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### A COMPARISON OF UNIDIMENSIONAL AND MULTIDIMENSIONAL LOCUS OF CONTROL SCALES FOR THE MEASUREMENT OF THE EFFECTS OF SELF-REGULATION TRAINING

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A COMPARISON OF UNIDIMENSIONAL AND MULTIDIMENSIONAL  
LOCUS OF CONTROL SCALES FOR THE MEASUREMENT OF THE  
EFFECTS OF SELF-REGULATION TRAINING

A Thesis Submitted to the Graduate School  
in Partial Fulfillment of the Requirements  
for the Degree of  
Master of Science

By

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PITTSBURG STATE UNIVERSITY

Pittsburg, Kansas

April 1992

A COMPARISON OF UNIDIMENSIONAL AND MULTIDIMENSIONAL  
LOCUS OF CONTROL SCALES FOR THE MEASUREMENT OF THE  
EFFECTS OF SELF-REGULATION TRAINING

An Abstract of the Thesis by  
Alan Joseph Paduano

Comprehensive training in self regulation (SR) (including biofeedback training, relaxation techniques, and cognitive therapy principles) has been proposed as a means of affecting change in individual locus of control (LOC) orientation. The current study directly compared a unidimensional LOC scale (Rotter, 1966) with a multidimensional LOC scale (Levenson, 1973) in the ability to detect changes in the LOC orientation. Other effects of SR training were measured by the State-Trait Anxiety Scale (STAI) and the Irrational Beliefs Test (IBT). Nineteen participants in a biofeedback/stress reduction class completed a course in SR training. The pretest/posttest results were compared with those of a matched control group. Results indicated SR training did not affect either state anxiety or LOC orientation as measured by the instruments. Consequently, the comparison of the two LOC scales revealed no differences and the null hypothesis could not be rejected. However, the scores on the IBT indicated the experimental group significantly decreased in their

scores on four irrational beliefs ( $p < .05$ ) while the control group decreased in one irrational belief ( $p < .05$ ). It was concluded that SR training decreased some aspects of irrationality in participants.

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## Chapter I

### PROBLEM BACKGROUND, FORMULATION, AND DEFINITION

#### Social learning theory and locus of control

Locus of control is a construct proposed by Rotter (1966) to describe the extent to which an individual perceives reinforcing or punishing events to be under his or her personal control. It arose out of his social learning theory (1954) which is "a theory of how choices are made by individuals from the variety of potential behaviors available" in social settings (Phares, 1976, p. 14). Rotter's general formula posits that the potentiality of the occurrence of a behavior of a person is a function of "the nature or importance of goals or reinforcements and the person's anticipation or expectancy that these goals will occur" (Rotter, 1954, p. 102). If the expectancy that certain behaviors will lead to valued reinforcement is low, then the likelihood that behavior will occur also tends to be low. Conversely, if this expectancy is high, then the likelihood that behavior will occur tends to be high.

This generalized expectancy of reinforcement is based upon an actual history of prior reinforcements or punishments (Carlson, 1982). If certain behaviors have, in the past, consistently led to the satisfaction of a need, then a person's generalized expectancy of reinforcement is likely to be relatively high. Locus of control, a specialized form of generalized expectancy, involves an

analysis by the individual of his or her source of reinforcements, positive or negative, and whether they are largely attributable to the environment or the person's own actions (Carlson, 1982). Through this causal analysis, one arrives at one of two orientations; the belief in internal control or the belief in external control:

When a reinforcement is perceived by the subject as following some actions 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).

#### A reformulation of locus of control

Rotter originally formulated LOC as a unidimensional construct or a general variable that does not differentiate between different aspects of control. However, many researchers (Gurin, Gurin, Lao, & Beattie, 1969; Mirels, 1970; Abramowitz, 1973; Levenson, 1973; Reid & Ware, 1973, 1974; Cherlin & Bourque, 1974; Collins, Martin, Ashmore, & Ross, 1973) have, using factor analytic procedures, found many separate aspects of control such as personal control, political control, impulse control, control by fate or chance, and others. These findings provide evidence for the multidimensional nature of the LOC construct.

That is, decisions made based on a belief in control by powerful others are considered separate from those decisions based on the belief in control by fate or chance, and both are distinguished from the belief in personal control.

Levenson created the first formal multidimensional scale of LOC in 1963. She posited that the I-E scale did not meaningfully differentiate between two types of external orientation- the belief in chance (i.e., the world is basically unordered and random) and the belief that powerful others are in control. Separating the unidimensional I-E scale of Rotter into three dimensions was done in order to understand better the relationship between expectation for control and other variables.

According to Levenson (1981):

"The I, P, and C Scales were designed to differ from Rotter's I-E Scale in five important ways:

1. They are presented as a Likert Scale, instead of in a forced-choice format, so that their three dimensions are more statistically independent of one another than are the two dimensions of Rotter's scale.

2. The I, P, and C Scales make a personal-ideological distinction. All statements are phrased so as to pertain only to the person answering. They measure the degree to which an individual feels he or she has control over what happens, not what the person feels is the case for 'people in general'.

3. The items in the scales contain no wording that might imply modifiability of the specific issues. Both the factors of personal versus ideological control and system modifiability were found by Gurin et al. (1969) to be contaminating factors in Rotter's I-E Scale.

4. The I, P, and C Scales are constructed in such a way that there is a high degree of



parallelism in every 3-item set. (This was done apparently to equate the three scales structurally as much as possible).

5. Correlations between items on the new scales and the Marlowe-Crowne Social Desirability Scale are negligible and nonsignificant." (p. 17-18)

Levenson agrees with other researchers in arguing that Rotter's construct is too broad and may not accurately reflect specific belief orientations.

#### Research on locus of control

The construct of locus of control has spawned a continuously increasing literature since its inception. The relationship between locus of control and psychological state is slowly becoming more clear. In a very general sense, in mainstream American culture, it appears that those individuals who are internally oriented (i.e., believe they are in control of reinforcements) are better adjusted overall (Vickers, Conway, & Haight, 1983; Lefcourt, 1982; Rotter, 1966), cope better, and are less defensive (French, Rodgers, & Cobb, 1974; Haan, 1977) than individuals who are externally oriented. "Internals" also report higher self-confidence (Lester & Tappert, 1981), score lower on neuroticism (Morelli, Krottinger, & Moore, 1979), and exhibit fewer irrational beliefs (Morelli & Morelli, 1979) than their counterparts. While it is true that an extremely internal orientation can at times be unrealistic (Gilbert, 1976) and lead to self-blaming (Davis & Davis, 1972; Phares & Lamiell, 1974), in general, an internal LOC seems to be

conducive to getting along in the world.

Conversely, "externals" in mainstream American culture (i.e., those who believe control of reinforcement is outside themselves) fare less well. They tend to exhibit more severe psychopathology (Shybut, 1968; Levenson, 1973), show more depression (Burger, 1984; Hanes & Wild, 1977; Calhoun, Cheney, & Dawes, 1974), show more suicidal ideation (Lester, 1989; Burger, 1984), manifest considerably more anxiety and hostility (Singh, 1986), perform poorer academically (Buck & Austrin, 1971; Goldston, Zimmerman, Seni, & Gadzella, 1977), and generally have lower self-confidence (Lester & Tappert, 1981). It appears that "externals" do not accept responsibility for their problems, and therefore, do not address their difficulties. Instead they tend to blame chance events and powerful others for their problems. While this attribution may be entirely appropriate at times when external events actually are in control, overall, it is not conducive to problem solving.

Many psychotherapists believe locus of control to be a mediating factor concerning whether or not productive therapy takes place or not. It is unlikely that clients will attempt to change themselves unless they believe they are responsible for themselves and have control over the outcome of their lives (Glasser, 1965; Peck, 1978). Consequently, it is important that psychologists find ways of encouraging and facilitating an internal locus of

control. Self-regulation (SR) training appears to hold some promise in this area.

### Self-regulation training (SR)

According to Shellenberger and Green (1986), SR training, also known as biofeedback training or psychophysiological therapy, is training in the cognitive, the behavioral, and the physiological domains with the ultimate goals being self-regulation in all domains. Techniques of SR training include the use of biofeedback, autogenic relaxation, progressive muscle relaxation, guided imagery, breathing methods, and rational emotive therapy. Through systematic practice of these techniques, subjects gradually gain control of autonomic functions.

### The rationale for using self-regulation

The rationale for using SR training to facilitate shifts in locus of control is fairly straightforward. According to Phares (1976) "an individual's generalized [LOC] orientation is not a fixed characteristic; changes in an expectancy can be brought about by introducing new experiences that alter previous patterns of success and failure" (p. 13). He goes on to say that "the presence of explicit situational cues about the contingency between behavior and outcome should diminish the importance of a generalized expectancy for internal or external control" (p. 22). Through 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 LOC (Yates, 1975).

SR training begins with behaviors that are normally out of the control of the individual such as physiological responses to stress or irrational thinking patterns. It then teaches the individual to control these behaviors through exposure to relaxation techniques, cognitive therapy, biofeedback and/or other programs. Repeated experiences with ample feedback and reinforcement lead the individual to make the causal attribution that they are in control of these behaviors. Research, to some degree, has demonstrated that increased personal control of physiological functions actually does lead to a shift towards a more internal LOC orientation (Cox, Freundlich, & Meyer, 1975; Carlson, 1977; Carlson & Feld, 1978; Stern & Berrenberg, 1977; Kappes & Michaud, 1978; Zaichowsky & Kamen, 1978; Omizo, 1980; Chen, 1986). Furthermore, since "expectancies generalize from a specific situation to a series of situations which are perceived as related or similar" (Rotter, 1966, p. 2), it seems plausible that once an individual experiences the ability to control some aspects of his or her life, such experiences will lead to further attempts to control life events and feelings of responsibility for the outcome of events.

### Statement of the problem

With the rationale stated above, researchers have attempted to demonstrate empirically that SR training affects LOC orientation. Unfortunately, only about half the studies have been successful. There exists a difficulty with the past research which may possibly account for some of the incongruence between studies:

- 1) The use of unidimensional rather than multidimensional LOC scales in the past research may have resulted in inaccurate findings.
- 2) Inadequate training procedures may have failed to adequately teach self-regulation skills.

### The purpose of the study

The primary concern of the study is to directly compare a multidimensional LOC scale with a unidimensional LOC scale in the ability to detect changes in LOC as a result of extensive training in self-regulation. An extensive training program is utilized in order to maximize the possibility of changing LOC orientation and thus create the right conditions in which to compare different LOC scales. The intent is to determine if real differences exist between unidimensional and multidimensional LOC scales in their ability to detect changes in LOC resulting from SR training.

A secondary concern of the study is to examine the effects of a comprehensive program in self regulation. Besides the locus of control variable, other dependent

variables such as the state/trait anxiety scale (STAI) and the irrational beliefs test (IBT) are utilized to measure the effects of SR training.

### Significance of the study

The study's significance is two-fold. First and most importantly, the study is attempting to compare a multidimensional LOC scale with a unidimensional LOC scale. If significant differences are found, researchers will not only have a new way of understanding the relationship between SR training and LOC, but they will also have a new criterion by which to judge past research.

Secondly, the study is attempting to demonstrate the effects of an extensive program of SR training on several dependent variables such as LOC, state/trait anxiety, and irrationality.

### Questions to be answered

- 1) Is there a significant difference in results between the multidimensional LOC scale and the unidimensional LOC scale?
- 2) What effect will SR training have upon LOC, anxiety, and irrational beliefs?

### Hypotheses to be tested

1.1 Null hypothesis: There is no difference between changes in the IPC Scales and changes in the I-E Scale from pretest to posttest.

2.1 Null hypothesis: There is no difference between

experimental and control group as determined by scores on pretests and posttests of the Internal, Powerful Others, and Chance (IPC) Scales.

2.2 Null hypothesis: There is no difference between experimental and control group as determined by scores on pretests and posttests of the Internal External (I-E) Scale.

2.3 Null hypothesis: There is no difference between experimental and control group as determined by scores on pretests and posttests of the State Trait Anxiety Inventory (STAI).

2.4 Null hypothesis: There is no difference between experimental and control group as determined by scores on pretests and posttests of the Irrational Beliefs Test (IBT).

### Definition of Terms

#### Unidimensional Locus of Control

Locus of Control is a generalized expectancy construct that reflects the extent to which an individual perceives reinforcing or punishing events to be under his or her personal control. An external orientation is defined as a belief that reinforcing events are a function of chance or other persons or forces acting upon the individual. An internal orientation is a belief that reinforcers are a function of one's own actions (Rotter, 1966).

#### Self-Regulation Training

Self-regulation training is an extensive program of

training in various techniques with the ultimate goal being self-regulation in the cognitive, the behavioral, and the physiological domains. Techniques for teaching self regulation are as follows:

1. Biofeedback training is a technique in which a biofeedback instrument "feeds back" ongoing biological information, such as heart rate, muscle tension, or skin temperature, usually by means of meters, lights, or audio signals, to subjects so that they can become aware of these inner occurrences.
2. Autogenic training is a technique described by Wolfgang Luthe (1963) and involves the subject reciting "self-suggestions" that focus on various physiological aspects such as heaviness and warmth in the extremities, regulation of cardiac activity and respiration, abdominal warmth and cooling of the forehead.
3. Progressive Muscle Relaxation is a technique originate by Edmond Jacobson (1935) which involves tensing and relaxing specific muscle groups in order to release tension as well as increase body awareness.
4. Guided Imagery involves a therapist or guide verbally instructing the subject to experience, verbally, visually, or kinesthetically, a series of images woven together in a fantasy.
5. Rational Emotive Therapy is a cognitive therapy originated by Albert Ellis (1962) and involves teaching



subjects to identify and dispute irrational thinking, and to permanently change maladaptive perceptions.

6. Controlled Breathing involves breathing awareness, deep breathing, diaphragmatic breathing, and other techniques. Proper breathing is an antidote to stress.

## Chapter II

### SELECTED REVIEW OF THE LITERATURE

#### LOC and SR training

The literature examining the relationship between SR training and LOC is somewhat confusing and contradictory. Of the fourteen studies reviewed, eight successfully demonstrated shifts in LOC to a more internal orientation for experimental groups only. The remaining six failed to do so.

#### "Successful" studies

One of the first studies to successfully demonstrate shifts in LOC as a result of SR training was conducted by Cox, Freundlich, and Meyer (1975). They divided 27 chronic tension headache sufferers into three groups: an EMG biofeedback and relaxation group (BF), a relaxation group (R), and a medication placebo control group (C). After four weeks of training, both the BF and R groups had significantly reduced their EMG levels, amount of psychosomatic complaints, and their intake of medication. Furthermore, only the BF and R groups shifted significantly to a more internal LOC and retained that change at a four month follow-up.

Similarly, Carlson (1977) administered college undergraduates four weeks of EMG biofeedback training and found that subjects who rated external on pretest LOC measures shifted significantly to a more internal

orientation while "internal" subjects did not change in orientation. A later study by Carlson and Feld (1978) has replicated this finding.

Additionally, a study by Omizo (1980) demonstrated significant shifts to a more internal LOC orientation for 28 hyperactive boys after they received EMG biofeedback and relaxation training over a period of six weeks. No changes occurred in a similar group of hyperactive boys who received no treatment.

Additional researchers have found similar results (Kappes & Michaud, 1978; Stern & Berrenberg, 1977; Zaichowsky & Kamen, 1978; Chen, 1986). All conclude that SR training effectively shifts LOC to a more internal orientation. Unfortunately, other research has either not demonstrated shifts in LOC or has not found significant differences between experimental and control groups.

#### "Unsuccessful" studies

Reed and Saslow (1980) divided 27 test anxious college freshmen into three groups; an EMG biofeedback and relaxation group (BF), a relaxation group (R), and a no-treatment control group (C). After four weeks of treatment, posttest LOC scores did not indicate significant differences between experimental and control groups. In this study, the BF group actually fared worse than the R group!

Hurley (1980) also found disconfirming evidence for the relationship between LOC and SR training. He compared four

groups of college undergraduates on LOC measures after each had received eight weeks of either EMG biofeedback, meditation, autogenic relaxation, or no treatment. Although all experimental groups increased in ego strength and decreased in anxiety, no significant differences between pretest and posttest were found on the LOC scores.

Other studies have either failed to demonstrate shifts in LOC as a result of SR training (Hickling, Sison & Vanderploeg, 1986; Johnson & Meyer, 1974; Bird & Wilson, 1988) or have failed to show differences between experimental and control groups (Katz, Simkin, & Beauchamp, 1987). Various explanations exist to account for this lack of congruence between studies.

#### Methodological problems in the research

Two main methodological problems exist which may account for some of the incongruence among studies examining the relationship between LOC and SR training. First, the reliance on unidimensional LOC scales in research dealing with SR training appears inappropriate because these instruments may not be sensitive to the changes that result from training. The possibility exists that even if changes are occurring, these LOC instruments do not reflect it as well as the newer multidimensional scales would (Stein & Wallston, 1983). Secondly, the "bare bones" biofeedback and relaxation training procedures used in the research are questionable in their ability to teach self-regulation

(Shellenberger & Green, 1986). Here the problem may be that the subjects fail to learn self-regulation to a degree where they feel competent despite physiological measures indicating a degree of control has been obtained. These subjects may not be convinced of their ability because of inadequate training procedures.

#### Unidimensional vs. Multidimensional LOC Instruments

The use of unidimensional LOC scales in nearly 80% of the studies reviewed demonstrates a lack of clear understanding by researchers of the LOC construct and the logic underlying the use of SR training to shift LOC. Because SR training is intended to increase one's sense of personal control over previously autonomic physiological processes, theoretically it should not affect beliefs in either the chance or the powerful others dimensions of LOC (Wagner, Bourgeois, Levenson, & Denton, 1974). Since unidimensional LOC scales do not differentiate between these separate belief orientations, they may not be as sensitive to changes in LOC orientation as a multidimensional LOC scale. Support for this contention comes from Stern and Berrenberg (1977) and Chen (1986).

Stern and Berrenberg administered true EMG biofeedback to one group of college undergraduates, false feedback to another group, and no feedback to another group. Then, using the subscales of the I-E scale as determined by Mirels (1970), they analyzed the differences between groups. Not

only was the group that received true feedback the only one to show significant reductions in EMG levels, it was the only one that demonstrated shifts towards internality on LOC. Furthermore, these changes occurred only on the personal control subscale, not on the political control subscale or the total I-E scale. They concluded that this finding "casts doubt on Rotter's (1966) assumption that locus of control is a unidimensional construct, and might caution researchers to consider aspects of the I-E scale as they relate to specific situational contexts" (Stern and Berrenberg, 1977, p. 181).

Similar results were found by Chen (1986) when he utilized the Wallston Multidimensional Health Locus of Control Scale (Wallston, Wallston & DeVellis 1978) in examining the effects of EMG biofeedback training on college students. He found that although LOC as a whole did not show significant differences, the levels of beliefs in personal control of health behaviors were significantly improved.

Additional support for efficacy of multidimensional LOC scales comes from a variety of studies. Ganellen and Blaney (1984) in examining the relationship between locus of control orientation, life stress, and depression found multidimensional LOC scales to be more accurate than unidimensional scales. Schlegel and Crawford (1978) compared a general I-E

scale with a multidimensional scale in studying drug use among high school students. They found the unidimensional LOC scale failed to find relationships in variables and in some cases indicated relationships that were misleading. They contend that "the older unidimensionally based instruments for assessing I-E should no longer be employed" (p. 149). Kapel, Hill, and Gourley (1983) agree with others in stating that multidimensional LOC scales provide researchers with "precision not afforded by a unidimensional LOC instrument" (p. 83) Stein and Wallston (1983) concur:

"By encompassing LOC within a multidimensional framework, there is more precise measurement of the relative extent to which an individual perceives personal control over his/her outcomes. This lack of precision in measurement with a unidimensional scale may explain some of the disparity in findings with [biofeedback training], and would suggest that future research would be better served by using a multidimensional measure of LOC." (p. 42)

The use of unidimensional scales in the research is unfortunate because it increases the likelihood that researchers will make a type II error and fail to reject the null hypothesis when it is false. Furthermore, if researchers are really interested in understanding the nature of the relationship between LOC and SR training, they need to find factors that correlate with LOC changes. No unidimensional scale has successfully found any such correlations. Only Stern and Berrenberg (1977) have found

significant correlations between EMG changes and changes in LOC orientation and then only for the personal control subscale, not for either the political control subscale or the I-E scale as a whole. The multidimensional nature of the LOC construct demands the use of multidimensional instruments in measurement.

### Training procedures

A second explanation for the disparity in findings between studies is the lack of congruence in training methods. The length of training sessions ranged from 20 minutes to one hour, and they occurred as many as two times per week to as little as one every three weeks. Furthermore, overall training lasted anywhere from three to twelve weeks. While some of the studies included only EMG biofeedback, others included progressive relaxation, guided imagery, autogenic relaxation, breathing exercises, taped relaxation programs, and/or other techniques. Conclusions concerning SR training become very difficult to make because of the lack of a clear well accepted methodology.

Shellenberger and Green (1986) argue that SR training is similar to training in any advanced skill and requires an extensive procedural methodology based on a mastery model. They describe twelve common methodological and conceptual errors found in research that utilizes biofeedback training. The majority involve the training procedures used by researchers. Common errors include insufficient number of



training sessions, insufficient length of each training session, lack of homework exercises, lack of cognitive support, the failure to establish training criteria, and the failure to train to mastery. They contend that "because so many methodological errors have occurred in the majority of biofeedback studies, it is difficult to determine whether or not biofeedback training has failed" (p. 55).

The essential ingredients of biofeedback training according to Shellenberger and Green are "clear goals, rewards for approximating the goals, enough time and practice for learning, proper instructions, a variety of training techniques, and feedback of information" (p. 3). Unfortunately, very few studies believe it methodologically sound to utilize such a mastery model because of the experimental "noise" it creates. Researchers have doggedly relied on "bare-bones" biofeedback training in an attempt to control for extraneous factors. Unfortunately, such procedures are grossly inadequate in teaching an advanced skill such as self-regulation. One may question whether subjects are learning anything at all in these studies or if they even understand what self-regulation is.

### Summary

In summary, reviewing the literature on LOC and SR training has revealed certain contradictions. Only eight out of the fourteen studies reviewed successfully demonstrated shifts in LOC. Two main methodological

problems in the research may account for the discrepancy between studies; the use of unidimensional LOC scales and inadequate training procedures.

The current study is attempting to account for these methodological problems by:

1. Comparing a unidimensional LOC scale with a multidimensional LOC scale in the ability to detect changes due to SR training.
2. Utilizing a comprehensive mastery model training program in self-regulation and comparing the results of experimental subjects with those of a matched control group.

## Chapter III

### METHODOLOGY

#### Sample Population

The sample population consisted of 73 male and female undergraduate college students enrolled in a small midwestern college of about 6,000 students. The experimental group consisted of 6 males and 13 females (mean age = 26.2 years) enrolled in a biofeedback/ stress reduction class. The control group consisted of 6 males and 13 females (mean age = 26.1 years) matched as closely as possible on age, sex, and pretest LOC scores. The control group was selected from a pool of 14 males and 39 females enrolled in a history and systems psychology class.

#### Research Design

In order to test the effects of training, a matched control group design was utilized:

O1	X	O2
-----		
O1		O2

SR training was the independent variable. The IPC Scales, the IE Scale, the STAI Scale, and the IBT were the dependent variables used for assessment. The control group was selected so as to maximize similarities to the experimental group.

### Apparatus

The biofeedback instrumentation used included an electromyograph (J&J module M-501), a photoplethysmograph (J&J module P-401), and a thermal trainer (J&J module T-601). All three instruments were interfaced with a Commodore personal computer (model 60C) and visual and auditory feedback were produced via software specified for biofeedback training (J&J "V8" system).

Muscle tension biofeedback was generated from frontalis electromyography monitored by three disk electrodes placed across the forehead (Budzynski, Stoyva, Adler, & Mullaney, 1973). Signals were calculated every 0.1 seconds and then presented visually in the form of a line graph and other computer graphics and auditorily in the form of a constant tone which fluctuated in pitch as muscle tension changed. Each time a change of 0.2 microvolts uv occurred, visual and auditory feedback changed one increment. Range of the instrumentation could be tailored to each client but generally ranged anywhere from 0.0 to 9.0 microvolts.

Skin temperature biofeedback was generated from thermal readings monitored by a sensor which was taped to the outside of the medial phalanx of the middle finger of each hand. Signals were calculated every 0.1 seconds and then displayed visually as a line graph and auditorily as a constant tone which fluctuated in pitch as temperature changed. Each time temperature changed 0.1 degrees,

feedback changed one increment. Range of the instrumentation was tailored to each client but generally encompassed 87 - 96 F.

Heart rate biofeedback was generated from photoplethysmography monitored by a sensor that fastened to the inside of the distal phalanx of the thumb of the right hand. The signal was calculated every 0.3 seconds and displayed visually in the form of a constantly changing history graph (a bar graph which displays past and present signals) and auditorily as a constant tone which changed in pitch as heart rate changed. Each time heart rate changed 0.1 beats per minute, feedback changed one increment. Range of the instrumentation encompassed 0.0 to 180.0 beats per minute.

Additionally, a small cassette tape recorder was utilized to play relaxation tapes.

### Instrumentation

The measures used for assessment were:

"Internal, Powerful Others, and Chance Scales" (IPC).

Levenson's "Internal, Powerful Others, and Chance Scales" (1973) is a modification of Rotter's (1966) Internal-External control scale. It is a 24-item self-report measure that assesses the degree to which individuals view environmental events as being under their personal control. Each of the I,P,C scales consists of eight items in a Likert

format. These are presented to the subject as a unified attitude scale. Scores can range from 0-48 for each of the scales.

The Internality scale measures the extent to which individuals feel personal control over their life circumstances. A high score indicates high internality. The Powerful Others scale measures the extent to which life circumstances are felt to be controlled by powerful others. A high score signifies a feeling of being controlled. Finally, the Chance scale measures the extent to which life circumstances are attributed to chance or fate. A high score signifies a belief in chance.

Although internal consistency estimates are only moderately high, this is to be expected because the items sample from a variety of situations. Levenson (1974) reported Kuder-Richardson reliabilities for 152 students of .64 for the I Scale, .77 for the P Scale, and .78. for the C Scale. Wallston, Wallston, and DeVellis (1978) found similar estimates for 115 adults (.51, .72, and .73 respectively). Walkey (1979) replicated the factor structure of the scale and reported reliability values of .71, .65, and .72 respectively for the three subscales. Test-retest reliabilities for a 1-week period are in the .60-.79 range (Levenson, 1973) and for a 7-week period they range from .62-.73 (Zukotynski and Levenson, 1976).

"Internal-External Scale" (IE). Rotter's "Internal-External Locus of Control Scale" is a self report measure that assesses a person's perception of contingency relationships between his own behavior and events which follow that behavior. It consists of 23 question pairs, using a forced-choice format, plus six filler questions. Internal statements are paired with external statements. One point is given for each external statement selected. Scores can range from zero (most internal) to 23 (most external).

Rotter (1966) reported an internal consistency coefficient (Kuder-Richardson) of .70. A test-retest reliability coefficient of .72 was also reported for 60 college students, after one month (for males,  $r = .60$ ; for females,  $r = .83$ ).

"State-Trait Anxiety Inventory" (STAI). The "State-Trait Anxiety Inventory" (Spielberger, 1970) is a self report measure that assesses anxiety in two ways; as a relatively stable characteristic (trait anxiety) and as more of a transient, situational reaction (state anxiety). It consists of two separate 20-item Likert scales.

Dreger (1978) reported test-retest reliabilities for the state and trait scores, separately by males and females, after a one-hour interval: .33 (males) and .16 (females) for state, .84 (males) and .76 (females) for trait; 20 days: .54 and .27 for state, .86 and .76 for trait; 104 days: .33 and .31 for state, .73 and .77 for trait. Additionally, alpha

reliability coefficients for normative samples range from .83 to .92 for state scores and .86 to .92 for trait scores. "Irrational Beliefs Inventory" (IBT). The "Irrational Beliefs Inventory" (Woods, 1969) is a 100-item self-report inventory having a Likert scale format. It was originally developed as a means of assessing the ten irrational beliefs identified by Ellis (1962). The factor structure has been independently validated and scoring has been modified to better conform to empirically determined factor content (Lohr & Bonge, 1982). Lohr and Bonge (1980) reported test-retest reliability of the subscales over an 8-week period from .58 to .80 with a total score of .79.

### Procedure

Pretesting. During the first class meeting, experimental participants were presented an informed consent statement to read and sign which stated that all information given was held confidential and instructed the subject that he/she was free to withdraw consent and participation at any time. There were no consequences for nonparticipation. They were then administered the IPC Scales, the IE Scale, the STAI Scale, and the IBT. The order in which the tests were administered was counterbalanced using a random starting order with rotation method. Upon completion, each participant picked up an intake data packet to be completed by the next class period. The packet insured participants'



willingness and appropriateness for self-regulation training.

The control group consisted of both undergraduate and graduate students enrolled in a history and systems psychology class. The experimenter asked for volunteers to participate in a study on "how people change." Volunteers were first given an informed consent statement to read and sign and then administered the four psychological scales in counterbalanced order. Students identified themselves by student number not name so that posttests could be matched up while anonymity was preserved. The experimenter remained blind to all pretest data. Control group subjects were matched with experimental group subjects on age, sex, and pretest LOC scores and the 19 closest matches were selected for use as a comparison group.

SR training. The experimental intervention began approximately two weeks after the first class meeting and continued for approximately ten weeks. All training was done in a dimly lit room and participants sat in a comfortable reclining chair. During the first biofeedback session, the instructor introduced the equipment and procedures involved in the training, described the benefits of training, and offered to answer any questions the client had. The instructors, a male graduate student and a female undergraduate student, were under the supervision of a certified biofeedback therapist and were thoroughly trained

and had demonstrated proficiency in self-regulation techniques.

Experimental participants participated in weekly 50-minute sessions consisting of frontalis muscle electromyographic, heart rate, and skin temperature visual and auditory biofeedback training for ten weeks. Approximately 25-30 minutes of each session involved focused training on reducing muscle tension, decreasing heart rate, and increasing the skin temperature of the hands. The remaining 20-25 minutes required the client to listen to taped relaxation programs and use feedback information to relax as much as possible. The taped relaxation programs, which covered a variety of relaxation techniques including diaphragmatic and controlled breathing, autogenic relaxation, progressive muscle relaxation, and guided imagery, were from the university's tape library of pre-recorded relaxation programs. The following tapes were available for use during sessions:

From SOURCE Cassette Learning Systems Inc.

- by Emmett Miller, M.D.:
- "A Healing Journey" (1979)
- "Letting Go of Stress" (1980)
- "Winning at Learning" (1980)
- "Writing Your Own Script" (1980)
- "10 Minute Stress Manager" (1983)
- "Optimal Performance" (1983)
- "Relaxation and Inspiration" (1985)
- "Headache Relief" (1985)

From Stress Management Research Assoc.:

- "Visual Imagery- Island Journey" (1977)

From "Healing" - by Todd Rungren, Bearsville records:

- "Healing" side 2 (1980)

Physiological measures were recorded during the entire session, and performance was summarized and shown to the student at the end of each session.

In addition to the weekly laboratory sessions, participants were provided with a small hand thermometer and a relaxation tape which included 2 programs from E. Miller's "Letting Go of Stress" (1980). Side one consisted of autogenic relaxation instructions and side two consisted of progressive relaxation instructions. Participants were instructed to listen to side one of the tape once a day for a few weeks, then switch to side two for a few weeks, and then listen to whichever side they liked best. During these homework sessions, participants were required to monitor the skin temperature in one of their hands and keep a daily log indicating any changes in skin temperature. Training criteria for mastery defined low arousal as 1.0 microvolts on forehead and as the ability to raise hand skin temperature one degree every minute to 95°F and remain at that level for five minutes. All students were trained with the intention of their achieving mastery. Upon completion of the training, all participants were presented with a graph demonstrating their actual progress over time.

Additionally, experimental participants received instruction in Rational Emotive Therapy, were required to read a textbook which explained rational emotive strategies

(Miller, 1986), and were required to complete worksheets which involved disputing irrational thoughts. Formal class meetings were held every other week once a week for one hour and consisted of presentations on relaxation, biofeedback, and cognitive therapy. The control group did not undergo any special training.

Posttesting. During the next to last formal class session, the treatment group was again administered the IPC Scales, the IE Scale, the STAI scale, and the IBT in counterbalanced order, as well as a post-treatment information form. Also during this same week, during a class period, control group participants were similarly posttested on all the scales.

#### Analysis of the Data

A 2 (group, training vs. no training)  $\times$  2 (time of testing, pre vs. post) with repeated measures on time of testing design was used.

All scales were hand-scored by the experimenter and an assistant. These data as well as physiological data and participants' age and gender were entered into a computer data base. A repeated measures analysis of variance (ANOVA) was computed to test for main effects across groups and across trainers. Then a Student Newman Keuls Post Hoc Analysis was computed to determine which dependent variables were sensitive to changes in each group over time.

### Methodological Assumptions

It was assumed that the participants would answer the self-report questionnaires with honesty.

It was assumed that the tests used adequately measured Locus of Control, Anxiety, and Irrational Beliefs.

It was assumed that the differences in construction between the IPC Scales (Likert format) and the IE Scale (forced-choice format) were insignificant.

### Limitations of the Study

The study was limited in a number of ways:

1. Limitations of this research design in internal validity come from:
  - a. the possibility of mistaking for an effect of the treatment, differences in maturation between groups which is, in fact, unrelated.
  - b. the possibility that an event other than the treatment affects one group and not the other.
  - c. the possibility that changes in LOC orientation, anxiety, or irrational beliefs were more likely to be detected by measuring instruments in one group than in the other.
  - d. the possibility of mistaking for an effect of treatment, changes from pretest to posttest that are due to statistical regression.
2. The fact that participants in the experimental group are receiving specialized attention and those in the control

group are not may be a contaminating variable.

3. The possibility exists that participants were aware of the experimental hypotheses and inadvertently biased their responding on the measurement instruments.

4. The study does not determine which aspects of the treatment accounted for changes in experimental participants.

5. Limitations of this research design in external validity come from:

a. the possibility that the college population at Pittsburg State University is not representative of other college populations or other populations in general.

b. the possibility that the SR training program at Pittsburg State University is not representative of other SR training programs.

c. the possibility that results of SR training may not be generalizeable outside this experimental situation.

## Chapter IV

### RESULTS

All pretest and posttest scales were scored and the resulting data entered into a computer data base. The trait anxiety scale was dropped from the analysis because numerous subjects failed to fill out this questionnaire due to experimenter error. Two experimental subjects were lost because they dropped out of the class before training began. One additional subject had to be dropped from the analysis due to lack of pretest data. The following analyses were performed based on the seventeen remaining experimental subjects with their matched controls.

#### ANALYSIS OF VARIANCE ACROSS ENTIRE GROUPS

Main Effects and Interactions. In order to test whether experimental and control groups were equivalent before treatment, all pretest data were subjected to a group by sex repeated measures analysis of variance. The group main effect was not significant ( $p < .86$ ). Matching procedures were apparently successful in equating the two groups prior to treatment.

Furthermore, in order to check for possible experimenter effects, an analysis of variance by experimenter was conducted. Again, no significant main effect was found ( $p < .89$ ) indicating the experimenters did not differ significantly in their teaching of SR training.

In order to test the effects of treatment vs. no treatment across time, a 2 X 2 repeated measures analysis of variance was computed for all the dependent variables (State Anxiety Scale, Rotter IE Scale, Levenson IPC Scale, Irrational Beliefs Test). A significant within-subjects main effect occurred between pretest and posttest,  $F(1,32) = 11.19$ ,  $p < .002$  indicating posttest data to be significantly different from pretest data. There was no main effect of groups  $F(1,32) = 0.04$ ,  $p < .84$ . A Group x Time interaction, however, was found,  $F(1,32) = 4.81$ ,  $p < .04$  indicating a significant difference between experimental and control groups across the time factor. In other words, treatment significantly affected dependent variables from pretest to posttest. Generally speaking, training affected decreases in the scores on the Irrational Beliefs Test. The LOC scales and the State Anxiety scale were unaffected.

Specific DV Effects. To determine which dependent variables were sensitive to changes in each group over time, a Student Newman Keuls Post Hoc Analysis was computed. Results of this analysis (see Table 1) revealed no significant differences from pretest to posttest for either group on any of the locus of control measures or the state anxiety measure although trends were observed in the predicted direction.

With regard to the Irrational Beliefs Scale, the experimental group showed significant decreases in the



strength of four different irrational beliefs (need for approval, irrational self expectations, uncontrolled emotions, and excessive worrying about the future). The control group, in turn, showed one significant difference, a decrease over time of one irrational belief (over-reacting to frustrations). Table 1 shows means pre and post, and differences over time.

TABLE 1  
Results of Student Newman Keuls Post Hoc Analysis

<u>Dependent Variable</u>	<u>Experimental</u>			<u>Control</u>		
	<u>PRE</u>	<u>POST</u>	<u>DIFF</u>	<u>PRE</u>	<u>POST</u>	<u>DIFF</u>
<u>Levenson's LOC Scales:</u>						
Internality Scale-	35.5	36.9	-1.4	34.4	32.9	+1.5
Powerful Others Scale-	17.7	15.5	+2.2	17.9	19.8	-1.9
Chance Scale-	13.6	12.7	+0.9	16.7	15.9	+0.8
<u>Rotter's IE-Scale-</u>	8.8	8.1	+0.7	9.2	8.6	+0.6
<u>State Anxiety Scale-</u>	38.2	37.2	+1.0	36.8	34.8	+2.0
<u>Irrational Beliefs Scale:</u>						
#1 Approval From Others-	30.4	25.2	+5.2*	26.5	25.7	+0.8
#2 Self Expectations-	31.8	25.4	+6.4*	30.4	28.4	+2.0
#3 Blaming-	28.7	28.6	+0.1	29.4	28.8	+0.6
#4 Frustrations-	26.5	26.5	+0.0	30.5	27.2	+3.3
#5 Emotional Control-	23.9	19.6	+4.3*	23.5	23.7	-0.2
#6 Concern About Future-	31.6	26.5	+5.1*	27.9	28.8	-0.9
#7 Avoiding Problems-	27.8	26.3	+1.5	26.8	27.5	-0.7
#8 Relying on Others-	32.3	30.4	+1.9	29.5	28.1	+1.4
#9 Helplessness-	23.4	22.1	+1.3	25.0	23.2	+1.8
#10 Perfectionism-	29.3	27.6	+1.7	25.2	24.6	+0.6

Note. Irrational Belief scores correspond to the strength of the belief.

\* =  $p < .05$

## Chapter V

### DISCUSSION

The primary purpose of the study was to directly compare a multidimensional locus of control scale with a unidimensional locus of control scale in the ability to detect changes as a result of self-regulation training. Differences between experimental and control group participants were measured at pretest and posttest. The dependent variables consisted of the two locus of control scales, the State Anxiety Scale, and the Irrational Beliefs Test. It was predicted that significant differences between groups would not be found at pretest but would appear at posttest, thus providing evidence for the effects of the SR training program.

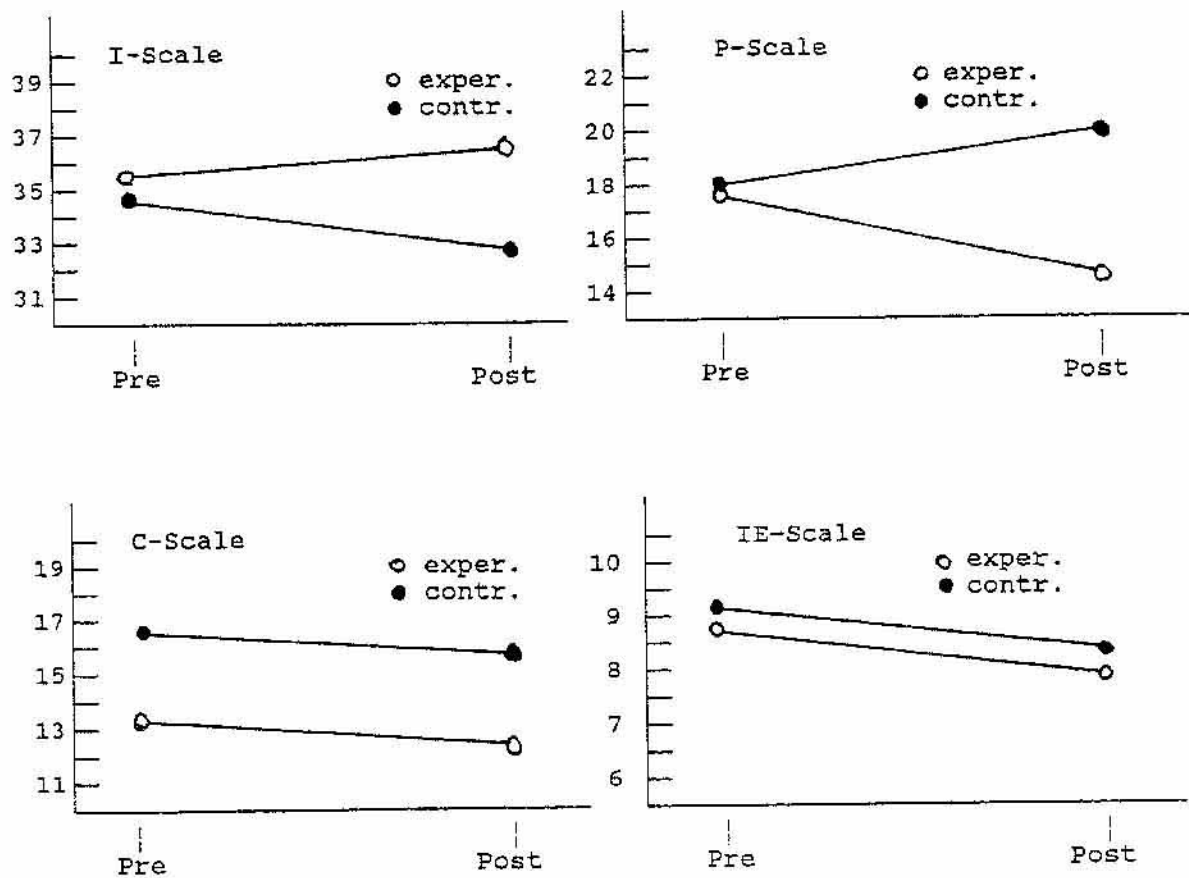
The results demonstrated that experimental and control groups were indeed successfully equated prior to treatment. Although a main effect across groups was not found initially, a Group x Time interaction was found to be significant, indicating SR-training affected significant differences between experimental and control groups at posttest.

With regard to the LOC scales, results did not indicate SR training was effective at significantly modifying locus of control. Because LOC scores were not found to be

significantly different between groups or across time by either Levenson's LOC Scale or Rotter's IE Scale, the null hypothesis could not be rejected. The scales did not differ significantly in their results.

One possible explanation for the failure to find significant differences between groups on the LOC variable is that the results were weak due to the small sample size and large error values. A larger N may have made a difference in the results. Some indication of this is that nonsignificant trends representing changes in LOC in the predicted direction were seen (see Figure 1). Trends towards increased beliefs in personal control as measured by the I-scale and decreased beliefs in control by powerful others as measured by the P-scale were seen. Results on neither the C-scale nor Rotter's IE-scale showed any apparent differences between groups.

Figure 1. Graphic representation of trends in Locus of Control scores between groups across time.



These trends give some indication that Levenson's theoretical formulation of LOC as multidimensional is correct since the unidimensional IE scale showed no change while two of the IPC scales showed some changes. Apparently, the IPC scales were sensitive to some changes in LOC that the IE scale did not detect. Unfortunately, such nonsignificant trends cannot be considered valid or reliable evidence. Perhaps continued research with larger sample sizes will provide more robust results confirming the usefulness of multidimensional LOC measurement.

Another alternative explanation for the failure to find differences between groups on the LOC variable is that SR training was not powerful enough to change a major personality variable such as locus of control. Perhaps SR training should be considered to be an adjunctive therapy or a skills training package rather than a major mode of therapy.

Secondary concerns of the study involved measuring the effects of SR training on several other dependent variables including the State Anxiety Scale, and the Irrational Beliefs Test. With regard to the State Anxiety Scale, since the groups did not differ significantly, the null hypothesis could not be rejected. SR training did not in this instance affect the state anxiety of participants.

Results on the Irrational Beliefs Test were more robust than for the other scales, indicating the efficacy of SR

training in modifying irrational beliefs. Nonsignificant decreases in all but one irrational belief were observed in the experimental group and indicate that they are clearly modifiable, although the permanence of this change is unknown at this time. Experimental subjects significantly decreased in their tendencies to believe that they must have the support and approval of everyone they know and care about; that they: must be successful in every task they undertake (and must judge themselves accordingly); that they have little control over their own happiness and emotions; and that they must be terribly concerned about possible future problems. In other words, experimental subjects at posttest, on the whole, accepted themselves more, were less perfectionistic, were less easily upset emotionally, and worried less about the future.

It is not known which different aspects of training, the rational emotive therapy principles, relaxation training, exposure to biofeedback, or a combination of these, were responsible for the changes in irrational beliefs. It would seem most plausible that learning the RET principles taught participants to examine and dispute some of their own irrational beliefs. However, learning to reduce tension and stress through biofeedback and relaxation training may also contribute to participants experiencing less physical and emotional upset. This effect might indirectly affect irrational belief systems. Further

research will have to determine the degree to which each of these factors contributed.

The fact remains, SR training resulted in decreases to some degree in irrationality. Assuming that changes in attitudes will generalize outside of the experimental situation, these findings are encouraging. Since irrationality has been positively correlated with depression, anxiety, and neurotic symptoms in general, finding an efficacious treatment for decreasing irrational beliefs is considered a worthwhile endeavor. In the current study, SR training demonstrated some efficacy in accomplishing this. Therapists would do well to consider SR training as a possible adjunctive treatment modality for clients with considerable irrationality.

Somewhat surprising was the control group's significant decrease in tendency to believe that, when things do not go the way one wants, it is terrible, awful, and frustrating. Apparently, the control group learned to upset themselves less when things went wrong during the course of the semester, although it is not known why this effect occurred. Possibly, learning about the history and systems of psychology helps one to recognize the usefulness of failure in learning. Such a revelation might generalize to one's own life and consequently increase one's frustration tolerance.

Other possibilities for this unexpected change are that they



resulted from regression toward the mean or large error values.

In summary, the direct comparison of the two LOC scales revealed no differences. However, the usefulness of SR training in reducing the degree of irrationality present in participants was apparent. Of course it is important to point out, all the observed changes in participants were specific to this experimental situation and may not be generalizable to different settings or populations. Further research using SR training as a multifaceted treatment approach is needed to determine just what effects can be expected and what role each of the different facets of treatment plays.

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