, 1977).

The holistic health movement has provided impetus for individuals to reclaim responsibility for their minds and bodies. Biofeedback has provided the procedures to regain self-control. "Through the provision of cues which can be utilized to regulate responses, a person may learn that control is self-generated. In a real sense, the process is one of achieving an enhanced belief in internal locus of control" (Stern & Berrenberg, 1977, p. 174). Individuals with an internal locus of control have the general belief that outcomes are contingent upon their behaviors. Externally controlled individuals believe that outcomes are determined by fate, luck, or powerful others and are not contingent upon their behaviors (Rotter, 1966).

Achievement in education has been shown to relate to disabled and nondisabled persons' locus of control orientations (Kloeppping, 1972; Rotter, 1966; Tseng, 1970). The positive relationship of individuals' internal locus of control orientations and their physical and psychological rehabilitation has been supported (Goldstein & Reznikoff, 1971;
Distefano, Pryer & Smith, 1971; Shipe, 1971). There also appears to be a relationship between disabled persons' locus of control orientations and their vocational rehabilitation (Garrity, 1973; MacDonald, 1971, 1972; Tseng, 1970). Professionals need to be aware that they can facilitate changes in locus of control through psychotherapeutic intervention and through biofeedback training (Dua, 1970; Zimet, 1979).

Biofeedback has been used extensively for stress and anxiety reduction (Budzynski & Stoyva, 1973; Coursey, 1975). Stress and anxiety have been associated with locus of control (Smith, 1973). The use of biofeedback to reduce the symptoms of stress and anxiety has also had the effect of modifying locus of control orientation toward internality (Stern & Berrenberg, 1977). Previous research examining the variables of biofeedback, locus of control, and anxiety has been with normally hearing individuals. The current study examines the effect of biofeedback training on locus of control and anxiety with deaf students.

**Statement of Problem**

This study is concerned with the application of electromyographic (EMG) biofeedback training in shifting the locus of control orientation of deaf college students. Inherent to the shift from externality toward internality is the ability of the deaf individual to reduce muscle tension and to perceive himself as being the cause rather than the effect of the lowered muscle activity.

This study will provide information pertaining to the usefulness of biofeedback with deaf students for stress and anxiety reduction.
The findings may be generalizable to other deaf people who want to reduce or prevent symptoms of stress. The findings may help professionals in the areas of rehabilitation and education who are direct service providers and who are responsible for program planning.

**Research Question**

This study was designed to answer the question: Can frontalis electromyographic biofeedback training shift the locus of control orientation and reduce the anxiety of deaf college students?

**Hypotheses**

This study is based on the general hypothesis that frontalis electromyographic biofeedback training does shift locus of control orientation toward internality and reduce anxiety of deaf college students.

For research purposes, the following null hypotheses were tested:

1. **Hypothesis 1**: There is no difference between experimental and control groups on locus of control as measured by the Learning Styles Inventory (Dowaliby, Burke & McKee, 1982).

2. **Hypothesis 2**: There is no difference between experimental and control groups on anxiety as measured by A Test of Attitudes (Dowaliby, 1981).

3. **Hypothesis 3**: There is no difference between experimental and control groups on final baseline EMG levels.
4. **Hypothesis 4:** There is no relationship between muscle activity as measured by EMG and locus of control orientation as measured by the Learning Styles Inventory.

5. **Hypothesis 5:** There is no relationship between muscle activity as measured by EMG and anxiety as measured by A Test of Attitudes.

6. **Hypothesis 6:** There is no relationship between locus of control as measured by the Learning Styles Inventory and anxiety as measured by A Test of Attitudes.

**Rationale for Study**

Biofeedback refers to the presentation of biological information to individuals so that individuals can modify physiological processes (Beatty & Legewie, 1977). Learning to control physiological functioning leads to what Brown (1977, p. 25) referred to as "probably the most revolutionary aspect of biofeedback." There is a shift in locus of control from external to internal dependence. "The link between biofeedback training and a shift toward internal locus of control involves two steps: (1) viewing outcomes as controllable and (2) developing a specific cognition that internal factors (one's own efforts) contribute more as determinants of outcomes than do external factors" (Stern & Berrenberg, 1977, pp. 180-181). Biofeedback training enables individuals to experience the relationship between thought processes or "mind" and body.

Locus of control orientation and anxiety levels can be modified by biofeedback training. A positive relationship between frontalis electromyographic (EMG) level at rest and the personality traits of anxiety
and external control has been found (Smith, 1973). Decreases in anxiety level and shifts toward internality have also been found to correlate with reductions in EMG tension level (Kothare, 1978). Test-anxious students are reported as being more external (Tuttle, 1978) and as being able to reduce test anxiety by EMG biofeedback training (Kappes & Michaud, 1978; Reed & Saslow, 1980).

Limited research on locus of control orientation of deaf individuals has shown deaf people to be external on locus of control measures (Bodner & Johns, 1977; Koelle, 1971; Nielsen, 1969). These results appear to be consistent with previous research on locus of control of disabled persons and persons with minority group status (Lefcourt, 1966; MacDonald, 1972). To the extent that deaf people form a subgroup (Davis & Silverman, 1978), they may perceive themselves as having minimal power and access to opportunities.

Currently, no studies are found in the professional literature that have used biofeedback as a general relaxation technique or that have attempted to modify locus of control orientation with deaf persons. Only a few studies have measured locus of control orientation of deaf individuals. Because of reported successes in reducing anxiety and shifting locus of control in normally hearing persons, a similar use of biofeedback with deaf persons needs to be explored.

**Definition of Terms**

The following terms are used in this study and are defined for the purposes of this project.
Biofeedback refers to the presentation of biological information to an individual so that individual can modify physiological processes (Beatty & Legewie, 1977).

Electromyographic (EMG) biofeedback is a technique by which myoelectric signals from the muscle are translated into auditory and visual signals to enable an individual to gain voluntary control of striated muscles (Wolf, 1979).

Locus of control refers to individuals' expectations of how reinforcement is controlled. Persons with an internal locus of control believe that their behaviors influence outcomes. Externally oriented persons do not perceive a contingency relationship between their actions and outcomes (Rotter, 1966).

Anxiety is an uncomfortable state of tension involving heightened physiological arousal and emotionality (Budzynski & Peffer, 1980).

**Assumptions Underlying Study**

The following assumptions were made in this study:

1. Frontalis electromyographic biofeedback training reduces muscle activity in the specific muscle site and generalizes to produce an overall state of muscle relaxation.

2. Anxiety and stress represent a physical and emotional state. This state can be measured as muscle tension by electromyography. It can also be measured by a paper-and-pencil test consisting of items describing overt symptoms of this state.

3. Locus of control is a multidimensional personality construct that can be measured by a paper-and-pencil test. An external orientation is
generally less desirable than an internal orientation. Modification of an external locus of control orientation affects the behaviors associated with externality.

4. Deaf individuals are accustomed to using visual information and will have no problems in processing visual biofeedback information.

Limitations of Study

The study was restricted to students at the National Technical Institute for the Deaf (NTID). The students who participated in the study were paid volunteers. These students may not be representative of the NTID student population. The students at NTID may not be representative of other deaf students attending less technically oriented institutions. The results of this study may or may not be generalizable beyond this specific population.
CHAPTER 2

REVIEW OF LITERATURE

The review of literature relevant to the study is presented in this chapter. The review is presented in three sections. The first section focuses on the theoretical construct of biofeedback, the use of electromyographic biofeedback in stress and anxiety reduction, the relationship of biofeedback with locus of control, and the use of biofeedback with deaf persons. The second section focuses on the theoretical construct of locus of control, the importance of the locus of control construct for disabled persons and more specifically for deaf persons, and the implications of locus of control for rehabilitation. The third section focuses on deafness and psychological and social adjustment and implications for counseling.

Biofeedback

Biofeedback is the technique or process of presenting physiological information to an individual to enable the individual to control bodily functioning. Any biological process that can be continuously monitored and made available to the individual has the potentiality of being changed or controlled (Green, Green & Walters, 1970; Pelletier, 1977).
Theoretical Construct

The interrelatedness of mind and body with the implications of voluntary control of bodily processes is expressed by the psychophysiological principle:

Every change in the physiological state is accompanied by an appropriate change in the mental-emotional state, conscious or unconscious, and conversely, every change in the mental-emotional state, conscious or unconscious, is accompanied by an appropriate change in the physiological state (Green et al., 1970, p. 3).

Astor (1977) referred to the mind and body connection as forming a closed-loop system that functions and exists as a unit. His comparison of biofeedback therapy and a household furnace thermostat may be useful to the biofeedback practitioner (Table 1). Green and Green (1975) referred to a cybernetic control loop that connects unconscious and involuntary processes (Figure 1). Biofeedback is used temporarily until internal control is learned.

Exactly how this learning takes place is not understood. Early research by Miller (1969) gave support to the use of operant conditioning to modify the responses of the autonomic nervous system. Previous research had suggested that operant learning involved voluntary skeletal responses in the cerebrospinal system and that the autonomic nervous system was modified only by classical conditioning (Olton & Noonberg, 1980; Winer, 1977).

There is some debate as to whether biofeedback learning should be called conditioning or voluntary control (Olton & Noonbery, 1980; Schwartz, 1973). Green and Green (1975, p. 6) said that "the conditioning paradigm suitable for animals (and useful in the treatment
Table 1. The closed-loop system as a continuous concept. -- From Astor (1977, p. 617).

<table>
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<tr>
<th>Biofeedback Therapy</th>
<th>Household Furnace Thermostat</th>
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<td>Patient experiences tension.</td>
<td>The house is cold.</td>
</tr>
<tr>
<td>Feedback device informs patient. Through amplification and transmission of tension signals, patient is made aware of bodily function.</td>
<td>Temperature reads cold and tells thermostat to transmit this information to the furnace.</td>
</tr>
<tr>
<td>Having this information, through mental activity and internal manipulation, patient is able to tell his muscles or heart-beat to relax or slow down.</td>
<td>Furnace gets the information. Depending on homeowner adjustments, furnace is able to tell itself to get going and to fire up.</td>
</tr>
<tr>
<td>Desired physiological effect is achieved and patient receives new feedback confirming that body is cooperating with his will to self-regulate.</td>
<td>The firing furnace sends heat up to the house and the thermometer confirms this and tells the thermostat that the furnace is cooperating.</td>
</tr>
<tr>
<td>Symptom relief occurs; patient becomes more relaxed and less anxious, fearful, and apprehensive.</td>
<td>The house is warmed, the temperature is up, the thermostat instructs the furnace to stop burning. The homeowner is warmed and satisfied.</td>
</tr>
</tbody>
</table>
Sensory perception of OUTS events, stressful or otherwise (upper left box), leads to a physiological response along Arrows 1 to 4. If the physiological response is "picked up" and fed back (Arrow 5) to a person who attempts to control the "behavior" of the Feedback device, then Arrows 6 and 7 come into being, resulting in a "new" limbic response. This response in turn makes a change in "signals" transmitted along Arrows 3 and 4, modifying the original physiological response. A cybernetic loop is thus completed and the dynamic equilibrium (homeostasis) of the system can be brought under voluntary control. Biofeedback practice, acting in the opposite way to drugs, increases a person's sensitivity to INS events and Arrow 8 develops, followed by the development of Arrows 9 and 10. External feedback is eventually unnecessary because direct perception of INS events becomes adequate for maintaining self-regulation skills. Physiological self control through classical yoga develops along the route of Arrows 7-3-4-9-10-7, but for control of specific physiological and psychosomatic problems biofeedback training seems more efficient.
of small children and in severely retarded or brain damaged persons) may be unsuitable for thinking self-conscious individuals." The term "passive volition" was used by Green et al. (1970) to describe what an individual uses to control the involuntary nervous system.

Pelletier (1975) said that few theories have attempted to explain how automatic control happens. He used the term "passive attention" to describe the learning necessary to create a harmonious interaction of mind and body. The passivity allows for a "letting go," or state of detachment, that allows the autonomic system to respond to the presented biofeedback information.

Brown (1974, 1977) related to the biofeedback learning process as a cognitive process. She (1977, p. 23) said, "The consensus of the biofeedback practitioners and users is, however, almost unanimous in the impression that biofeedback deals with higher mind processes of awareness, interior concentration, subliminal perception, and complex mental processes."

Use of EMG Training in Stress and Anxiety Reduction

Although there are several definitions of stress and anxiety, both involve heightened physiological arousal. Both are helpful to the individual if they are motivational or lifesaving. However, they become maladaptive under the following conditions (Budzynski & Peffer, 1980):

1. When the physiological response is elicited too frequently and maintained too long.

2. When the response is inappropriate to the task resulting in decreased performance.
3. When recovery to prestress levels is prolonged.
4. When physiological arousal provides no release for muscular tension.
5. When the response contributes to mental and physical problems.

The use of deep muscle relaxation to reduce the physiological response to stress and anxiety has been supported by the work of Jacobson (1938), Wolpe (1958), and Schultz and Luthe (1959). In 1969, Budzynski and Stoyva described their use of an analog information feedback system to obtain deep muscle relaxation. They suggested that biofeedback could help people to obtain deeper states of relaxation more quickly than possible by conventional methods. Budzynski and Stoyva used the frontalis muscle as a target site for relaxation training because of the reported difficulty in relaxing the muscle (Balshan, 1962). They reasoned that successful relaxation of the frontalis using biofeedback would support the use of biofeedback to train less difficult muscles in relaxation.

Since Budzynski and Stoyva's (1969, 1973) early successes in using frontalis EMG training as a relaxation procedure with normal subjects and with chronically anxious subjects, there has been a proliferation of research using biofeedback for general relaxation and for specific stress-related disorders.

Coursey (1975) compared frontalis EMG levels in a feedback group of 10 normal undergraduate male subjects with two no-feedback control groups. One control group received specific instructions about relaxation, whereas the other control group was only told to relax.
Each subject had one baseline session and seven 21-minute sessions for a 2-week time period. Results showed that EMG feedback was more effective in lowering specific (frontalis) muscle activity than either verbal instructions or the subject's own unassisted attempts.

Similar results were reported by Haynes, Moseley & McGowan (1975) with 101 male and female university students in a one-session design. Biofeedback produced lower frontalis EMG levels more quickly than either active relaxation (tensing-relaxing exercises) or passive relaxation (focusing and passively relaxing).

Reinking and Kohl (1975) also found frontalis EMG feedback to produce lower levels of muscle activity more quickly than classical Jacobson-Wolpe cognitive training exercises. Fifty undergraduate students were assigned to four relaxation conditions and a no-feedback control group. The four treatment groups were: (1) classic Jacobson-Wolpe instructions, (b) EMG feedback, (c) EMG feedback plus Jacobson-Wolpe instructions, and (4) EMG feedback plus a monetary reward. Subjects in the three biofeedback groups decreased EMG levels by almost 90%, whereas the classic relaxation group reduced muscle tension by 50% over the 12 training sessions.

In addition to the use of frontalis EMG feedback for relaxation training with normal subjects, research supports its use with persons suffering from chronic anxiety.

Raskin, Johnson, and Rondestvedt (1973) used frontalis EMG training with 10 patients with severe generalized chronic anxiety. Psychotherapy and medication had not been successful with these individuals. Feedback was given for 5 one-hour sessions per week
until a 2.5 μV peak-to-peak criterion level was maintained for 25 minutes. Patients then received two biofeedback sessions per week for 8 weeks and practiced at home two half-hour sessions per day. All 10 patients reduced frontalis muscle activity. Three patients showed moderate improvement with one patient reporting lessening of all anxiety symptoms. Four patients with headaches reported improvement after biofeedback training. Five out of 6 patients suffering insomnia reported improvement in going to sleep.

Canter, Kondo, and Knott (1975) compared biofeedback and progressive relaxation in the treatment of 28 patients with anxiety neurosis and complaints of muscle tension and insomnia. Both biofeedback and progressive relaxation produced significant reductions in frontalis EMG activity, but the reductions were greater for the biofeedback group. Patients' self-reports and their therapists' ratings of changes in anxiety symptoms gave support to the superiority of EMG feedback training over progressive relaxation.

Townsend, House, and Addario (1975) compared the effects of frontalis EMG training and general muscle relaxation with the effects of group psychotherapy for chronically anxious patients. The feedback group showed a significant reduction in EMG activity during feedback treatment and had greater clinical improvement relative to initial mood and anxiety ratings.

Lavallée et al. (1977) compared frontalis EMG feedback and diazepam (Valium), alone and in combination, for 40 patients with free-floating anxiety. The effects of frontalis EMG feedback plus diazepam were additive in reducing muscle tension during the treatment phase.
Diazepam-treated patients did less well than other subjects on anxiety measurements. EMG feedback without diazepam had more prolonged therapeutic effect than did tranquilizing medication.

Frontalis EMG biofeedback has also been found to be an effective relaxation training technique in educational settings. Engelhardt (1978) described a program incorporating biofeedback and other relaxation skills into the curricula of a public school system. A correlation between muscle relaxation skill acquisition, anxiety levels (state and trait) and self-concept was reported for primary and secondary students. Decreases in muscle tension and anxiety levels correlated with positive self-concept.

Hodge and Collatz (1980) evaluated the efficacy of EMG biofeedback training in improving examination performance of test-anxious college students. Students receiving EMG feedback while taking practice examinations had significantly lower muscle tension levels and test anxiety scores, and their performance on classroom examinations improved.

Stout, Thornton, and Russell (1980) found that college students in a remedial academic program who received frontalis EMG biofeedback had greater course attendance than either students assigned to a progressive relaxation group or a no-treatment control group. The biofeedback group and the progressive relaxation group had significantly better semester averages than the control group.

It is apparent that frontalis EMG biofeedback has been effective as a relaxation training procedure. In fact, Qualls and Sheehan (1981) in their survey of published literature relating to EMG biofeedback as a
relaxation technique did not find a single study that did not report a reduction in frontalis EMG recordings. The reviewers (1981, p. 22) concurred with Davis (1980) in that "the frontalis decreases attained during EMG biofeedback reflect a relaxation response and cannot simply be attributed to the effects of adaptation." Qualls and Sheehan also found frontalis EMG biofeedback to be as effective as other relaxation techniques in reducing muscle tension levels or alleviating tension-related disorders.

Mention should be made that there is a dispute over the efficacy of frontalis EMG feedback as a technique for producing general relaxation. Several studies have failed to find relaxation of the frontalis generalizing to other muscle groups (Alexander, 1975; Fee & Girdano, 1978; Fridlund, Fowler & Pritchard, 1980; LeBoeuf, 1980; McGowan, Haynes & Wilson, 1979; Whatmore, Whatmore & Fisher, 1981; Yock, 1978). Other studies have supported the generalization of frontalis EMG feedback to other muscle sites (Finley et al., 1977; Glaus & Kotses, 1979; Stoyva & Budzynski, 1974) and to other bodily response systems (DeGood & Chisholm, 1977; Sittenfeld, Budzynski & Stoyva, 1976; Stoyva, 1977).

It is important to remember that in practice the biofeedback clinician evaluates the individual and proceeds according to the needs of that person. A physiological stress profile and the procedure of shaping a pattern of low arousal contribute to the efficacy of biofeedback training for the individual (Stoyva, 1979).
Relationship with Locus of Control

Research studies on locus of control and biofeedback have investigated the efficacy of using (1) locus of control orientation to predict biofeedback performance and (2) biofeedback to shift locus of control from externality to internality.

Several studies have indicated that subjects with an internal locus of control orientation (internals) perform better during EMG biofeedback than subjects with an external locus of control orientation (externals) (Carlson, 1977; Fotopoulos & Binegar, 1977; Reinking, 1977). Qualls and Sheehan (1981, p. 37) stated, "The locus of control research suggests that EMG biofeedback is preferable as a relaxation procedure for subjects with an internal locus of control rather than an external locus of control." Other studies have found no difference between subjects with an internal locus of control orientation and subjects with an external locus of control orientation on EMG biofeedback performance (Carlson & Feld, 1978; Herzog, 1978; Stern & Berrenberg, 1977).

Performance in biofeedback training may be dependent on the instructions or structure provided by the therapist. Zimet (1979, p. 873) stated, "It would appear that as long as a highly structured framework is provided for externals and a loosely structured one is provided for internals, biofeedback treatment may be equally effective for both groups."

Several studies support the efficacy of using EMG biofeedback training to shift locus of control from externality to internality. This suggests that biofeedback training may be an effective technique to strengthen a person's belief in self-control. It also suggests that
initial differences between internals and externals may decrease with extended biofeedback training.

Stern and Berrenberg (1977) compared the effects of frontalis EMG feedback with false feedback and no-feedback controls. The 33 subjects, volunteers from undergraduate psychology classes, participated in three weekly sessions of 25 minutes each. The biofeedback training proved effective in reducing frontalis muscle activity and in shifting locus of control toward internality as measured by the Rotter I-E scale.

Carlson (1977) also found frontalis EMG levels to be lower for the biofeedback group than for the constant pitch feedback control group. Internal subjects were able to achieve lower EMG levels than external subjects. External subjects receiving EMG feedback had a significant shift in locus of control orientation toward the internal direction. This study involved 48 undergraduates receiving a total of 10 sessions, 2 initial and 8 feedback, of 20 minutes each for 5 weeks. There were no baseline differences between internals and externals on EMG levels. Carlson (1977, p. 269) said that this "indicates that generalized expectancies concerning one's control over behavioral consequences are likely to be important only when subjects are task-involved."

A study by Carlson and Feld (1978) assessed the influence of social reinforcers on frontalis EMG biofeedback training for internals and externals. Externals were predicted to respond more to the social reinforcer than internals with the subsequent EMG performance differences being minimized. The results showed no significant differences
between internals and externals on EMG training to facilitate muscle relaxation. Externals appeared more affected by the removal of social reinforcers in the posttraining stage. There was a significant shift toward internality on locus of control scores for external subjects receiving biofeedback.

Another study (Holliday & Munz, 1978) assessed the effects of EMG biofeedback training on locus of control by comparing a group of psychosomatic subjects using biofeedback to control psychosomatic problems with a group of nonpsychosomatic subjects using biofeedback to relax. In addition to giving the Rotter scale and a modified Levenson scale to measure locus of control, the Tennessee Self-concept Scale was given to assess before and after changes in self-esteem. Use of biofeedback to reduce psychosomatic problems was assumed to increase self-esteem and self-mastery more than use of biofeedback merely to relax. Results of the study showed no significant changes in self-esteem in either the psychosomatic group or in the nonpsychosomatic group. Findings indicated that subjects will change their beliefs about their self-control capabilities if physiological control gained by biofeedback has led to a sense of mastery over themselves. Both groups had significant decreases in frontalis EMG levels. The psychosomatic group had a 44% decrease in symptoms during the last 2 weeks of biofeedback. The nonpsychosomatic group reported more control over minor psychological problems such as instability. Only the nonpsychosomatic group, however, showed a significant shift toward internality on the I-E scales. This has led Zimet (1979, p. 879) to state: "The relative success or failure of biofeedback (or any therapy) at modifying
externality may not only be a function of the therapy, but may also be due to the particular population.

Use with Deaf Persons

Few studies are available on the use of biofeedback with deaf persons. Most of these studies are in the area of speech training. In fact, the work of Alexander Graham Bell in developing a technique of visible speech for training profoundly deaf persons to speak is considered an antecedent to biofeedback training (Yates, 1980).

Yates (1980, p. 3) described two early devices used to display the vibrations of speech. One was a phonautograph invented by Leon Scott. As a person spoke into the wider end of a cone, the diaphragm across the narrow end vibrated. The vibrations were transferred by a cork to the free-moving end of a rod that traced a pattern on smoked glass. Another device was the manometric flame invented by Rudolph Koenig. A membrane was stretched across a hole in a gas pipe. Speech vibrations caused variations in the gas pressure affecting the visible gas flame. The flame was reflected in mirrors so that the bands of light produced a pattern for each sound.

These early attempts and more recent attempts to present visible feedback of speech sound have been unable to reflect the natural flow of speech. The work of Nickerson, Kalikow, and Stevens (1976) in the development of a system of computer-controlled visual displays of speech characteristics represents an advancement in this area. The computer has various modes of visual displays for whatever aspect
of speech is being monitored. A correct model of speech can be visually displayed with the deaf person attempting to match it.

Holbrook and Crawford (1970) described a device that uses operant conditioning to shape pitch levels. The deaf subject is reinforced by a colored light if the appropriate response is made. An incorrect response elicits a different color of light. Positive results in reducing high-pitch levels of four deaf adults was reported. A 3-month follow-up found that pitch levels remained in the normal range.

Another example of biofeedback in speech training is Stratton's (1974) use of tactile feedback. The deaf subject feels the vibrations of variations in pitch through the fingers. The deaf person may experience the vibrations of correctly produced words and phrases and then attempt to match them.

Only two studies unrelated to speech training were found in the professional literature. Sachs, Martin, and Fitch (1972) reported that visual feedback resulted in improved motor functioning for a functionally deaf cerebral-palsied child. Finley et al. (1978) reported the use of audio and visual feedback to control brainstem response. They proposed that biofeedback may reduce the auditory threshold in some persons with partial hearing loss.

Locus of Control

Concern for man's ability to control his personal environment has generated much research in the area of locus of control. Rotter (1975) suggested that the increasing complexity of society with the
subsequent feeling of powerlessness at all levels of society stimulates this interest.

Theoretical Construct

The concept of internal versus external control of reinforcement developed out of social learning theory (Rotter, 1954; Rotter, Chance & Phares, 1972). The concept is defined as follows:

When a reinforcement is perceived by the subject as following some action of his own but not being entirely contingent upon his action, then, in our culture, it is typically perceived as the result of luck, chance, fate, as under the control of powerful others, or as unpredictable because of the great complexity of the forces surrounding him. When the event is interpreted in this way by an individual, we have labeled this a belief in external control. If the person perceives that the event is contingent upon his own behavior or his own relatively permanent characteristics, we have termed this a belief in internal control (Rotter, 1966, p. 1).

Social learning theory has four classes of variables: behaviors, expectancies, reinforcements, and psychological situations. The potential for behavior to occur in any specific psychological situation is seen as a function of the expectancy that the behavior will lead to a particular reinforcement in that situation and the value of that reinforcement. Expectancies in a specific situation are determined not only by the specific experiences of the situation but also by the individual's perception of similar experiences in other situations. Locus of control as a psychological construct is considered a generalized expectancy variable that operates across many situations and relates to an individual's perception of control or power over the reinforcements (Rotter, 1975).

In contrast to Rotter's unidimensional locus of control construct, Wiener (1979, p. 7) proposed a "locus of causality" with three
dimensions. Causes are categorized as (1) internal or external to the individual, (2) stable or unstable, and (3) controllable or uncontrollable (Table 2).

Table 2. Causes of success and failure, classified according to locus, stability, and controllability. -- After Weiner (1979, p. 7).

<table>
<thead>
<tr>
<th>Controllability</th>
<th>Internal</th>
<th>External</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Stable</td>
<td>Unstable</td>
</tr>
<tr>
<td>Uncontrollable</td>
<td>Ability</td>
<td>Mood</td>
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<td></td>
<td>Unstable</td>
<td>Stable</td>
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<tr>
<td></td>
<td>Unstable</td>
<td>Unstable</td>
</tr>
<tr>
<td>Controllable</td>
<td>Typical effort</td>
<td>Immediate effort</td>
</tr>
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<td></td>
<td>Teacher bias</td>
<td>Unusual help from others</td>
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Weiner stated that each of the dimensions of causality has a primary psychological function. The locus dimension has implications for self-esteem. The stability dimension relates to the magnitude of expectancy change following success or failure. The control dimension relates to how others view a person's responsibility for success and failure and how others help, evaluate, and feel about the person as a result of this perceived control.

Weiner suggested that in achievement-related contexts, a person progresses through a cognition-emotion sequence: (1) a feeling is generated by an outcome, (2) the outcome is attributed to some cause, (3) a connection is made between the feeling state and the cause that
contributes to forming a perception of self, and (4) expectancies for future outcomes are formed.

The expectancy of success depends on past success attributed to internal, stable, and controllable causes.

Research with Disabled Persons

Comparisons between disabled and nondisabled persons on locus of control orientation have generally supported the relative externality of disabled individuals. Among disabled populations, the less externally oriented persons have been found to have attributes considered more positive for success in education and rehabilitation.

Land and Vineberg (1965) compared blind children to normally sighted children on the Bialer-Cromwell Children's Locus of Control Scale (Bialer, 1960) and found blind children to be significantly (p < .01) less internal. All subjects were in the normal range of intelligence with ages ranging from 6 years 6 months to 14 years. All blind subjects had had an onset of blindness before 5 years of age. Although it was hypothesized that blind children in a public school setting would be more internal than blind children in a residential setting, the results did not support this.

A study of two groups of mildly and borderline retarded (IQs ranged from 50-85) youth investigated measures of impulsivity and locus of control as predictors of academic achievement and personal-social adjustment (Shipe, 1971). The vocational school males who lived in the community and had more internal locus of control orientations and less impulsivity received higher academic and shop grades and better
personal-social adjustment ratings. For the institutionalized subjects enrolled in a vocational rehabilitation program in a residential occupational training center, the most impulsive subjects tended to be those who received the greatest number of demerits and therefore the lowest weekly wages.

Although learning-disabled persons may be expected to have external orientations and were found to be more external than the non-learning disabled (Hallahan et al., 1978), educators may find the use of locus of control orientations beneficial for structuring academic programs suitable for the learning-disabled student. A study with 50 learning-disabled male adolescents found that internal subjects performed better in a less structured learning environment as opposed to external subjects who performed better in a more highly structured situation (Bendell, Tollefson & Fine, 1980).

Tseng (1970) used Rotter's scale to measure clients in a vocational training program at a state vocational rehabilitation center. The study investigated the relationship of job proficiency, personal quality, employability, training satisfaction, need for achievement, fear of failure, and 16 other personality factors with locus of control. Results indicated that internally controlled rehabilitation clients received higher employer ratings on job proficiency and personal quality and had higher self-ratings on satisfaction with training than externally oriented clients. There were positive correlations between clients' compliance with rules, observance of safety practices, operation and care of equipment, ability to work with others, work tolerance, manners in the shop,
abstract thinking, the tendency to be conscientious and the level of training satisfaction" (Tseng, 1970, p. 488).

External locus of control orientations have been found in persons hospitalized for chronic problems. Goldstein and Reznikoff (1971) used Rotter's scale to compare a group of chronically ill patients with a group of patients convalescing from minor medical problems. The group of chronic hemodialysis patients was found to have a significantly ($p < .05$) greater external locus of control. The researchers suggested that the external orientation may be a way of coping with the continuous responsibility and anxiety the patient faces in treatment. Unfortunately, this would increase the likelihood of the patient not accepting responsibility for medical treatment.

A study conducted by Distefano et al. (1971) compared adult psychiatric patients, normal adults, and normal adolescents on Rotter's scale. The normal adult group was found to be significantly ($p < .01$) lower in externality than the patient group and significantly ($p < .05$) lower than the normal adolescents. A significant ($p < .01$) inverse relationship between age and locus of control scores suggested that perceptions of rewards as being externally controlled decreased with increasing age.

Research with Deaf Persons

An extensive review of the professional literature relating to locus of control and to deafness located the following studies.

Dillon (1980) modified the Nowicki-Strickland Internal-External Control Scale (Nowicki & Strickland, 1973) and administered it in sign
language to 97 residential deaf children ranging from 8 to 12 years of age. The scale was found to be as reliable for deaf subjects compared with hearing subjects when items were linguistically simplified and when the deaf subjects were thoroughly questioned to assure their understanding. Results of the study indicated that external subjects appeared threatened by testing conditions giving the subjects high control. Conclusions were that standard testing procedures cannot adequately access the deaf person's cognitive abilities. Individual differences like locus of control need to be considered so that procedures and measurements appropriate to the individual can maximize his performance.

Dowaliby, Curwin, and Quinsland (1981) expressed a similar concern for individual differences. They found that deaf college students representing extreme internal learners preferred high-participation classroom conditions. These students also had higher test scores, indicating that they performed better in a high-participation environment. External students in low-participation conditions rated teacher skill more highly for a high versus low structure.

Blanton and Nunnally (1964) compared 137 deaf residential students with 302 public school hearing students on the Bialer-Cromwell Locus of Control Scale (Bialer, 1960) and on the Locus of Evaluation Scale (Miller, 1963). The deaf group was found to be more externally controlled. It was suggested that deafness results in relatively little experience with evaluative terms and associations. This would contribute to feelings of inadequacy in making evaluative judgments. The
tendency to depend on others for evaluations of performance results in greater externality.

Tams (1978) compared locus of control orientations of 20 hearing impaired, 10 visually impaired, and 20 nondisabled children. The children attended public schools and ranged from 9 to 12.6 years of age. The study examined internality for positive outcomes and for negative outcomes separately as well as overall internality. Results indicated that hearing impaired children were less internal than visually impaired children. Children with visual impairments had less internal control than their nonimpaired peers. Tams (1978) concluded that "a severe sensory deficit often has a negative impact on the psychological and social adjustment of children and their mothers, as reflected on their [internal-external] I-E scores."

Koelle (1981) investigated the effects of locus of control and self-concept on academic achievement in deaf adolescents. A modified Rotter Internal-External Locus of Control Scale (Rotter, 1966) was found to be significantly correlated with all Stanford Achievement Test subtests, except for mathematical computations. On the original Rotter scale, a significant correlation was found only with the vocabulary subtest. Students with deaf parents were significantly ($p < .05$) more internal on the modified Rotter scale but not on the original Rotter scale. For the total deaf sample, students with scores indicating higher self-regard and internality on the original instruments were significantly better achievers on most of the Stanford Achievement Test subtests. Conclusions from this study are questionable because Koelle (1981) stated "the erratic performance by deaf Ss [subjects] on both the
original and modified Rotter questionnaires suggests strongly that these tests may be measuring more than two factors for deaf examinees. Item revisions did not produce uniform nor anticipated results."

Nielsen (1969) used a modified form of the Bialer-Cromwell Children's Locus of Control Scale (Bialer, 1960) to compare 11 residential deaf students, 11 nonresidential deaf students, and 11 public school normally hearing students on locus of control orientation. The nonresidential deaf were integrated into regular public school classes. Onset of deafness for the deaf students had been before 18 months of age. Their ages ranged from 14 to 18 years with hearing losses of 75 decibels (American Standards Association speech range average) or greater. All deaf students were instructed with oral communication for 6 years previous to the study. Findings indicated that residential deaf students were significantly \( (p < .05) \) more internal than nonresidential deaf students. No significant differences were found between residential deaf and normally hearing students. Nonresidential deaf students were significantly \( (p < .01) \) less internal than normally hearing students. Nielsen suggested that the nonresidential deaf, through their greater association and competition with hearing peers, may be more aware of their inadequacies and therefore develop feelings of having less control of their environment. The reason for the lack of difference between residential deaf and normally hearing students was not understood; however, Nielsen suggested that the sense of control felt by each group in their respective environments may explain this finding.

Bodner and Johns (1977) assessed locus of control orientation of 228 deaf students divided into two age groups. The young age group
consisted of 84 students ranging in age from 10 to 13.25 years with a mean of 11.4 years. The adult age group consisted of 144 post-secondary students ranging in age from 17 to 46 years with a mean of 20.35 years. Hearing loss for all students was severe to profound and had occurred before 3 years of age. The Bialer-Cromwell Scale (Bialer, 1960) was administered in total communication on videotape to the young age group. The reliability data from the young age group were unacceptable. The Rotter Internal-External Locus of Control Scale (Rotter, 1966) was administered in the original form to the adult age group. A statistically significant difference ($p < .001$) resulted between the scores of the adult deaf sample and hearing norms. No difference was found between residential and day students. Because a low reliability estimate for the total adult deaf sample was thought to be a function of low reading levels, the researchers selected a subsample of "high reading" students representing the upper 25% of the reading level distribution. The reliability was acceptable for the subsample. Comparisons made using this high-reading group also indicated a significant ($p < .001$) difference between the deaf subgroup and the hearing adult norms, indicating that these deaf students were more externally oriented compared with hearing norms.

Dowaliby et al. (1982) compared 267 deaf and 100 hearing students on the Internality, Externality and People Orientation Sub-scales of the Learning Styles Inventory (LSI) developed for use with deaf students at the National Technical Institute for the Deaf. Deaf students were found to be significantly ($p < .01$) more external in their perceived locus of control orientations and significantly ($p < .01$) more
people oriented. Deaf students were also found to be significantly \( p < .05 \) more internal than hearing students. An explanation for this unexpected finding was that deaf students may perceive high effort expenditure as necessary to compensate for their hearing loss.

Comparisons between deaf and hearing students were also made on the LSI subscales and the subscales of the Survey of Study Habits and Attitudes (SSHA) (Brown & Holtzman, 1955). Findings indicated that externally oriented students had less effective study habits and attitudes. Students who were more people oriented tended to delay or avoid study and had a negative attitude toward study activities. Deaf students had less positive attitudes on the attitude subscales than hearing students. The attitude subscales were significantly correlated \( p < .01 \) to the LSI Externality subscale. The only difference between deaf and hearing students on study habits was reflected in a subscale having items focusing on written communication.

The few studies relating locus of control to deafness have generally found that deaf persons are more external than hearing persons.

Implications for Rehabilitation

The research findings that disabled persons, and more specifically deaf persons, appear to have an external rather than internal locus of control have implications for rehabilitation (MacDonald, 1972). Disabled persons may not achieve or perform well if they feel they cannot succeed. This does not imply that externally oriented persons are unmotivated. In fact, Tseng (1970) found no differences between
internally and externally oriented persons on two motivational variables. This lends support to the idea of locus of control being an expectancy variable instead of a motivational one (Lefcourt, 1966; Rotter, 1966). MacDonald (1972) suggested differentiating between unmotivated and externality oriented persons and planning programs accordingly. He (1972, p. 45) stated:

> It has been a common practice to treat both groups as one and to expose them to programs or efforts designed to raise their motivational levels. For the latter group this may be a serious mistake, for it may do little more than increase their sense of frustration. For them, we might better focus on efforts designed to increase their feelings of personal efficacy.

Such efforts may take the form of counseling and psychotherapy. Several studies have proposed that locus of control orientation can be modified by psychotherapeutic techniques. Lefcourt (1972) saw changing locus of control as a goal of psychotherapy because an external orientation can inhibit desired behavioral change. Dua (1970) found that an action plan focusing on specific behaviors was more effective than a reeducation program focusing on changing attitudes and beliefs. This is strong support for behavioral therapy in contrast to insight therapy.

Work done by Reimanis and Schaefer, as described by MacDonald (1972), resembled a rational emotive therapy approach for modifying internal-external locus of control. "External statements" are challenged and replaced by "internal statements," and subjects are encouraged to recognize and focus on the contingencies of their actions. Hagmeier (1973) found that a 5-week self-discovery program used by
vocational rehabilitation clients changed locus of control toward internality.

Although some empirical evidence supports the lasting effects of shifting locus of control orientation (Gottesfeld & Dozier, 1966; Levens, 1968), there has been a call for further research of techniques and their effectiveness to change locus of control (MacDonald, 1972).

**Deafness**

Research findings in personality and social development of deaf persons must be interpreted with caution. The language development of deaf persons influences the appropriateness of testing instruments, methods of test administration, and interpretations of test results for deaf individuals. To the extent that variables influential to psycho-social adjustment can be identified, research may be helpful to counselors, educators, and rehabilitation specialists.

**Psychological and Social Adjustment**

Reviews of the research literature in the area of psychological and social adjustment are inconclusive. Berlinsky (1952) reviewed 15 studies and concluded that deaf persons have the same overall adjustment as hearing persons. There were some minor but consistent differences. Deaf persons may (1) experience problems in adjusting to the environment, (2) be more introverted, (3) show less dominance, (4) be slightly more neurotic, (5) be slightly more egocentric, (6) show more feelings of depression and suspicion, and (7) be less mature in judgment and social competence.
DiCarlo and Dolphin (1952) reviewed at least 12 studies and found inconclusive results. They (1952, p. 336) said, "Most of the research fails to equate the semantic dynamics involved, does not control the groups in terms of language and other variables, and fails to utilize standardized measurement criteria."

Levine (1963, p. 508) concluded, after reviewing several studies, that "the personality patterns and traits of the deaf . . . suggest weakness and deficiencies for dealing effectively and knowledgeably with the complex problems of life today."

Personality characteristics attributed to deaf persons by various researchers suggest a maladaptiveness due to hearing loss. Pintner, Fusfeld & Brunschwig (1937) found deaf persons to be more introverted and neurotic and less dominant than hearing persons.

Deaf persons also have been characterized as immature, submissive, dependent, insecure, apathetic, suspicious, and anxious (Soloman, 1943). Levine (1956) found deaf subjects to be egocentric, irritable, impulsive, suggestible, and dependent on external controls. Altshuler (1962, 1963) described the behavior of deaf subjects as egocentric, dependent, and impulsive. Schlesinger and Meadow (1972) concluded that the characteristic most often attributed to deaf persons is emotional immaturity.

Altshuler et al. (1976) found American and Yugoslavian deaf subjects showed impulsivity, short-sighted action, and a lack of internalized controls. Muller (1977) identified traits and needs of deaf adolescents that influence their success in a mainstreamed program.
Included are a lack of self confidence, a need to be allowed to make decisions and be responsible, and a need for structure.

Several studies have focused on the self-concept of deaf persons. Myklebust (1960) found that deaf children had less accurate self-images than hearing peers. Deaf children in residential school settings had less stress, but they had less accurate self-perceptions than deaf day school students. Craig (1965) also found deaf students to have less accurate self-perceptions than hearing students. However, the inaccuracy was in the direction of perceiving themselves more positively on sociometric ratings than their peers perceived them. Residential deaf students rated themselves more highly than deaf day school students, suggesting perhaps inflated self-esteem. These two studies suggest that the educational environment has considerable impact on the development of self-concept.

Other researchers have suggested that the home environment, more specifically, the interaction between the deaf child and the parents, is a contributing factor to the development of self-concept. Schlesinger and Meadow (1972) compared mother–child interactions of 40 deaf children and their parents, and 20 hearing children and their parents. The parents of the deaf children were normally hearing individuals. The children ranged from 2½ to 4 years of age. Observations of videotaped mother–child interactions resulted in the mothers of deaf children being rated as more controlling, more intrusive, more didactic, more rigid, and more critical. Deaf children were rated as being less happy, less creative in play, and less excited about their accomplishments. They were also less responsive to their mothers'
requests. The results were seen as indications of the lack of communication between the deaf child and the hearing parent.

Mindel and Vernon (1971) pointed out the importance of early parent–child communication. The authors (1971, pp. 75-76) referred to several studies as support for the use of manual communication as opposed to oral communication. They (1971, p. 77) stated:

The existing research unanimously reports superior linguistic and academic achievement for children exposed to manual communication or combined manual-oral communication in preschool years. The studies which obtained data on speech reading show the manual groups were equal to or better than matched oral samples. Except for one sample, both groups produced equivalent speech performance. Psychosocial adjustment test measures favored the manual group.

Greenberg (1980) compared the attitudes and stress of hearing families with a deaf child. One group of families used the oral method of communication. The other group used the simultaneous method of communication. Each group was subdivided by high and low communicative ability. Results indicated few differences between the oral and simultaneous families. Greenberg viewed this as a result of early intervention and parental counseling. Comparisons of the subgroups did reveal some differences. The high-ability simultaneous communication subgroup had a longer time period using total communication. The children in this group had the highest developmental ages and the most positive social interactions and had mothers who reported having the least stress and the most positive attitudes. Children in the high-competence oral subgroup were reported somewhat negatively compared with the high-ability simultaneous group. The high oral group was viewed by their mothers as having a lower social age. Their
mothers reported more stress and had less trust and acceptance in their parenting attitudes. Greenberg (1980, p. 1069) concluded, "While an oral educational approach may be appropriate for some profoundly deaf children, it should not be achieved at the expense of less-than-optimal affective relationships with significant others."

In summary, deaf persons have been found to differ in self-concept when compared with hearing persons. There also appear to be differences within the deaf population related to educational setting and parental communication. Garrison and Tesch (1978) questioned whether the differences between deaf persons' self-concept and hearing persons' self-concept may not reflect a developmental lag directly related to language acquisition for the deaf individuals.

Two areas of limited research that relate to the present study are learned helplessness and field dependence. McCrone (1977) examined the impact of an unsolvable pretreatment situation on posttest performance of deaf adolescents. Severely underachieving students compared with mildly underachieving students had more posttest error scores indicating a learned helplessness. A person learns helplessness if the outcome of some event is uncontrollable (Seligman, 1975). Learned helplessness is highly correlated with external locus of control (Hiroto, 1974).

Parasnis, Long, and Blasdell (1977) found deaf college students more field dependent than those with hearing norms. Deaf persons with poor communication skills were more field dependent than those with good communication skills. Deaf males were found to be more field
independent than deaf females. According to Cognitive Style theory, cognitive development progresses toward field independence (Witkin et al., 1977). Field dependence is correlated with external locus of control (Chance & Goldstein, 1971; Lefcourt & Telegdi, 1971; Swanson, 1980).

Implications for Counseling

Is there a difference between counseling deaf persons and counseling hearing persons? Is there a "psychology of deafness"?

Hardy and Cull (1974, p. 160) said that there is no science, philosophy, or discipline called "psychology of deafness." They said that what has been referred to as a "psychology of deafness" is the result of studies and investigations of the psychological or psychosocial nature of persons with hearing loss. Moores (1978, p. 140) said that the term "psychology of deafness" implies that general psychological principles are inadequate and deafness is so overwhelming that the general principles of human behavior do not apply to deaf people.

Patterson and Stewart (1971, p. 57) said:

We may speak of a "psychology of deafness" if we are referring to their special learning and adjustment needs, but if we are using the term to suggest that all deaf people learn according to unique processes, or have unique personalities, then its use is unjustified. We might as well have a psychology of the Negro, of the Jew, of the Catholic, of the northerner, of the southerner, and so on and on. Thus, we may state as one helpful assumption that there is no unique psychology of deafness in the sense that deafness automatically and invariably results in a set of needs, learning patterns, and motives that differ markedly from those of the normally hearing.

Meadow (1976, p. 68) said that deafness per se is not the reason for certain personality characteristics:
Deafness is an exceedingly complex disability. It incorporates elements of medical, audiological, linguistic, sociological, and psychological factors that influence the developmental process and that contribute to some of the experiences that deaf children often share. It is these shared experiences rather than the hearing deficit itself that lead us to talk about a "psychology of deafness." At least some of the noxious experiences shared by deaf persons are subject to change. Therefore, some of the apparently shared personality characteristics are not a necessary accompaniment of a hearing handicap.

Approximately 90% of the parents of deaf children are normally hearing with limited or no experience with deafness (Schein & Delk, 1974). Hereditary or genetic factors account for as much as 50% of early-childhood deafness (Moores, 1978). Given these figures, the need for counseling exists as soon as parents suspect their child is deaf.

Parents may experience the reactions to crisis described by Shontz (1965), which are similar to the stages of acceptance of death and loss described by Kübler-Ross (1975):

<table>
<thead>
<tr>
<th>Reactions to Crisis</th>
<th>Stages of Acceptance of Death or Loss</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Shock</td>
<td>1. Denial (shock)</td>
</tr>
<tr>
<td>2. Realization</td>
<td>2. Anger (emotion)</td>
</tr>
<tr>
<td>3. Defensive retreat (includes denial and avoidance of reality)</td>
<td>3. Bargaining</td>
</tr>
<tr>
<td>4. Acknowledgment</td>
<td>4. Preparatory depression</td>
</tr>
<tr>
<td>5. Adaptation</td>
<td>5. Acceptance (increased self-reliance)</td>
</tr>
</tbody>
</table>

Cober-Ostby (1978) suggested that the counselor's role during these stages is to listen, provide support, and provide educational and technical information as needed.
Moores (1978, p. 98) in agreement with Mindel and Vernon (1971) stated that:

the fixation on normalcy (speaking) prevents parents from working through their grief to the mature acceptance of deafness that is a prerequisite for adequate psychological and social development. Without such acceptance, parents will not develop healthy mechanisms to cope with the outer reality of a child with a hearing loss and the inner reality of adjusting to the feeling of loss of a desired normal child.

In addition to the parental response to deafness, the communication between parents and their deaf child contributes to psychosocial development. Furth (1973, p. 118) said, "Parents who can fully communicate with their children, regardless of method, will naturally provide a most significant part of those children's education." Several researchers have strongly advocated the use of total communication or sign language as the preferred mode of communicating (Mindel & Vernon, 1971; Stokoe, 1978). The counselor working with parents of a deaf child needs to inform parents of the various communication modalities and the respective research available. This will hopefully contribute to a well-informed parental decision that will result in optimal parent-child interaction.

The need for counseling the school-age deaf child is reflected in the findings of Schlesinger and Meadow (1972). Teachers and counselors in a residential school for deaf children rated 11.5% of the children as severely disturbed and 19.5% as moderately disturbed. This compares to only 2.5% and 7.5%, respectively, for an entire public school system. Because the incidence of severe mental illness is no greater in the deaf population than in the general population (Meadow, 1976), these percentages may reflect a greater number of "problems of

Rainer and Altshuler (1970, p. iv) made some recommendations for rehabilitation and preventive services for the deaf that are applicable to counseling with the school-age population:

Turning to prevention of psychiatric disturbance, schools for the deaf can make effective use of a mental health team—psychiatrist, psychologist and social worker. Trouble shooting with early psychiatric intervention is but one approach. Group therapy with adolescent students encourages greater awareness of interpersonal relations and forestalls problems in this area. Discussions with teachers and cottage personnel alert them to difficulties and assist them in proper handling of their pupils.

The nature and principles of counseling with deaf persons are no different than those for counseling with hearing persons; however, the application or implementation of these principles may differ (Patterson & Stewart, 1971).

Stewart's (1970) comment on the lack of information about counseling the deaf still holds true today. He said that there is a paucity of objective descriptive and experimental research on the relationship, the process, and the outcomes of individual and group counseling with deaf individuals. Reasons given for the lack of research were: (1) people working with deaf people do not have the counseling skills, communication skills, and research skills needed for research and (2) there are no appropriate testing instruments to use with deaf people.

Patterson and Stewart (1971) stated that, despite the lack of research, the less verbal and less abstract counseling approaches seem more appropriate for most deaf clients. The more verbal and abstract
approaches can be used with deaf persons having normal or exceptional verbal skills.

Vernon (1967, p. 10) stated that counseling must be concrete and related to the here and now:

It means counseling is best done on the job or in the job evaluation center where actual behavior and specific incidents can be dealt with. It means environmental manipulation, talking to employers, getting the family to help, and giving support instead of abstractly discussing super ego problems, displacement of unconscious drives, and other valid but intangible therapeutic concepts. The immaturity and the communication limitations of many deaf clients often make abstract procedures a useless tour de force.

Similar support for a concrete, action-oriented approach to counseling was given by Grinker et al. (1969) in their report on research with psychotic deaf patients. This approach required the therapist to become more involved with the patient and to participate in therapy outside the consulting room. This facilitated the patient's understanding of negative behaviors when the patient's actions could be discussed within the immediate context of the situation. Also, the patient appeared to establish a trusting relationship with the therapist because of the active involvement of the therapist.

In an overview of literature dealing with definitions and approaches to counseling with deaf people, Scott (1978) found a lack of agreement as to what constitutes counseling with deaf individuals. There were also many different types of counseling approaches used. Curtis (1979) surveyed counselors working with deaf students and found the most utilized approaches were Rogerian client-centered therapy, Glasser's reality therapy, and behavior modification.
Action-oriented counseling techniques such as role playing, play therapy, and psychodrama were used.

Zieziula (1980) proposed a nontraditional counseling approach termed "community" or "outreach" counseling. The counselor's role would be to analyze and manipulate the environment to better serve the needs of the deaf individual. The counselor would also design and implement preventive education programs, train paraprofessionals as helpers, serve as a social and legal advocate, and develop educational programs that teach the client responsibility and self-direction. Zieziula (1980, p. 3) said: "Community counseling acknowledges that positive growth and development are in part affected by forces which are external to the individual and that efforts must be made to harness external forces toward positive development and eliminate damaging forces in the environment."

This approach is directive and action oriented. The recognition of the influence of external forces in the lives of deaf people appears congruent with previously cited research on locus of control and disabled persons. This counseling approach would not only attempt to modify some of these external forces, but it also proposes to prepare deaf persons to better control their lives.
CHAPTER 3

RESEARCH METHODOLOGY

The purposes of this chapter are: (1) to describe the subjects, the setting, and the research instrumentation; (2) to describe the research design, experimental procedures, and dependent variables; and (3) to delineate the statistical treatment of the data.

Description of Subjects

The subjects in this study consisted of 70 deaf students enrolled at the National Technical Institute for the Deaf during Spring 1982. The students reported no secondary disabilities or use of medications that would be a contraindication to biofeedback training in the study. All students were paid for their voluntary participation in the study. Descriptive data are presented in Table 3. Figure 2 represents the data graphically for comparison of the experimental and control groups.

Description of Setting

The setting for this study was the National Technical Institute for the Deaf (NTID), located at One Lomb Memorial Drive, Rochester, New York. NTID serves deaf students from all 50 states and territories. Enrollment at the time of data collection consisted of 423 males and 272 females.
Table 3. Descriptive data for experimental and control groups

<table>
<thead>
<tr>
<th>Group</th>
<th>Absolute Frequency</th>
<th>Mean</th>
<th>SD</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Number of subjects</strong></td>
<td>36</td>
<td>21.4</td>
<td>3.1</td>
<td>21.2</td>
<td>3.2</td>
</tr>
<tr>
<td><strong>Sex</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>21</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>15</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Onset of deafness</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Birth-2 years</td>
<td>30</td>
<td></td>
<td></td>
<td>29</td>
<td></td>
</tr>
<tr>
<td>3-5</td>
<td>3</td>
<td></td>
<td></td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>6-12 years</td>
<td>3</td>
<td></td>
<td></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>13-18 year</td>
<td>0</td>
<td></td>
<td></td>
<td>0</td>
<td></td>
</tr>
<tr>
<td><strong>Educational background</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(high school)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Residential students</td>
<td>8</td>
<td></td>
<td></td>
<td>14</td>
<td></td>
</tr>
<tr>
<td>Other students</td>
<td>28</td>
<td></td>
<td></td>
<td>20</td>
<td></td>
</tr>
<tr>
<td><strong>Age</strong></td>
<td>21.4</td>
<td>3.1</td>
<td></td>
<td>21.2</td>
<td>3.2</td>
</tr>
<tr>
<td><strong>PTA (pure tone average in better ear)</strong></td>
<td>96.8</td>
<td>13.17</td>
<td>100.06</td>
<td>12.18</td>
<td></td>
</tr>
<tr>
<td><strong>Years used sign</strong></td>
<td>6.4</td>
<td>6.1</td>
<td>9.1</td>
<td>6.9</td>
<td></td>
</tr>
<tr>
<td><strong>Year in college</strong></td>
<td>1.8</td>
<td>1.0</td>
<td>1.9</td>
<td>1.0</td>
<td></td>
</tr>
</tbody>
</table>
Figure 2. Descriptive data for experimental and control groups
Figure 2--Continued
Figure 2--Continued
The procedures described in this study were conducted in an office located in the Department of Educational Research and Development. The room had no major source of electrical artifact and was considered suitable for biofeedback procedures.

**Research Instrumentation**

**Biofeedback Equipment**

The Myosone 409 EMG Monitor/Data Processor manufactured by Bio-Logic Devices, Inc., Plainview, New York, was used to measure frontalis muscle action potentials. The electrode assembly consisted of three disposable snap-on electrodes attached to a 5½-foot shielded cable. A bandpass filter of 100-200 Hz was selected. The data processor averages EMG activity over a selected analysis time interval. For this study cumulative average EMG levels were computed every 30 seconds.

Three forms of visual feedback were available: (1) a meter reading indicating average EMG activity according to the setting of the meter sensitivity switch, (2) a digital display indicating percentage of the full-scale meter reading, and (3) a 6-inch light bar display operating in direct proportion to the EMG input.

The EMG monitor was battery operated and electrically isolated from the data processor. This prevents the subject from receiving any high-voltage current.

**Learning Styles Inventory**

The Learning Styles Inventory (LSI) developed by Dowaliby et al. (1982) was especially designed for deaf students at NTID. The LSI
is a paper-and-pencil instrument consisting of 23 Likert items. Each item is rated on a 5-position scale from "strongly agree" to "strongly disagree." The LSI consists of three subscales: (1) Internality, (2) Externality, and (3) People Orientation.

The Internality subscale has 5 items with a reliability of 0.67. Items on this subscale reflect a person's tendency to attribute positive and negative events to effort expenditure. The Externality subscale has 11 items with a reliability of 0.73. Items on this subscale reflect a person's tendency to attribute consequences to external uncontrollable events or powerful others. The People Orientation subscale consists of 7 items with a reliability of 0.62. This subscale reflects a person's preference for working alone versus working with others.

The LSI subscales are essentially uncorrelated with each other. The Internality and Externality subscales reflect the locus of control construct. The People Orientation subscale reflects the field dependence-independence cognitive style.

A Test of Attitudes

A Test of Attitudes (Dowaliby, 1981) is a revised version of the Children's Manifest Anxiety Scale (CMAS) (Castaneda, McCandless & Palermo, 1956). The CMAS was developed for use with fourth, fifth, and sixth grade children and has been used at NTID because of the appropriateness of its reading level. The CMAS is based on the assumption that the intensity of internal anxiety or emotionality can be measured by a paper-and-pencil test consisting of items described as overt or manifest symptoms of anxiety. The CMAS is a 42-item anxiety
scale and an 11-item Lie (L) scale. Each item elicits a forced-choice "yes" or "no" response. The items on the L scale are designed to provide an indication of the tendency to falsify answers to the anxiety items. One-week retest reliabilities of about 0.90 for the anxiety scale and about 0.70 for the L scale are reported. Intercorrelations between the anxiety scale and the L scale were close to zero.

A Test of Attitudes has the same L-scale items but has a reduced number (15) of anxiety items. The reliability for the reduced number of anxiety scale items essentially remained unchanged (0.78 for the revised scale as compared with 0.77 for the full scale of items) with the NTID subjects.

General Design of the Study

The research design for this study was the pretest-posttest control group design (Campbell & Stanley, 1963, p. 13). The design is described as a true experimental design and is based on the equivalence of the experimental and control groups. The observations or measurements (O) are administered before and after treatment (X) to the randomized (R) groups. The design has the following form:

\[ RO_1 \quad X \quad O_2 \]

\[ RO_3 \quad O_4 \]

Although equivalence of groups may be assumed, for greater precision of comparison, analysis of covariance was used.
Procedure

Subjects who volunteered for the project were randomly assigned to experimental and control groups.

Pretreatment

1. All subjects were required to read an informed consent and to sign a release form (Appendix A).
2. All subjects completed a demographic questionnaire (Appendix B).
3. All subjects completed the Learning Styles Inventory (Dowaliby et al., 1982) (Appendix C).
5. All subjects completed a no-feedback baseline EMG session.

Treatment

Experimental subjects were scheduled for six half-hour biofeedback sessions during a 3-week treatment phase. Each session consisted of the following:

1. The subject's forehead was cleansed with isopropyl alcohol and cotton.
2. Surface electrodes were affixed over the frontalis muscle following standard procedures (Venables & Martin, 1967).
3. The subject was instructed to relax, limit body movement, and keep the eyes open during the session. The subject was instructed to watch the machine for visual feedback. No audio feedback was given.
4. Recordings of the integrated average EMG levels were made every 30 seconds for 20 minutes.

5. At the end of 20 minutes, the electrodes were removed and the forehead cleansed. A lotion was available to the student to combat the drying effects of the alcohol.

Posttreatment

1. All subjects were readministered the Learning Styles Inventory and A Test of Attitudes. All subjects completed another no-feedback baseline EMG session.

**Dependent Variables**

The dependent variables for each deaf subject were: (1) locus of control orientation as measured by the Learning Styles Inventory, (2) anxiety level as measured by A Test of Attitudes, and (3) EMG level as measured by the Myosone 409 EMG Monitor/Data Processor. These three variables were expected to change as a result of the biofeedback treatment.

**Treatment of Data**

The null hypotheses are stated with the specific analyses made.

1. **Hypothesis 1**: There is no difference between experimental and control groups on locus of control as measured by the Learning Styles Inventory.

   Analysis of covariance was used to compare experimental and control groups on posttreatment locus of control scores after adjusting
the posttreatment scores for differences in locus of control scores on the pretreatment.

2. **Hypothesis 2:** There is no difference between experimental and control groups on anxiety as measured by A Test of Attitudes.

   Analysis of covariance was used to compare experimental and control groups on posttreatment anxiety scores after adjusting the posttreatment scores for differences in anxiety scores on the pretreatment.

3. **Hypothesis 3:** There is no difference between experimental and control groups on final baseline EMG levels.

   Analysis of covariance was used to compare experimental and control groups on posttreatment EMG measurements after adjusting the posttreatment measurements for differences on pretreatment EMG measurements.

4. **Hypothesis 4:** There is no relationship between muscle activity as measured by EMG and locus of control orientation as measured by the Learning Styles Inventory.

   Pearson product-moment correlations were computed between pretreatment EMG baseline and locus of control subscores and between posttreatment EMG baseline and locus of control subscores.

5. **Hypothesis 5:** There is no relationship between muscle activity as measured by EMG and anxiety as measured by A Test of Attitudes.

   Pearson product-moment correlations were computed between pretreatment EMG baseline and anxiety scores and between posttreatment and EMG baseline and anxiety scores.
6. **Hypothesis 6**: There is no relationship between locus of control as measured by the Learning Styles Inventory and anxiety as measured by A Test of Attitudes.

Pearson product-moment correlations were computed between pretreatment locus of control subscores and anxiety scores and between posttreatment locus of control subscores and anxiety scores.

In addition, analysis of covariance was used to compare experimental and control groups on posttreatment people orientation scores after adjusting the posttreatment scores for differences in people orientation scores on the pretreatment. A correlation matrix using the Pearson product-moment correlation was generated for the total sample of 70 subjects. The alpha level was set at 0.05 for this study. The *Statistical Package for the Social Sciences* (Nie et al., 1975) was used for data analyses.
CHAPTER 4

RESULTS OF STUDY

This chapter reports the results of this research project. The general results are presented, the null hypotheses are restated, and specific analyses are made.

General Results

As a result of the analysis of covariance, an F value beyond the 0.05 level of significance was found for Hypothesis 3, indicating a difference between experimental and control groups on posttreatment EMG baseline levels. Statistically significant relationships at the 0.05 level were found between posttreatment anxiety scores and posttreatment people orientation scores and posttreatment anxiety scores.

Testing the Hypotheses

Hypothesis 1

There is no difference between experimental and control groups on locus of control as measured by the Learning Styles Inventory.

The analysis of covariance for the locus of control subscores did not exceed the 0.05 significance level, indicating that the locus of control subscores do not differ significantly between the experimental and control groups on the adjusted posttreatment means (Tables 4 and 5). The null hypothesis was therefore not rejected.
Table 4. Summary for analysis of covariance comparison of posttreatment internality by group adjusted for pretreatment internality differences.

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
<th>Mean Squares</th>
<th>F</th>
<th>Significance of F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Covariates, Pretreatment Internality</td>
<td>104.947</td>
<td>1</td>
<td>104.947</td>
<td>13.575</td>
<td>0.000</td>
</tr>
<tr>
<td>Main Effects, Group</td>
<td>0.072</td>
<td>1</td>
<td>0.072</td>
<td>0.009</td>
<td>0.923</td>
</tr>
<tr>
<td>Explained</td>
<td>105.019</td>
<td>2</td>
<td>52.509</td>
<td>6.792</td>
<td>0.002</td>
</tr>
<tr>
<td>Residual</td>
<td>517.967</td>
<td>67</td>
<td>7.731</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>622.986</td>
<td>69</td>
<td>9.029</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 5. Summary for analysis of covariance comparison of posttreatment externality by group adjusted for pretreatment externality differences.

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
<th>Mean Squares</th>
<th>F</th>
<th>Significance of F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Covariates, Pretreatment Externality</td>
<td>1449.495</td>
<td>1</td>
<td>1449.495</td>
<td>68.067</td>
<td>0.000</td>
</tr>
<tr>
<td>Main Effects, Group</td>
<td>0.304</td>
<td>1</td>
<td>0.304</td>
<td>0.014</td>
<td>0.905</td>
</tr>
<tr>
<td>Explained</td>
<td>1449.798</td>
<td>2</td>
<td>724.899</td>
<td>34.041</td>
<td>0.000</td>
</tr>
<tr>
<td>Residual</td>
<td>1426.773</td>
<td>67</td>
<td>21.295</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>2876.571</td>
<td>69</td>
<td>41.689</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Hypothesis 2

There is no difference between experimental and control groups on anxiety as measured by A Test of Attitudes.

The analysis of covariance for the anxiety scores did not exceed the 0.05 level of significance, indicating that the anxiety scores do not differ significantly between the experimental and control groups (Table 6). The null hypothesis was therefore not rejected.

Table 6. Summary for analysis of covariance comparison of posttreatment A Test of Attitudes by group adjusted for pretreatment A Test of Attitudes differences.

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
<th>Mean Squares</th>
<th>F</th>
<th>Significance of F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Covariates, Pretreatment A Test of Attitudes</td>
<td>330.960</td>
<td>1</td>
<td>330.960</td>
<td>74.566</td>
<td>0.000</td>
</tr>
<tr>
<td>Main Effects, Group</td>
<td>2.379</td>
<td>1</td>
<td>2.379</td>
<td>0.536</td>
<td>0.467</td>
</tr>
<tr>
<td>Explained</td>
<td>333.339</td>
<td>2</td>
<td>166.670</td>
<td>37.551</td>
<td>0.000</td>
</tr>
<tr>
<td>Residual</td>
<td>284.064</td>
<td>64</td>
<td>4.438</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>617.403</td>
<td>66</td>
<td>9.355</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Hypothesis 3

There is no difference between experimental and control groups on final baseline EMG levels.

The analysis of covariance for the EMG microvolt levels did exceed the 0.05 requirement, indicating that the adjusted mean frontalis EMG levels differ significantly between the experimental and control groups (Table 7 and Figures 3 and 4). The null hypothesis was rejected.

Table 7. Summary for analysis of covariance comparison of posttreatment EMG by group adjusted for pretreatment EMG differences.

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
<th>Mean Squares</th>
<th>F</th>
<th>Significance of F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Covariates, Pretreatment EMG</td>
<td>131.382</td>
<td>1</td>
<td>131.382</td>
<td>67.001</td>
<td>0.000</td>
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<tr>
<td>Main Effects, Group</td>
<td>7.552</td>
<td>1</td>
<td>7.552</td>
<td>3.851</td>
<td>0.054</td>
</tr>
<tr>
<td>Explained</td>
<td>138.934</td>
<td>2</td>
<td>69.467</td>
<td>35.426</td>
<td>0.000</td>
</tr>
<tr>
<td>Residual</td>
<td>131.380</td>
<td>67</td>
<td>1.961</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>270.314</td>
<td>69</td>
<td>3.918</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
CONTROL GROUP
ADJUSTED POST TEST EMG LEVEL (MICROVOLTS) = 2.72

EXPERIMENTAL GROUP
ADJUSTED POST TEST EMG LEVEL (MICROVOLTS) = 2.04

Figure 3. Comparison of groups on adjusted posttreatment EMG level
Figure 4. Experimental group's unadjusted averaged EMG level by session
Hypothesis 4

There is no relationship between muscle activity as measured by EMG and locus of control orientation as measured by the Learning Styles Inventory.

Pearson product-moment correlations computed between pretreatment EMG baseline and locus of control subscores and between posttreatment EMG baseline and locus of control subscores were not significant at the 0.05 level (Table 8). The null hypothesis was therefore not rejected.

Hypothesis 5

There is no relationship between muscle activity as measured by EMG and anxiety as measured by A Test of Attitudes.

Pearson product-moment correlations computed between pretreatment EMG baseline and anxiety scores and between posttreatment EMG baseline and anxiety scores resulted in a significant correlation at the 0.05 level between posttreatment EMG and posttreatment anxiety (Table 8). The null hypothesis was rejected for posttreatment EMG and posttreatment anxiety.

Hypothesis 6

There is no relationship between locus of control as measured by the Learning Styles Inventory and anxiety as measured by A Test of Attitudes.

Pearson product-moment correlations computed between pretreatment locus of control subscores and anxiety scores and between posttreatment locus of control subscores and anxiety scores were not
<table>
<thead>
<tr>
<th>Variable</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Pretreatment EMG</td>
<td>.00</td>
<td>-.06</td>
<td>.13</td>
<td>.02</td>
<td>.69*</td>
<td>.03</td>
<td>-.04</td>
<td>.17</td>
<td>.15</td>
<td></td>
</tr>
<tr>
<td>2. Pretreatment Internality</td>
<td>-.01</td>
<td>-.29*</td>
<td>.08</td>
<td>-.08</td>
<td>.41*</td>
<td>.17</td>
<td>-.12</td>
<td>.07</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Pretreatment Externality</td>
<td>.07</td>
<td>.14</td>
<td>-.14</td>
<td>-.01</td>
<td>.70*</td>
<td>.27*</td>
<td>.07</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Pretreatment People Orientation</td>
<td>.05</td>
<td>.04</td>
<td>-.20</td>
<td>.00</td>
<td>.67*</td>
<td>.18</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Pretreatment A Test of Attitudes</td>
<td></td>
<td>.13</td>
<td>.07</td>
<td>-.03</td>
<td>.17</td>
<td>.73*</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>6. Posttreatment EMG</td>
<td></td>
<td>-.06</td>
<td>-.13</td>
<td>.07</td>
<td>.24*</td>
<td></td>
<td></td>
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<td>7. Posttreatment Internality</td>
<td></td>
<td>.10</td>
<td>-.11</td>
<td>.01</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>8. Posttreatment Externality</td>
<td></td>
<td>.23*</td>
<td>-.04</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Posttreatment People Orientation</td>
<td></td>
<td></td>
<td>.26*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. Posttreatment A Test of Attitudes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*p < .05
significant at the 0.05 level (Table 8). The null hypothesis was therefore not rejected.

Other results indicated a significant correlation at the 0.05 level for the posttreatment EMG and posttreatment anxiety scores, posttreatment externality and posttreatment people orientation subscores, and posttreatment people orientation subscores and posttreatment anxiety scores.

Analysis of covariance for the people orientation subscale did not exceed the 0.05 level of significance, indicating that the people orientation scores do not significantly differ between the experimental and control groups (Table 9).

Table 9. Summary for analysis of covariance comparison of posttreatment people orientation by group adjusted for pretreatment people orientation differences.

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Degrees of Freedom</th>
<th>Mean Squares</th>
<th>F</th>
<th>Significance of F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Covariates, Pretreatment People Orientation</td>
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<td>427.208</td>
<td>57.239</td>
<td>0.000</td>
</tr>
<tr>
<td>Main Effects, Group</td>
<td>1</td>
<td>14.005</td>
<td>1.876</td>
<td>0.175</td>
</tr>
<tr>
<td>Explained</td>
<td>2</td>
<td>220.607</td>
<td>29.558</td>
<td>0.000</td>
</tr>
<tr>
<td>Residual</td>
<td>67</td>
<td>7.464</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>69</td>
<td>13.642</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
CHAPTER 5

SUMMARY AND RECOMMENDATIONS

This chapter contains a summary of the study, conclusions based on the results obtained from the data, and recommendations for further research.

General Summary

A review of the literature supported the use of frontalis EMG training in stress and anxiety reduction. Research findings also supported the use of EMG training to produce a shift in locus of control orientation from externality to internality.

A review of the locus of control research indicated that locus of control may be an important variable in the rehabilitation and education of physically disabled persons.

There is limited research on locus of control and deaf persons and a lack of research on frontalis EMG biofeedback and deaf persons. No research has focused on the effects of frontalis EMG biofeedback training on locus of control and anxiety in deaf college students.

Purpose

The purpose of this study was to examine the effects of frontalis electromyographic biofeedback training on locus of control and anxiety of deaf college students.
Sample

Seventy students at the National Technical Institute for the Deaf were paid for their voluntary participation in the study. The 39 male and 31 female subjects ranged in age from 18 to 35 years. The average pure tone hearing loss in the better ear for these students was 98.7 and ranged from 68 to 120 decibels.

Procedure

Subjects were randomly assigned to experimental and control groups. Both groups completed pretreatment measures of frontalis electromyographic levels, locus of control, and anxiety. The experimental group completed six half-hour biofeedback sessions during a 3-week treatment phase. The control group was not seen during the treatment phase. Both groups completed posttreatment measures for frontalis electromyographic levels, locus of control, and anxiety.

Statistical Treatment

Analyses of covariance were used to compare experimental and control groups on posttreatment means after adjusting the posttreatment means for differences on the pretreatment means. A correlation matrix (Table 8) using the Pearson product-moment correlation was generated for the total sample of 70 subjects.

Results

A significant difference at the 0.05 level resulted between experimental and control groups on posttreatment EMG means. No
significant differences between the groups were obtained for the depen-
dent variables of locus of control and anxiety.

A significant correlation at the $p < .05$ levels resulted for post-
treatment EMG and posttreatment anxiety scores, posttreatment
externality and posttreatment people orientation subscores, and
posttreatment people orientation subscores and posttreatment anxiety
scores.

Limitations

The study was restricted to volunteer subjects from the
National Technical Institute for the Deaf, Rochester, New York. The
students are not necessarily representative of other deaf students
attending postsecondary schools or of the adult deaf population.

Conclusions

The conclusions based on the results of the statistical analyses
of the data are:

1. Deaf college students in the experimental group differed signifi-
cantly in mean frontalis EMG levels from students in the control group.
This supports previous research that EMG biofeedback training reduces
specific muscle tension. The results indicate that deaf college students
using only visual feedback were able to reduce muscle activity.

2. Deaf students in the experimental group did not differ signifi-
cantly in mean locus of control scores from students in the control
group. It appears that within the parameters of the present study,
EMG biofeedback training had no significant effect on shifting locus of
control from externality to internality.
3. Deaf students in the experimental group did not differ significantly in mean anxiety scores from students in the control group. It appears that frontalis EMG biofeedback training has no significant effect on reducing anxiety.

4. No significant correlations were found for EMG levels and locus of control orientations. There appear to be no significant relationships between the levels of muscle tension and internality or externality.

5. No significant correlations were found for locus of control orientations and anxiety. There appear to be no significant relationships between internality or externality and anxiety.

6. A significant relationship was found between posttreatment EMG levels and posttreatment anxiety scores.

**Discussion**

This study was initiated to investigate the effects of frontalis EMG biofeedback training on locus of control and anxiety in deaf college students. Results indicated a reduction in EMG microvolt levels in a specific muscle following biofeedback. This is encouraging as it implies that EMG biofeedback could be successfully used with a deaf population for the prevention and remediation of stress-related illnesses.

Individuals' responses to stress in educational, job training, and work environments often lead to maladaptive coping mechanisms such as the excessive use of drugs or alcohol. Counselors may find biofeedback training for stress reduction useful as an adjunct to counseling with deaf students or deaf rehabilitation clients. Biofeedback is immediate and concrete and fits well into a directive counseling mode.
often recommended as effective with externally oriented persons (Dua, 1970; Friedman & Dies, 1974) and with deaf persons (Patterson & Stewart, 1971). At the same time, biofeedback may be used with minimal involvement of a counselor. This nondirective approach may be more effective and more preferred by internally oriented persons (Friedman & Dies, 1974).

Previous research indicated that externals require more biofeedback training time than internals (Carlson, 1977; Fotopoulos & Binegar, 1977). To the extent that deaf persons are external (Bodner & Johns, 1976; Dowaliby et al., 1982) they may require extended time to establish a training effect. Although a significant result in lowering EMG levels was obtained in the present study, the reduction was minimal. However, the decreasing EMG level of the experimental group was encouraging and suggests that continued training would have produced a clinically significant reduction. Extended training may also be needed to modify the locus of control orientations toward internality and to lower anxiety levels.

**Recommendations**

The results of this study suggest areas for further research:

1. There is a need to investigate the time element of biofeedback training with deaf persons. It is possible that an increase in the number of biofeedback sessions and in the frequency of the sessions would result in greater decreases in EMG levels, significant decreases in anxiety and externality, and significant increases in internality. It would be beneficial to have some indication of the length of training
needed with deaf persons to establish significant changes on these variables.

2. There is a need to investigate locus of control orientations of deaf persons with different educational backgrounds. Students with residential school backgrounds may differ on locus of control compared with students with mainstreamed public school backgrounds. There is also a need to investigate locus of control orientations of deaf students at different educational levels, including elementary, secondary, and postsecondary. Results could possibly help administrators, educators, and counselors in providing an appropriate educational environment.

3. There is a need to investigate locus of control orientations of deaf persons with different preferred modes of communication. There may be differences between students preferring oral, sign, and total communication methods.

4. There is a need for further investigation of the relationships of locus of control, anxiety, field-dependent cognitive styles, and EMG levels of deaf persons. In addition to the need for continuing research with the measures used in this study, research with other measures especially designed for the deaf or modified for use with deaf persons is needed.
APPENDIX A

CONSENT FORMS
Experimental Subject's Consent

Title: Effects of Electromyographic Biofeedback Training on Locus of Control of Deaf College Students.

Purpose: To examine the relationship between electromyographic (EMG) biofeedback training and locus of control within deaf college students.

Objectives: To increase control of muscle activity and internal locus of control within deaf college students.

Population: Deaf college students enrolled in a postsecondary program with support services for deaf persons.

You are being asked to voluntarily be part of this study. During the first meeting you will be asked to complete three questionnaires: The Demographic Questionnaire, the Learning Styles Inventory, and A Test of Attitudes. You will also be introduced to electromyographic (EMG) biofeedback, a machine that tells you how much muscle tension you have. The first meeting will last about 1-1½ hours. You will be scheduled for six biofeedback meetings. Each meeting will be for one-half hour. We will meet two times a week for three weeks. A final meeting of about 45 minutes will also be set up. During the final meeting, you will again complete the questionnaires. The total time required of you in the study will be about five hours.

During each of the eight meetings, the following will be done: (1) surface sensors will be placed on your forehead after the forehead is cleaned; (2) you will be asked to sit in a comfortable chair for 20 minutes and to completely relax; (3) during each meeting the forehead tension level will be recorded; (4) when the meeting is finished the sensors will be removed; (5) your forehead will be washed.

Cleaning the forehead may cause a little irritation so a lotion will be provided to you. There are no physical or psychological problems expected. You may enjoy learning about your muscle tension and how relaxation and biofeedback can help to reduce body tension. You may ask questions at any time during the study. The researcher will provide time for questions at the end of each meeting. If you are interested, you may see the information about yourself and the general results when the study is finished. You may withdraw from the study at any time without fear of penalty from the researcher or the college. You are asked to make a sincere effort to come to the eight meetings once you agree to be in the study. The results of the study will be confidential. No names will be used. If the study is published, the results will be discussed as group results, with no names mentioned.
"I have read the above 'Subject's Consent.' The nature, demands, risks, and benefits of the project have been explained to me. I understand that I may ask questions and that I may withdraw from the project at any point in time without ill will.

I also understand that this consent form will be filed in an area designated by the Human Subjects Committee with access restricted to the principal investigator or authorized representative of the particular department. I understand that a copy of this consent form is available to me upon request."

Subject's Signature: ____________________________ Date: _________
Witness's Signature: ____________________________ Date: _________
Principal Investigator: __________________________ Date: _________
Title: Effects of Electromyographic Biofeedback Training on Locus of Control of Deaf College Students.

Purpose: To examine the relationship between electromyographic (EMG) biofeedback training and locus of control within deaf college students.

Objectives: To increase control of muscle activity and internal locus of control within deaf college students.

Population: Deaf college students enrolled in a postsecondary program with support services for deaf persons.

You are being asked to voluntarily be part of this study. During the first meeting you will be asked to complete three questionnaires: The Demographic Questionnaire, the Learning Styles Inventory, and A Test of Attitudes. You will also be introduced to electromyographic (EMG) biofeedback, a machine that tells you how much muscle tension you have. The first meeting will last about 1-1½ hours. A final meeting of about 45 minutes during the fifth or sixth week will be scheduled. During the final meeting, you will again complete two questionnaires. The total time required of you in the study will be about two hours.

During each of the two meetings, the following will be done: (1) surface sensors will be placed on your forehead after the forehead is cleaned; (2) you will be asked to sit in a comfortable chair for 20 minutes and to completely relax; (3) during each meeting the forehead tension level will be recorded; (4) when the meeting is finished the sensors will be removed; (5) your forehead will be washed.

Cleaning the forehead may cause a little irritation so a lotion will be provided to you. There are no physical or psychological problems expected. You may enjoy learning about your muscle tension and how relaxation and biofeedback can help to reduce body tension. You may ask questions at any time during the study. The researcher will provide time for questions at the end of each meeting. If you are interested, you may see the information about yourself and the general results when the study is finished. You may withdraw from the study at any time without fear of penalty from the researcher or the college. You are asked to make a sincere effort to come to the two meetings once you agree to be in the study. The results of the study will be confidential. No names will be used. If the study is published, the results will be discussed as group results, with no names mentioned.
Subject's Consent (Continued)

"I have read the above 'Subject's Consent.' The nature, demands, risks, and benefits of the project have been explained to me. I understand that I may ask questions and that I may withdraw from the project at any point in time without ill will.

I also understand that this consent form will be filed in an area designated by the Human Subjects Committee with access restricted to the principal investigator or authorized representative of the particular department. I understand that a copy of this consent form is available to me upon request."

Subject's Signature: ___________________________ Date: __________
Witness's Signature: ___________________________ Date: __________
Principal Investigator: ___________________________ Date: __________
Demographic Questionnaire

I.D. Number:__________  
Date:__________________

1. Age: ____________
2. Sex: ____________
3. When did you become deaf? ____________________________
4. How long have you used sign language? ________________
5. Are any other members of your family deaf?  
   Yes _______  No _______
   Please check and list ages of brothers and sisters:

   Deaf           or           Hearing

   Father
   ____________  ____________
   Mother
   ____________  ____________
   Brother or Sister
   ____________  ____________  Age: ________  ____________
   ____________  ____________  ____________  ____________
   ____________  ____________  ____________  ____________
   ____________  ____________  ____________  ____________

6. Where did you got to school before college:

   Residential School ______  Date: ______  No. of years _______
   Other ___________________  Date: ______  No. of years _______
7. What is your major in college? ____________________________

8. What class are you?  Freshman _______ Sophomore _______
    Junior _______ Senior _______

9. Do you have any disability other than deafness?
   Yes ____ No ____  If yes, what? __________________________

10. Do you take any medication prescribed by a doctor:
    Yes ____ No ____  If yes, what? __________________________

11. Do you use any non-prescription medication (like aspirin, Excedrin, Milk of Magnesia, Sominex)? Yes _____ No ______

12. Do you drink coffee, tea or Coca Cola? Yes _____ No ______

13. Do you drink alcoholic beverages?  Yes _____ No ______
    If yes, how many glasses of beer, wine or mixed drink do you drink each week? __________________________

14. Do you exercise regularly?  Yes _____ No _____
    If yes, what kind of exercise do you do? __________________________

15. Do you think that you are generally healthy?
    Yes _____ No _____

16. Have you ever had biofeedback training? Yes _____ No _____
    If yes, please describe: __________________________
APPENDIX C

NTID LEARNING STYLES INVENTORY

The NTID Learning Styles Inventory was used for this study by permission of the developers, F. J. Dowaliby, N. E. Burke, and B. G. McKee, Department of Educational Research and Development of the National Technical Institute for the Deaf at Rochester Institute of Technology, Rochester, New York.
A SURVEY OF:
Learning Styles and Study Habits

All information collected from this questionnaire will be kept confidential. Your answers will not affect your grades in any of your classes.

Name ____________________ Social Security No. ____________________

Are you: Male _______ Female _______

What is your major? ____________________

How old are you? ______

How many quarters have you had this major? ____________________

What year did you first come to NTID? ______
Please circle the letter that best describes how you feel

<table>
<thead>
<tr>
<th></th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Not Sure</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. When I think my homework is hard, most of the time it is hard because the teacher gave out hard work.</td>
<td>SA</td>
<td>A</td>
<td>NS</td>
<td>D</td>
<td>SD</td>
</tr>
<tr>
<td>2. I learn better in class when I find out how to do a problem by myself.</td>
<td>SA</td>
<td>A</td>
<td>NS</td>
<td>D</td>
<td>SD</td>
</tr>
<tr>
<td>3. If my boss fired me, it would probably be because other people did not help enough when I needed help.</td>
<td>SA</td>
<td>A</td>
<td>NS</td>
<td>D</td>
<td>SD</td>
</tr>
<tr>
<td>4. If I fail a course, it means that my work was not good enough.</td>
<td>SA</td>
<td>A</td>
<td>NS</td>
<td>D</td>
<td>SD</td>
</tr>
<tr>
<td>5. When I am successful in my job, it is probably because other people did my work for me.</td>
<td>SA</td>
<td>A</td>
<td>NS</td>
<td>D</td>
<td>SD</td>
</tr>
<tr>
<td>6. I learn better when I study with my friends than when I study by myself.</td>
<td>SA</td>
<td>A</td>
<td>NS</td>
<td>D</td>
<td>SD</td>
</tr>
<tr>
<td>7. I will be successful in my career if I know important people.</td>
<td>SA</td>
<td>A</td>
<td>NS</td>
<td>D</td>
<td>SD</td>
</tr>
<tr>
<td>8. If I have to work on (solve) a new problem in math or science class, I like to try to do the problem myself.</td>
<td>SA</td>
<td>A</td>
<td>NS</td>
<td>D</td>
<td>SD</td>
</tr>
<tr>
<td>9. When a teacher says that I did not do a good job on my homework, that means the teacher does not like me.</td>
<td>SA</td>
<td>A</td>
<td>NS</td>
<td>D</td>
<td>SD</td>
</tr>
<tr>
<td>10. When I get a bad grade on a test, most of the time, it is because I did not study enough for the test.</td>
<td>SA</td>
<td>A</td>
<td>NS</td>
<td>D</td>
<td>SD</td>
</tr>
<tr>
<td>11. To get more money at work, a person has to be lucky.</td>
<td>SA</td>
<td>A</td>
<td>NS</td>
<td>D</td>
<td>SD</td>
</tr>
</tbody>
</table>
12. When a teacher gives me a project, I like best to do the project alone (by myself).

13. When a teacher tells me that my homework is very good, that means that the teacher says that to all the students to make them work harder.

14. When I think my homework is hard, most of the time it is hard because I did not study enough before I tried to do the homework.

15. When I get an “A” on a test, most of the time it is because the test was very easy.

16. When my teacher gives me a homework problem which is not exactly like examples given in class, I often ask my friends for help with the problem.

17. If my boss fired me, it would probably be because I did not work hard enough.

18. When I get a good grade in a course, it is most often because the teacher liked me.

19. I learn better when I study by myself than when I study with my friends.

20. When a teacher tells me to improve by work, that means that the teacher says that to all the students to make them work harder.

21. When I have trouble learning something in a class, it is most often because I did not try hard enough to learn it.

22. If I fail a course, it means that the teacher did not like me.

23. When my teacher gives me a homework problem which is not exactly like examples given in class, I find out how to do the problem by myself.
NTID's principle goal in doing research is to influence the education, training and career placement of deaf citizens through systematic examination of issues related to deafness. As one part of NTID's total research effort, the Department of Research and Development conducts descriptive and experimental research. Research findings are used in the development of programs and materials in the areas of learning and instruction, personal and social growth, and career development of deaf students.

This material was prepared through an agreement between Rochester Institute of Technology and the U.S. Department of Education

NTID Learning Styles Inventory

Developed by: Dowaliby, F.J., Burke, N.E., & McKee, B.G.
Department of Educational Research and Development
National Technical Institute for the Deaf at Rochester Institute of Technology. 1982
APPENDIX D

A TEST OF ATTITUDES

A Test of Attitudes is a revised form of the Children's Manifest Anxiety Scale (see Castenada, McCandless & Palermo. 1956). It was used by permission of the developer, F. J. Dowaliby of the Department of Educational Research and Development, National Technical Institute for the Deaf at Rochester Institute of Technology, Rochester, New York. The December 1981 revised form was used.
Answer all questions below. Put a circle around "Yes" if the sentence is usually true for you. Circle "No" if the sentence is not usually true for you.

Yes No 1. I get nervous when someone watches me work.
Yes No 2. I like everyone I know.
Yes No 3. I would rather win than lose in a game.
Yes No 4. I am secretly afraid of a lot of things.
Yes No 5. I have trouble making up my mind.
Yes No 6. I get nervous when things do not go the right way for me.
Yes No 7. I worry most of the time.
Yes No 8. I am always kind.
Yes No 9. I worry about what my parents will say to me.
Yes No 10. I always have good manners.
Yes No 11. I have worried about things that did not really make any difference later.
Yes No 12. I am always good.
Yes No 13. I worry about what is going to happen.
Yes No 14. I worry about how well I am doing in school.
Yes No 15. I am always nice to everyone.
Yes No 16. I tell the truth every single time.
Yes No 17. I feel someone will tell me I do things the wrong way.
Yes No 18. It is hard for me to keep my mind on my school work.
Yes No 19. I never get angry.
Yes No 20. Often I feel sick in my stomach.
Yes No 21. I often do things I wish I had never done.
Yes No 22. I never say things I shouldn't.
Yes No 23.  I get tired easily.
Yes No 24.  It is good to get high grades in school.
Yes No 25.  I am nervous.
Yes No 26.  I never lie.
REFERENCES


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