

**THE EFFECT OF IMAGERY ON SELF-EFFICACY
FOR A MOTOR SKILL**

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A Thesis Submitted in Partial Fulfillment
of the Requirements for the Degree of

DOCTOR OF PHILOSOPHY

in the School of Physical Education

We accept this thesis as conforming
to the required standard

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MEMORANDUM

TO: Chris Petter, Archivist

FROM: Bruce Howe

Re: Dissertation of Alex McKenzie

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Supervisor: Dr. Bruce L. Howe

ABSTRACT

Two studies were conducted to investigate the effect of mental imagery training on the magnitude and strength of individuals' self-efficacy for a dart throwing task, and to compare the utility of single-subject and group design studies in investigating imagery in the motor skill domain.

The first study employed a multiple-baseline-across-subjects design, in which six ($n=6$) subjects were administered a 15-session mental imagery training program following baseline sessions of varying lengths. The first ten imagery training sessions included a three minute relaxation component, followed by four minutes of specific imagery training (incorporating self-perception imagery and imagery vividness and controllability training). Subjects were then asked to stand, perform a one minute centering exercise, and to image successful performance of the task. This was immediately followed by the completion of a self-efficacy and imagery rating scale, and actual performance of the task while blindfolded.

Two subjects showed that their self-efficacy magnitude for the task had increased as a result of the intervention, one subject demonstrated an increase in self-efficacy strength due to imagery training, and all subjects evidenced

a change in their overall pattern of performance from the baseline to intervention phases.

The second study used a more traditional group design in which nineteen (n=19) randomly assigned subjects were administered a similar 15-session mental imagery training program. These subjects were compared to a control group of nineteen (n=19) subjects on their ratings of self-efficacy magnitude and strength prior to, immediately following, and eight days after the completion of the imagery intervention. For this study, the intervention differed from the multiple-baseline study, in that the subjects were not required to complete the self-efficacy or imagery rating scales on each day of the intervention, and were not required to physically perform the task.

Two 2 X 3 Analyses of variance showed no significant differences between the control and experimental groups on ratings of self-efficacy magnitude or strength.

It was concluded from the multiple-baseline study that imagery was able to enhance self-efficacy for the dart throwing task in subjects who were high ability imagers, had previous experience at throwing darts, believed in the performance-enhancing capabilities of mental imagery training, and had been exposed to relaxation and imagery procedures prior to the study. It was concluded from the group design study however, that imagery had no effect on self-efficacy for the dart throwing task for subjects who

had previous experience at imagery training, and who believed in the potential for imagery to enhance performance. A comparison of the two designs demonstrated the effectiveness of the single-subject design study in more fully investigating imagery's effect on various aspects of motor skill performance. In particular, the importance of high imagery ability, the use of more task-specific measures of imagery ability, and the possibility that performance-based sources of efficacy information may be the only avenue for enhancing self-efficacy for certain individuals, were issues that were raised as a result of the single-subject design study. It was further concluded that the systematic use of such designs provided a practical, relevant and comprehensive evaluation of the effect of imagery on aspects of motor skill performance, although the complementary use of both types of research was recommended.

Examiners:

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TABLE OF CONTENTS

Abstract	ii
Table of Contents	vi
Tables	ix
Figures	x
Acknowledgements	xi
Dedication	xii
CHAPTER I: INTRODUCTION	1
Purpose of the Study	6
Hypotheses	8
Definition of Terms	8
CHAPTER II: REVIEW OF LITERATURE	10
Section 1: Self-Efficacy	10
Definition of Self-Efficacy	10
Basic Tenets of Self-Efficacy Theory	11
Related Concepts	13
Dimensions of Self-Efficacy	16
Measurement of Self-Efficacy	17
Sources of Efficacy Information	20
Self-Efficacy Research	25
Research into Modelling Effects on Performance and Self-Efficacy	29
Criticisms of Self-Efficacy Theory	33
Section 2: Imagery for Movement	35
Imagery's Effect on Sport and Motor Performance	35
Content of the Imagery Package	37
Task Characteristics that Enhance Imagery's Effect on Performance	43
Subject Characteristics that Facilitate Imagery's Effect on Performance	45
Measurement of Movement Imagery Ability	48
Theories of Imagery	50
Imagery's Link to Self-Efficacy	54
Section 3: Research Design	57
The Use of Single-Subject Designs in Sport Psychology	57
Basic Characteristics of Single-Subject Designs	59
Multiple-Baseline Studies	65
Data Analysis of Single-Subject Designs	68
Strengths and Weaknesses of Single-Subject and Group Designs	73

CHAPTER III: METHOD	84
Section 1: Single-Subject Research Design	84
Subjects	84
Setting and Personnel	87
Equipment	88
Experimental Design	89
Procedures	90
Data Analysis	95
Section 2: Group Design	96
Subjects	96
Experimenters and Setting	97
Equipment	98
Measures	98
Procedures	99
Experimental Design and Data Analysis	101
CHAPTER IV: RESULTS	103
Section 1: Single-Subject Design Results	103
Self-Efficacy Magnitude	105
Self-Efficacy Strength (75% level)	115
Mental Imagery Questionnaire (MIQ Visual)	126
Mental Imagery Questionnaire (MIQ Kinesthetic)	131
Performance Scores	136
Section 2: Group Design Results	147
CHAPTER V: DISCUSSION	155
Section 1: Single-Subject Design Results	155
Self-Efficacy Magnitude	155
Self-Efficacy Strength (75% level)	163
Ratings of Visual Imagery (MIQ Visual)	166
Ratings of Kinesthetic Imagery (MIQ Kinesthetic)	167
Overall Imagery Ability (MIQ Visual and MIQ Kinesthetic)	168
Performance Scores	170
Section 2: Group Design Results	172
Section 3: Comparison Between the Single-Subject and Group Design Studies	174
Conclusions	182
REFERENCES	185
APPENDIX A: Information Questionnaire	199
APPENDIX B: Vividness of Movement Imagery Questionnaire	201
APPENDIX C: Informed Consent Form	204
APPENDIX D: Illustration of Target	206
APPENDIX E: Diagram of Multiple-Baseline Design	208
APPENDIX F: Self-Efficacy Rating Scale	210

APPENDIX G: Transcript of Imagery Instructions	212
APPENDIX H: Modified Movement Imagery Questionnaire	217
APPENDIX I: Post-Study Questionnaire	219
APPENDIX J: Subject Letter: Experimental Group	222
APPENDIX K: Subject Letter: Control Group	225
APPENDIX L: Timetable of Events: Experimental Group	227
APPENDIX M: Timetable of Events: Control Group	229
APPENDIX N: Self-Efficacy Strength Graphs for 0%, 25%, 50% and 100% levels	231

TABLES

Table 1: Means and standard deviations for self-efficacy magnitude (SEM) scores for each group during pre-test, post-test, and follow-up phases. 148

Table 2: Means and standard deviations for self-efficacy strength (75% level) scores for each group during pre-test, post-test, and follow-up phases. 149

Table 3: Means and standard deviations for MIQ Visual and MIQ Kinesthetic scores at Day 1 and Day 15 of the intervention phase. 150

Table 4: Results from the repeated measures ANOVA conducted upon self-efficacy magnitude (SEM) scores for each group at pre-test, post-test, and follow-up phases. 152

Table 5: Results from the repeated measures ANOVA conducted upon self-efficacy strength (SES) (75% level) scores for each group at pre-test, post-test, and follow-up phases. 153

FIGURES

Figure 1: Self-Efficacy Magnitude scores for each subject showing mean scores for baseline, intervention, and follow-up phases 106

Figure 2: Self-Efficacy Magnitude scores for each subject showing trends for baseline, intervention, and follow-up phases 108

Figure 3: Self-Efficacy Strength (75% level) scores for each subject showing mean scores for baseline, intervention, and follow-up phases 116

Figure 4: Self-Efficacy Strength (75% level) scores for each subject showing trends for baseline, intervention, and follow-up phases 118

Figure 5: MIQ Visual scores for each subject during the intervention phase of the study 127

Figure 6: MIQ Kinesthetic scores for each subject during the intervention phase of the study . 132

Figure 7: Performance scores for each subject showing mean scores for baseline, intervention and follow-up phases 137

Figure 8: Performance trends for each subject for baseline, intervention, and follow-up phases 139

ACKNOWLEDGEMENTS

I would like to thank my supervisor, Dr. Bruce Howe, for his guidance, patience, encouragement and friendship throughout the course of my graduate work. I would also like to thank the other members of my committee, Drs. David Docherty, Richard May, Frank Spellacy, and Geri Van Gyn for their assistance and input.

Special thanks are extended to all of the subjects who agreed to participate in the studies, especially Brenda, Ian, Jonathon, Lana, Spencer and Teri. Your patience was much appreciated during such frustrating conditions.

Special thanks also to my fellow graduate students and friends at the University of Victoria, especially Ben, Bruce, Caroline, Carson, Dave S., Dave H-L., Elaine, Gladys, Gord, Jan and Karla, Jim C., Jim H., Linda, Milena, Paddy, PJ, and Sue.

Finally, to Mum, Dad, Kent, Lyn, Adrian and Brigid. Thanks for your support over the past few years.

DEDICATION

For Brenda

CHAPTER I
INTRODUCTION

Since the publication of Bandura's theory of self-efficacy in 1977, the concept has been incorporated into numerous studies and reviews by researchers in a variety of fields, including sport and motor performance (Feltz, 1988; Feltz, Landers & Raedlar, 1979; Feltz & Riessinger, 1990; Gould, Hodge, Peterson & Giannini, 1989; McAuley, 1985; Wurtele, 1986). Feltz (1988, p. 423) defined self-efficacy as "the conviction one has to execute successfully the behaviour (e.g., a sports performance) required to produce a certain outcome (e.g., a trophy or self-satisfaction)," and described the concept as pertaining not to the skills that an individual possesses, but to their judgements about what they can do with those skills. Bandura (1977) postulated that an individual's perception of self-efficacy was a major determinant of task performance, provided that the individual possessed the component capabilities, and was provided with adequate incentives for performance of the task.

According to Bandura (1977), expectations of personal efficacy are based on four main sources of information; performance accomplishments, vicarious experiences, verbal persuasion, and physiological arousal. Each of these categories can act independently, or in association with one

or more categories, to provide efficacy information. For example, performance-based treatments can promote behavioral accomplishments while simultaneously extinguishing fear arousal, thereby enhancing self-efficacy through enactive and arousal sources of information (Bandura, 1977).

Performance accomplishments, as a source of efficacy information, are based on personal mastery experiences. Strong efficacy expectations can be developed through repeated successful performances of a task, whereas repeated failures can lower efficacy expectations. Studies by Bandura (1977), Feltz et al. (1979), and McAuley (1985) have clearly identified performance accomplishments as the most influential of the four sources of efficacy information in determining self-efficacy perceptions. On their own, each of the other three sources are reported by Bandura (1977) as having weaker but significant effects on self-efficacy perceptions, simply because they do not provide an authentic experiential base for the formulation of these perceptions.

Bandura's (1977) original perception of vicarious experiences was largely based on the concept of modelling. He reported that individuals who observed a model successfully performing a particular task could enhance their perceptions of, and their actual, performance capabilities. In support of this, McCullagh, Weiss, and Ross (1989) reported that studies which used models perceived as similar to the observer, have demonstrated a

relationship between modelling and self-efficacy (Corbin, Laurie, Gruger, & Smiley, 1984; Gould & Weiss, 1981; Schunk, Hanson, & Cox, 1987).

McCullagh et al. (1989) have further suggested that a conceptual link between modelling and mental imagery may exist. They proposed that the processes governing the two concepts may be similar. Modelling consists of observing a performance, encoding and rehearsing this information, and then reproducing a response. Similarly, mental imagery typically involves viewing or mentally experiencing oneself performing a task, encoding and rehearsing this information, and then reproducing a response. In support of this, several studies (Feltz & Landers, 1983; Ryan & Simons, 1981; 1983; Smyth, 1975) have shown mental imagery to be more effective than modelling in improving cognitive task components. As McCullagh et al. (1989, pp 492-493) stated,

If modeling can be viewed as a form of covert rehearsal that primarily influences performance because task components are symbolically coded and if these representations provide the internal standard upon which reproduction is based, then the parallels between modelling and mental imagery may not be that distant.

It would follow then that imagery rehearsal of a sport or motor performance, as a form of vicarious experience akin to modelling, should be able to enhance an individual's self-efficacy for that task. A study by Feltz and Riessinger (1990) investigated the effect of imagery as a form of vicarious experience in influencing individual's

perceptions of self-efficacy, in conjunction with performance feedback. Subjects performed a competitive muscular endurance task against a confederate, and results indicated that subjects who had been exposed to an imagery treatment demonstrated significantly higher self-efficacy scores than either feedback alone or control subjects after each performance trial.

The effect of mental imagery on the acquisition, performance, retention, and transfer of motor and sport skills has been well documented (Feltz, Landers & Becker, 1988; Hall, 1985; Kohl & Roenker, 1980; Minas, 1980; Mumford & Hall, 1985; Ryan & Simons, 1981; Van Gyn, Wenger & Gaul, 1990). Studies have demonstrated that imagery is better able to facilitate performance of closed as opposed to open skills (Feltz & Landers, 1983), and that subjects involved in interventions using imagery for these skills should utilize an internal imagery perspective (Mumford & Hall, 1985), be experienced at the task (Harris & Robinson, 1986), and demonstrate a reasonable level of proficiency at imaging (Housner & Hoffman, 1981). In addition, a belief in the effectiveness of the intervention strategy is a necessary prerequisite for improved performance (Girodo & Wood, 1979; Smith, 1987). Imagery's influence on individuals' perceptions of self-efficacy for motor and sport skills, however, has not been as fully investigated (Feltz & Riessinger, 1990). Despite this, many elite coaches have

reported that they often use imagery as a strategy for developing self-efficacy (Gould et al., 1989). A study by McKenzie and Howe (1991) found that despite equivocal results, almost all subjects exposed to an imagery program designed to improve rugby tackling performance, perceived that their performance had improved as a result of their imagery training. Kelly (1991) also noted that despite consistent performance decrements in on-ice sprinting ability following an imagery training program, 5 out of 21 subjects reported that they felt more confident in their hockey ability. In attempting to reconcile such findings, Howe, Barber, McKenzie, and Steinbrink (1990) suggested that imagery may function to elevate an athlete's feelings of self-efficacy, and may facilitate an increased satisfaction with performance, which in turn would be likely to correlate highly with perceptions of improved performance.

Numerous investigators have outlined the importance of developing self-efficacy for sport performance, and various strategies have been recommended, including the use of imagery to visualize performance success (Gould et al., 1989). However, the contribution of imagery alone, as a form of vicarious experience and therefore a source of efficacy information for motor and sport skills, has not been determined. Until now, studies have investigated the influence of imagery in conjunction with performance feedback on subject's perceptions of self-efficacy (e.g.,

Feltz & Riessinger, 1990), and so the influence of imagery has been confounded by the presence of the performance feedback. A preliminary study regarding this issue has provided some evidence that imagery alone may act to elevate self-efficacy perceptions for individuals who have had some imagery experience, were competent imagers, and who believed in the potential effectiveness of the technique in enhancing actual task performance (Howe, McKenzie, Mossman, Naylor, & Scott, 1991). This evidence, however, was not conclusive, and further research was recommended.

The primary purpose of this study was to investigate the effect of successful imagery alone on subjects' ratings of self-efficacy for the performance of a dart throwing task. It was predicted that subjects who were exposed to a mental imagery training program in association with the performance of a dart throwing task without knowledge of results, would improve their ratings of self-efficacy for the performance of that task.

A second purpose of the study was to compare the effectiveness of two different research designs in investigating the effect of the imagery program on subjects' perceptions of self-efficacy for the dart throwing task. A multiple-baseline-across-subjects single-subject design, and a repeated measures between-group design were used for this comparison.

According to Feltz et al. (1988), group designs have

been able to demonstrate the influence of certain variables in mediating imagery's effect on task performance, however several investigators have advocated using single subject designs to better evaluate the effectiveness of intervention strategies used in sport psychology (Bryan, 1987; Elko & Ostrow, 1991; Smith, 1988; Wollman, 1985). According to Wollman (1986) the advantage of single subject designs over group designs in investigating imagery is that the link between imagery and its effects or non-effects on motor performance can be more clearly demonstrated. In support of this notion, Barlow and Hersen (1984) proposed that the process of averaging the results from a group design may misrepresent the performance of any individual within the group and thus generalisations to specific individuals cannot be made. Differences between the two designs in terms of between- and within-group variability and the issue of practical versus statistical significance have also been noted (Hersen & Barlow, 1976; Valsiner, 1986). Kazdin (1982) has reported that single-subject and between-group designs represent two separate levels of analysis, each with their own set of limitations and relative advantages, but often sharing the same research objectives. In using both types of designs to answer a particular research question, differing but equally relevant perspectives may emerge (Kazdin, 1982).

Hypotheses.

In fulfilling the primary purpose of the study, the following hypotheses were tested for the repeated measures between-group study:

Hypothesis 1: There will be no difference in ratings of self-efficacy magnitude for a dart throwing task, between subjects who were exposed to an imagery training program for that task, and subjects who did not experience the mental imagery training program.

Hypothesis 2: There will be no difference in ratings of self-efficacy strength for a dart throwing task, between subjects who were exposed to an imagery training program for that task, and subjects who did not experience the mental imagery training program.

Definition of Terms.

Mental Imagery: The mental rehearsal of a motor performance in conditions where the auditory, visual or kinesthetic qualities of a movement may be experienced (McIntyre, 1987).

Self-efficacy: "People's judgements of their capabilities to organize and execute courses of action required to attain designated types of performances" (Bandura, 1986, p. 391).

Self-efficacy strength: A percentage rating of how confident a subject is of achieving a particular score when performing a blindfolded dart throwing task.

Self-efficacy magnitude: The score that a subject believes that they are capable of achieving when performing a blindfolded dart throwing task.

Internal Imagery perspective: Style of imagery where the individual imagines the performance from a first-person perspective, as if they were actually performing the task.

CHAPTER II

REVIEW OF LITERATURE

This chapter presents a current review of the literature covering self-efficacy, imagery, and research design in sport psychology. Section 1 will review self-efficacy, section 2 will review the imagery literature, and section 3 the research design literature.

Section 1: Self-Efficacy

The topics to be discussed in this section include; a definition of self-efficacy, a description of the basic tenets of the theory, related concepts, dimensions of self-efficacy, measurement of self-efficacy, sources of efficacy information, modelling as a form of vicarious experience, research regarding self-efficacy and its relationship to performance in general and motor performance in particular, research on the effects of modelling on self-efficacy, the effects of imagery on self-efficacy, and criticisms of self-efficacy theory.

1:1 Definition of self-efficacy.

Based on his original formulation of self-efficacy theory, Bandura (1986, p. 391) has defined perceived self-efficacy as "people's judgements of their capabilities to

organize and execute courses of action required to attain designated types of performances". With regard to sport performance, Feltz (1988) has described the concept as one's conviction that they are capable of successfully performing the behaviour (e.g., a sports performance) required to produce a certain outcome (e.g., a trophy or self-satisfaction). Bandura (1986) further proposed that self-efficacy relates not to the skills that an individual possesses, but rather, to their judgements about what they can do with those skills.

1:2 Basic Tenets of Self-Efficacy Theory.

Bandura (1977) originally outlined a 'theoretical framework' that accounted for behavioural changes in fearful and avoidant behaviour, in which self-efficacy was accorded a central role. The principle assumption of this framework was that psychological procedures, whatever their form, served as a means of creating and strengthening expectations of personal efficacy (Bandura, 1977). These judgements of self-efficacy partly govern the selection and regulation of transactions with the environment, and also determine the level of effort expended, and the degree of persistence at an activity in the face of obstacles or aversive experiences (Bandura, Reese, & Adams, 1982). According to Bandura (1986), those who perceive themselves as highly efficacious in social, intellectual and physical pursuits will expect

favourable outcomes from such endeavours, whereas self-doubters who expect mediocre performances of themselves will expect negative outcomes. As such, self perception of efficacy has been found to be a generally good predictor of performance and emotional arousal (Bandura et al., 1982). However, Bandura (1977) has suggested that self-efficacy is a major determinant of behaviour only when an individual possesses the requisite skills for performance of the task, and the proper incentives for doing so. Efficacy expectations would be expected to exceed actual performance levels when little incentive to perform the activity exists, or when physical and social constraints are imposed on performance. It may be that an individual possesses the necessary skills to perform, but has no incentive to do so, and thus performance does not match the efficacy perceptions. Differences between performance levels and efficacy expectations would also be predicted if an individual was unfamiliar with the task and therefore had little or no information on which to base their efficacy expectations.

Self-efficacy then, can be conceptualised as a common cognitive mechanism for affecting people's motivation and behaviour. Further, judgements of self-efficacy affect not only behaviour (in the form of activity choice, effort expenditure, persistence), but also thought patterns and emotional reactions in demanding or anxiety provoking

situations (Feltz, 1938).

1:3 Related Concepts.

A number of terms have been used in the literature that may sometimes be confused with "self-efficacy" as Bandura (1977, 1986) has described it. It is appropriate then that these terms be outlined in order to provide a more definitive demarcation between them and Bandura's original perception of self-efficacy. "Self-confidence" is one term that has sometimes been used synonymously with self-efficacy (Feltz, 1988). Bandura (1986) has distinguished the two terms by proposing that self-confidence refers to the **strength** of an individual's conviction or belief that they are capable of performing certain actions, whereas self-efficacy encompasses more than this by specifying the level of perceived competence, as well as the strength of that belief. Both terms are situation- and task-specific.

"Self-concept" is a term that reflects an individual's composite view of themselves that is developed through direct environmental experiences and through social interactions with, and evaluations adopted from, significant others (Bandura, 1986). As Bandura has noted, it is a much more global concept than self-efficacy and therefore does not reflect the complexity of self-efficacy concepts, which vary across different activities, levels of the same activity, and across circumstances. Modest correlations may emerge

between measures of performance and self-concept, but the concept itself cannot accurately predict intra-individual variability in performance (Bandura, 1986).

"Self-esteem" is another global concept that relates to self-efficacy but is more concerned with an individual's evaluation of self-worth. Self-esteem is based on how society values the attributes that an individual possesses and the relationship between their behaviour and their personal standards of worthiness (Bandura, 1986). As Feltz (1988) has pointed out, people may not be highly efficacious about a particular activity, but may still 'like themselves'. Conversely, some individuals may possess low levels of self-esteem, but regard themselves as highly capable of performing particular activities. Judgements of self-esteem and self-concept then, may bear little relation to each other (Bandura, 1986).

With regard to sport and motor performance, there are several terms that are related to self-efficacy for motor performance. Within the achievement motivation literature the terms "perceived competence" and "perceived ability" refer to the sense that an individual has the ability to successfully perform a task. This sense is derived from cumulative interactions with the environment. While these terms are highly congruent with self-efficacy as defined by Bandura (1977), the difference lies in the theoretical construct in which the terms are used. Harter's (1978)

theory of competence motivation uses the terms in an attempt to explain participation motivation rather than specific task performance. This theory is not as well tested as self-efficacy theory within the sport and motor performance area (Feltz, 1988).

The terms "movement confidence" and "sport confidence" also warrant comparison to self-efficacy. Although described differently by their authors, both are conceptually very similar. Griffin and Keogh (1982) described movement confidence as an individual's feeling of adequacy in a movement situation, whereas Vealey (1986) used the term sport confidence to refer to an individual's belief about their ability to be successful in sport. Both of these terms therefore, are akin to self-esteem and self-concept in that they represent global concepts that, unlike self-efficacy, do not account for either intraindividual variability in performance, or variations across activities and situations.

Outcome expectations differ from efficacy expectations in that the former are estimates of the result of particular performance behaviours, whereas the latter indicate whether or not the individual deems themselves capable of producing the behaviour required to produce a certain outcome. Bandura (1977) has lamented the fact that some empirical tests of the relationship between expectancy and performance of threatening activities have measured people's hopes for

favourable outcomes rather than their sense of personal mastery. According to Bandura (1977, 1986), it is self-efficacy and not outcome expectancy that is a major predictor of task performance. Barling and Abel (1983) found support for this notion in a study which indicated that tennis performance was significantly related to self-efficacy perceptions and only minimally related to outcome expectancies.

1:4 Dimensions of Self-Efficacy.

According to Bandura (1977, 1986), efficacy expectations vary on three dimensions, all of which have implications for subsequent performance. **Self-efficacy magnitude** refers to the level of task difficulty at which individuals feel they are capable of performing successfully. For example, when tasks are ordered according to level of difficulty, self-efficacy expectations may be limited to relatively easy tasks (low self-efficacy magnitude) or extend to extremely difficult tasks (high self-efficacy magnitude). Self-efficacy also varies along the dimension of **strength**. Individuals who possess strong efficacy expectations for a particular task will persevere with that task despite disconfirming experiences, whereas weak efficacy expectations will quickly disappear in the face of failure at a particular task (Bandura, 1977). **Self-efficacy generality** relates to the degree to which a sense

of efficacy extends beyond the original performance task to other performance situations. For example, perceived self-efficacy for tennis performance may generalise to other racquet sports such as squash or badminton.

1:5 Measurement of Self-Efficacy.

Given the acknowledged dimensions of self-efficacy, and the fact that it represents a psychological state (i.e., may vary across activities and circumstances), studies which purport to measure self-efficacy should ideally account for each of the dimensions of the construct. Indeed, Bandura (1986, p. 397) has stated that "the most informative efficacy analysis requires detailed assessment of the level, strength and generality of perceived self-efficacy commensurate with the particularity and precision with which performance is measured". Bandura has therefore advocated a microanalytic approach to measuring self-efficacy, in which efficacy expectations for, and performance of, a particular task should undergo periodic assessment at significant points in the change process in order to clarify their effects on each other. According to Bandura (1977), an individual's efficacy expectations will influence their performance and will in turn be influenced by the cumulative effects of that person's efforts.

In accordance with Bandura's proposed assessment procedure, many researchers have developed instruments that

are idiosyncratic to the task being studied. Biran and Wilson (1981) produced individualised measures of self-efficacy for subjects suffering from various phobias. Each subject was provided with a list of tasks relating to their particular problem and were instructed to identify those that they expected to be able to perform. "For each task they rated the strength of their expectations on a 100 point probability scale, ranging in 10-point intervals from high uncertainty to complete certainty" (Biran & Wilson, 1981, p. 888). Self-efficacy generality was measured by subjects rating the magnitude and strength of their expectations of coping with similar fearful situations in unfamiliar settings.

Bandura and Adams (1977) followed a similar procedure for self-efficacy assessment of snake phobics. In order to quantify each dimension of self-efficacy, the researchers decided that **self-efficacy magnitude** would be measured as the number of performance tasks that subjects reported they could expect to perform with a probability value above 10. A measure of **self-efficacy strength** was obtained by summing the performance probability values across tasks and dividing this sum by the total number of tasks. For **self-efficacy generality** the same procedures were used with reference to performance of the tasks with an unfamiliar snake as well as with one similar to that used during treatment.

In the areas of sport and motor performance, several

researchers have followed Bandura's guidelines specifically in measuring self-efficacy for task performance (e.g., Feltz et al., 1979; Weinberg, Gould, Yukelson, & Jackson, 1981). However, several researchers in this domain have attempted to retain the intent of the original recommendations, but have modified the individual procedures to better accommodate the particular performance task (e.g., Feltz, 1988b; Kavanagh & Hausfeld, 1986).

Wurtele (1986) criticized a number of studies for failing to take into account all of the self-efficacy dimensions in their assessment procedures. For example, Barling and Abel (1983) assessed only self-efficacy strength for a tennis performance task, and Lee (1982), in investigating gymnastics performance, measured only self-efficacy magnitude. In addition, Wurtele (1986) reported that the majority of studies have failed to follow Bandura's recommended microanalysis of the congruence between self-efficacy and performance at the level of individual tasks, and have instead correlated aggregate self-efficacy scores with aggregate performance scores. According to Wurtele (1986), the combination of the failure to assess all self-efficacy dimensions, and not analyzing the relationship between performance and self-efficacy at the level of individual tasks has led to much inconsistency in the literature regarding self-efficacy and motor performance.

1:6 Sources of Efficacy Information.

According to Bandura (1977, p. 193), "psychological procedures, whatever their form, serve as means of creating and strengthening expectations of personal efficacy". These procedures are encompassed in four major sources of information regarding efficacy expectations; performance accomplishments, vicarious experiences, verbal persuasion, and physiological arousal. All four categories can, according to the theory, act alone or in concert with one or more other sources, to alter an individual's efficacy expectations. Some sources however, are more influential than others in this respect.

(a) Performance Accomplishments:

Because it is based on personal mastery experiences, this source of efficacy information is the most powerful and the most dependable (Bandura, 1986). The information alone is not sufficient to alter efficacy expectations however. Cognitive processing of such information is a necessary condition for change. Repeated perceived success at a task will likely raise efficacy expectations, whereas repeated failures will likely lower such expectations. These changes in self-efficacy however, are also dependent on factors such as the perceived difficulty of the task, the amount of effort expended during performance of the task, and the amount of guidance or assistance received during task performance, as well as the previous history of success and

failure at the task (Bandura, 1982). Successful performance of difficult tasks, tasks attempted independently (i.e., without guidance or assistance), and tasks performed successfully early in the learning process will provide more powerful efficacy information than tasks that are easy, require assistance to complete, and are often failed early in the learning process (Feltz, 1988).

It has been proposed that once established, enhanced self-efficacy gained through performance mastery can generalize to other situations in which the person possesses low self-efficacy (Bandura, Adams, & Beyer, 1977). These situations can sometimes be quite dissimilar to the original performance situation and yet self-efficacy is still elevated as a result of mastery of the original task. However, a stronger generalization effect will be evident in activities that are most similar to the original task (Bandura, 1977).

(b) Vicarious Experiences

Bandura (1986) asserted that although vicarious experiences are generally weaker than those of personal mastery, they are able to produce significant and enduring changes in self-efficacy percepts through their effects on performance. Without this performance-based confirmation of enhanced efficacy however, vicarious experiences provide a less dependable source of information about performance capabilities (Bandura, 1977). Despite this, the observation

of others successfully performing activities that an observer had previously perceived to be threatening or beyond their capabilities, can generate expectations in the observer that they too will be able to perform the task successfully.

Efficacy information conveyed through vicarious experiences such as modelling can augment or diminish the effects of performance based efficacy influences, according to Bandura (1986). He suggested that people who have been vicariously convinced of their personal inefficacy tend to produce performances that serve to confirm their perceptions of inability. The converse is also true. Studies by Brown and Inouye (1978), and Weinberg, Gould, and Jackson (1979) have shown that vicarious enhancement of perceived self-efficacy through modelling, can weaken the disconfirming impact of performance failures, by sustaining effort and persistence at the task.

Modelling has been the most extensively researched vicarious source of efficacy information. Bandura (1977) noted a number of modelling variables which, although not as powerful as performance-based factors, were able to enhance the influence of the vicarious experience on self-efficacy perceptions. These were;

- (a) Observation of the model achieving successful performance through determined effort. This is likely to enhance efficacy expectations more than the

observation of an accomplished model who successfully performs the task with minimum effort.

(b) Use of models who display similar characteristics to the observer. This will increase the relevance of the vicariously derived information, thus enhancing its influence on self-efficacy for the modelled task.

(c) The portrayal of clear outcomes in modelled activities. This is likely to convey more efficacy information than those in which the outcome is vague or ambiguous. Modelled performances resulting in clear successes translate to greater efficacy enhancement than the observation of the same performance without a clearly evident outcome.

(d) Observation of clearly successful task performance by a number of models with varying characteristics. This will ensure that observers have a stronger basis for increasing their own sense of personal efficacy for that task.

Given these conditions, Bandura (1977, pp 197-198) states that "exemplifications of success through sustained effort with substantiating comparative information can enhance observers' perceptions of their own performance capabilities".

(c) Verbal Persuasion.

Because of its relative ease and availability, verbal persuasion is often used in an attempt to enhance a person's

belief that they are capable of performing a particular activity. Like vicarious experiences, verbal persuasion in itself has no experiential basis, and so changes in efficacy expectations induced by this method are likely to be weaker than performance-based experiences of personal mastery. However, several factors are likely to impact upon the extent of persuasive influence that this source of efficacy information may provide. According to Feltz (1988), the credibility, prestige, trustworthiness, and expertise of the persuader will influence the effect of verbal persuasion on efficacy expectations. Presumably, this is a direct relationship, in that increased self-efficacy is more likely to be associated with greater levels of each of these factors.

(d) Physiological States.

Bandura (1977) has suggested that as well as being a source of efficacy information, anxiety or autonomic arousal can be viewed as a co-effect of behaviour. In proposing this notion, Bandura also suggested that a reciprocal relationship existed between self-efficacy and physiological arousal. He later (Bandura, 1986) expanded the notion of physiological states to include perceptions of fatigue, fitness, and pain levels in endurance and strength activities as indicators of physical efficacy.

Feltz (1988) has noted that cognitive processing of perceived physiological states is necessary for influencing

percepts of efficacy, and that efficacy can either be enhanced or decreased depending on individual interpretations of the meaning of such information. For example, an elevated heart rate, and increased perspiration immediately prior to performance might be perceived as fear or anxiety, and therefore indicate low self-efficacy for the task. However, this same information might be interpreted as excitement and optimal readiness to perform by another individual, and produce elevated self-efficacy for that task.

The cognitive processing of efficacy information from all sources is necessary before any alterations to self-efficacy can be made. As Bandura (1986, p. 409) states,

In forming their efficacy judgements, people have to deal not only with different configurations of efficacy-relevant information conveyed by a given modality, but they also have to weigh and integrate efficacy information from these diverse sources. The weights assigned to different types of efficacy information may vary across different domains of activity. There has been little research on how people process multidimensional efficacy information. However, there is every reason to believe that efficacy judgements are governed by some common judgemental processes.

1:3 Self-Efficacy Research.

In a series of experiments using the treatment of snake phobics, Bandura and his colleagues (Bandura & Adams, 1977; Bandura et al., 1977) found support for his theory of self-efficacy. Bandura and Adams (1977) conducted two experiments in which snake phobics were exposed to treatment

using systematic desensitization (experiment 1), and participant modelling (experiment 2). Measures of the level, strength, and generality of perceived self-efficacy were taken prior to treatment and immediately prior to, and after, the behavioural post-test, for experiment 1. Measures of the strength and level of self-efficacy were taken throughout the participant modelling treatment procedure for experiment 2. Results from both experiments supported Bandura's (1977) contention that efficacy expectations were accurate predictors of performance levels regardless of the treatment used to induce the self-efficacy changes. Similar results were demonstrated by Bandura et al. (1977), in a study which compared the effects of treatments based upon performance mastery experiences and vicarious experience. Results showed that mastery-based treatments produced higher, stronger, and more generalized efficacy expectations than treatments using vicarious experience alone, and that self-efficacy was an accurate predictor of performance regardless of whether the source of efficacy enhancement was enactive mastery or vicarious experience.

In examining the relationship between self-efficacy and motor performance, a number of studies have found support for Bandura's (1977) theory. Self-efficacy has been found to be a significant predictor of performance in such diverse activities as tennis performance (Barling & Abel, 1983),

exercise adherence (Desharnais, Bouillon, & Godin, 1986), springboard diving (Feltz et al., 1979), handgrip strength (Kavanagh & Hausfeld, 1986), gymnastics performance (Lee, 1984), and muscular endurance (Weinberg et al., 1979; Weinberg, 1985).

Following an experiment comparing the effects of various modelling techniques on self-efficacy and performance of a springboard diving task (Feltz et al., 1979), Feltz conducted a series of experiments which investigated the effect of self-efficacy in the approach/avoidance behaviour of subjects asked to perform a modified back-dive from a springboard (Feltz, 1982; Feltz & Mugno, 1983; Feltz, 1988b). Feltz (1982) found that self-efficacy was the best predictor of diving performance for Trial 1. However, as more trials were performed, self-efficacy decreased in strength as a causal influence of performance. Following trial 1, performance was more accurately predicted by previous trial performance than by self-efficacy, although self-efficacy remained a significant predictor of performance. This finding was replicated in subsequent experiments (Feltz & Mugno, 1983; Feltz, 1988b). Heart rate was also found to be a significant predictor of performance for Trial 1 (Feltz & Mugno, 1983). Indeed, Feltz (1988b) found heart rate to be equally predictive of first trial performances as self-efficacy for females, but not for males. All three experiments however, supported

Bandura's (1977) predictions of self-efficacy as being an important predictor of performance.

Self-efficacy was found to be a more significant predictor of tennis performance (Barling & Abel, 1983) and exercise adherence (Desharnais et al., 1986) than outcome expectations for both tasks, although Desharnais et al. (1986) also found that outcome expectations were a significant cognitive mediator of adherence to exercise. These findings lend support to Bandura's (1977) contention that outcome expectations are differentiated from efficacy expectations in that the latter can more accurately predict subsequent task performance.

Research into self-efficacy's relationship to motor performance has also investigated the association between efficacy perceptions and causal attributions. Duncan and McAuley (1987) found no evidence that efficacy expectations mediated causal attributions for outcome on a competitive cycling task. However McAuley, Duncan, and McElroy (1988), using a similar task with children aged between 9 and 12 years, found that self-efficacy cognitions were significantly related to perceptions of success and to stable and controllable attributions. Specifically, higher efficacy expectations resulted in more stable and controllable attributions. Further investigation of this relationship was recommended.

1:8 Research into Modelling Effects on Performance and Self-Efficacy.

Prior to the publication of Bandura's (1977) theory, treatments of various disorders and dysfunctions using various modelling techniques such as systematic desensitization (Wolpe, 1969), covert modelling (Cautela, 1971), contact desensitization (Ritter, 1969), symbolic and live modelling had been used. These procedures can be roughly divided into those that could be termed "participant modelling", which engage some enactive mastery experiences, and "modelling alone", which does not involve any actual task performance, or part thereof, on the part of the observer, whether assisted or not. Studies by Ritter (1969), Roper, Rachman and Marks (1975), and Bandura, Blanchard and Ritter (1969) have all attested to the superiority of participant modelling over modelling alone in enhancing task performance. In addition, Bandura et al. (1969) and Roper et al. (1975), found that both modelling procedures reduced fear arousal in subjects exposed to the treatments.

Since Bandura's (1977) theory was introduced, numerous studies have measured the changes to self-efficacy and performance in a variety of settings using modelling techniques. In the treatment of phobic behaviour, Bandura et al. (1977) and Biran and Wilson (1981) found that not only was participant modelling superior to modelling alone

in enhancing task performance, but that both procedures were associated with positive changes in self-efficacy. Kazdin (1979) found covert modelling to be effective in enhancing self-efficacy during the treatment of unassertive behaviour, and Schunk et al. (1987) showed that self-efficacy for, and the performance of, mathematical skills in children who had previously experienced difficulty in learning such skills, was enhanced through observation of peer models successfully performing mathematics tasks. Schunk et al. (1987) found that the type of modelled behaviour influenced subsequent performance and ratings of self-efficacy. Specifically, subjects who observed a coping model (i.e., a model who gradually improved in performance) exhibited greater self-efficacy and better performances than those who observed a mastery model (i.e., a model who demonstrated errorless performance from the outset). This result supported Bandura's (1986) assertion that perceived similarity in competence to a model is an important means of conveying self-efficacy information.

Modelling effects on performance and self-efficacy have also been demonstrated in the motor performance domain. McAuley (1985) investigated the influence of two types of participant modelling on the performance of a gymnastic skill. Aided participant modelling, in which a model, after describing and demonstrating the task, physically assisted the subject in performance of the task, was found to be a

superior treatment to unaided participant modelling in enhancing subsequent performance of the gymnastic task. Subjects in the unaided participant modelling group underwent a similar procedure to those in the aided participant modelling group, except that the model provided no physical assistance in task performance during treatment. Both modelling groups were found to exhibit significantly higher levels of self-efficacy than a control group following treatment, although no differences in efficacy expectations were found to exist between the two modelling groups.

Gould and Weiss (1981) investigated the effects of model similarity and model talk on the performance of, and self-efficacy for, a muscular endurance task. Similar and dissimilar models who made positive, negative and irrelevant self-efficacy statements during their demonstrated performance of the task, were viewed by female subjects. Those who viewed similar models, regardless of the type of model talk, were found to exhibit superior performance on the criterion task than those who viewed dissimilar models. Self-efficacy was not found to be a major mediating variable affecting performance changes, although significant correlations were found between self-efficacy measures and performance, thus providing support for Bandura's (1977) prediction that efficacy expectations are related to performance. Gould and Weiss (1981) postulated that

increased performance after viewing a similar model, was due not only to increased self-efficacy, but also to increased observer motivation and heightening of the social comparison process. Similar-model subjects reported that they competed with the model to a greater extent than dissimilar-model subjects.

The influence of model similarity has been extended by Dowrick's (1983) use of self-modelling. This procedure is defined as "the behavioural change that results from the observation of oneself on videotapes that show only desired behaviours" (Dowrick, 1983, p. 106). Dowrick (1983) has utilised the conclusions drawn from numerous modelling studies that proposed that an effective model would be similar to the observer except for an added degree of competency. Watching oneself perform successfully fulfils this criterion. Dowrick has reported positive performance gains following self-modelling treatment for pool playing (Dowrick, 1983), and for swimming behaviour in spina bifida children (Dowrick & Dove, 1980). Dowrick believed that self-modelling could be extended to include mental rehearsal and live practice, but that self-modelling using video offers a number of advantages over both these procedures. In self-modelling, activities can be seen to be mastered, whereas with live practice, such activities may prove defeating. The advantage over mental rehearsal is that the video image of oneself would be more compelling than a

mental image, and would require no special skills to produce. In contrast however, a mental image would be cheaper and more flexible (Dowrick, 1983).

1:9 Criticisms of Self-Efficacy Theory.

Following its introduction in 1977, numerous researchers were quick to criticize self-efficacy theory on methodological and conceptual grounds (Borkovec, 1978; Eysenck, 1978; Kazdin, 1978; Wolpe, 1978).

A number of researchers (Biglan, 1987; Borkovec, 1978; Kazdin, 1978; Kirsch, 1980; Eastman & Marzillier, 1984) felt that the use of self-report measures as a basis for evaluating self-efficacy was problematic. Borkovec (1978) and Biglan (1987) argued that individuals who make efficacy judgements create a demand or goal to match the performance with the judgement, thus ensuring high correlations between performance and self-efficacy. However Feltz (1988) has countered that variations in demand have shown little congruence between self-efficacy and performance, and social demand may in fact encourage conservatism, thereby reducing the congruence between self-efficacy and performance.

Methodological criticisms have also been forwarded on the basis of Bandura's (1977) advocacy of individualised measures of self-efficacy for each performance situation. Several researchers (Ryckman, Robbins, Thornton & Cantrell, 1982; Vealey, 1986) have developed more generalised measures

of sport confidence in an attempt to allow more consistent prediction of behaviours across different sport situations (Vealey, 1986). However, Vealey's (1986) measurement of sport confidence is not as powerful as the microanalytic approach recommended by Bandura (1977) in predicting performance, and the constructs of trait and state sport confidence that make up situational sport confidence do not add any new conceptual dimensions to the area, according to Feltz (1988).

Conceptually, self-efficacy theory has been criticised by those with behaviourist views who believed self-efficacy to be merely a by-product of conditioned responses, especially those of reduced anxiety. Eysenck (1978) and Biglan (1987) have argued that high self-efficacy is brought about through reduced anxiety, which is the primary determinant of successful performance and self-efficacy. However, path-analysis studies (e.g., Feltz, 1982; Feltz & Mugno, 1983; Feltz, 1988b; McAuley, 1985) have confirmed that self-efficacy and performance factors are necessary to explain performance, whereas conditioned anxiety responses have often failed to predict avoidance behaviour (Bandura, 1986).

Lee (1989) has criticised self-efficacy theory on the basis that it's ability to explain behaviour adequately is largely illusory. According to Lee (1989), the theory's reliance on unobservable variables and a lack of precision

are its two major weaknesses, and these lead to confusion and practical problems. Self-efficacy theory describes rather than explains phenomena, which according to some researchers is enough to invalidate it as a theory, and Lee (1989) has contended that this is a practical weakness which prevents precise predictions from being made, and makes any crucial tests of the theory impossible.

Section 2: Imagery for Movement

A current review of the imagery literature as it pertains to movement and self-efficacy is provided in this section. The following topics are covered; imagery's effect on sport and motor skills; the content of imagery intervention characteristics; task characteristics that enhance imagery's effect on performance; subject characteristics that facilitate imagery's effect on performance; the measurement of imagery ability; imagery's relationship to self-efficacy; and the major theories of imagery as they relate to movement.

2:1 Imagery's Effect on Sport and Motor Performance

Despite the range of research findings with regard to imagery's effect on sport and motor performance, athletes and coaches have reported that they use imagery to enhance performance through a variety of methods (Gould et al., 1989; Hall, Rodgers & Barr, 1990). According to Hall et al.

(1990), athletes use imagery during competition to help maintain focus and self-confidence, and to control emotion and arousal levels. Gould et al. (1989) reported that elite coaches in the U.S.A. frequently use imagery rehearsal as a means of enhancing self-efficacy for performance, and believed it to be effective in this function.

A number of extensive reviews of imagery studies in the sport and motor performance areas have been conducted (Corbin, 1972; Feltz & Landers, 1983; Feltz et al., 1988; Richardson, 1967; Weinberg, 1982). All of these studies reported that imagery was able to enhance performance, either on its own, or in conjunction with physical practice of the particular skill. In the most recent review, Feltz et al. (1988), using meta-analytic techniques, found that physical practice alone produced the largest effect size, followed by a combination of physical practice and mental imagery, then mental imagery alone, and finally no practice. A large mean positive effect size of approximately one half of one standard deviation was found in a diverse array of studies investigating the effect of imagery on the learning of a motor skill, which prompted Feltz et al. (1988) to conclude that imagery's effect was replicable and demonstrated considerable generality.

Despite Feltz et al.'s (1988) finding that physical practice alone was superior to the combination of physical practice and mental imagery, the effect of the relative

combinations of imagery and physical practice has yet to be fully investigated. A study by Oxendine (1969) found that the combination of 75% physical practice and 25% mental practice was slightly more effective than 100% physical practice for a motor skill performance. However, Oxendine (1969) also demonstrated that physical practice alone was superior to rehearsals involving 50% physical and 50% mental practice. It seems then, that the relative amounts of physical and mental rehearsal may have a bearing on the potential performance effect. Most of the studies reported in Feltz et al.'s (1988) review utilised a combination of 50% physical practice and 50% mental imagery.

2:2 Content of the Imagery Package

It is generally accepted that a number of specific features need to be incorporated into an imagery program designed to enhance motor skill performance if it is to be effective. Smith (1987) reported that a relaxation component, the evocation of vivid and controllable images, and the use of internal rather than external imagery are essential components of an effective imagery training program. Other researchers have suggested that the production of successful rather than unsuccessful images (Denis, 1985, Suinn, 1985) will also facilitate performance improvements. Each of these factors will be discussed in turn.

Smith (1987) noted the importance of a relaxed state of mind during imagery training, and cited research which supported this notion. Anecdotal support has been provided by Lane (1980), and Horsley (1980) has advocated the use of relaxation procedures immediately prior to imagery training. The combined use of relaxation with imagery has been supported by Suinn's (1984, 1987) work with Visuo-Motor Behaviour Rehearsal (VMBR). Suinn (1987) viewed relaxation as a basic skill that is needed for other psychological training such as imagery, and coined the term VMBR to refer to the systematic application of relaxation and imagery to motor skill training. Studies by Weinberg, Seabourne and Jackson (1979), Hall and Erffmeyer (1983), and Wrisberg and Anshel (1989) have attested to the superiority of VMBR over mental practice alone, relaxation alone, or placebo training in enhancing motor skill performance.

Uniform support for the use of relaxation with imagery training has not been demonstrated however. A study by Murphy, Woolfolk and Budney (1988) found that relaxation imagery prior to the execution of a hand grip strength task, decreased performance in comparison to baseline levels. However, this study did not utilise specific imagery of the performance task, and so it is difficult to make comparisons with studies that employed relaxation procedures prior to specific imagery of the task.

Gray, Haring and Banks (1984) found that imagery

vividness was hampered by relaxation training prior to imagery for a football task. They concluded that it may be beneficial to induce arousal levels that are optimal for task performance prior to imagery rehearsal of that performance. It was found that the most realistic imaginal representations of the task were produced by mental rehearsal in conjunction with arousal instructions that more closely matched the actual competitive situation (Gray et al., 1984). Failure to demonstrate enhanced imagery following relaxation was also demonstrated by Hamberger and Lohr (1980).

The vividness and controllability of images are considered to be important influences on the facilitatory effect of imagery on successful task performance. Suinn (1983) reported that highly proficient skiers were able to produce more vivid images than less able skiers, and Start and Richardson (1964) were able to show that gymnasts with vivid and controllable images demonstrated the greatest gains from mental practice, when compared to those with less vivid and less controlled images.

According to Smith (1987), the most vivid images are those which recreate events in colourful and realistic detail, and involve the appropriate senses and related emotions. Smith (1987) believed that individuals who could evoke such images were likely to use previous experience as the basis for their image production. However, in

speculating about the relationship between imagery vividness and task performance, Smith (1987, p. 238) cautiously stated that,

...it is difficult to determine whether vivid images make athletes more effective, or whether elite athletes are simply better able to use imagery. Most likely a combination of the two explains this correlation. Vivid images may aid in skill execution for the elite athlete, who in turn develops better imagery skills.

The ability to successfully manipulate an image to produce a desired movement response has also been associated with increased levels of self-confidence and error detection capabilities (Clark, 1960). Smith (1987) speculated that athletes who are confident in their ability to manipulate their mental images may correspondingly increase confidence in their ability to successfully perform the mentally imaged skills. Despite this, Mahoney and Avener (1977) found no clear correlation between image controllability and gymnastics performance (as measured by final standings).

It has been proposed that movement imagery where the individual experiences the movement from a first person perspective, incorporating visual, kinesthetic, auditory, olfactory, and gustatory sensations, is superior to imagery where the individual watches themselves perform from a spectator's perspective. This superiority of "internal" imagery over "external" imagery for sport and motor skill performance has been proposed mainly on the basis of studies which have shown that elite performers utilised internal

imagery more than non-elite performers (Mahoney & Avenier, 1977). Some support for this proposition however, was demonstrated experimentally by White, Ashton and Lewis (1979), who found that kinesthetic imagery was significantly related to improvement scores for performance of a swimming skill. Similarly, Hall and Erffmeyer (1983) found that subjects trained in VMBR with videotaped modelling improved their basketball foul-shooting performance in comparison to a relaxation/visual imagery group (without modelling) who demonstrated no improvements in foul-shooting performance. The subjects in the VMBR group with videotaped modelling reported feeling kinesthetic sensations in association with their visual imagery, thereby providing support for the effectiveness of internal over external imagery for task performance (Hall & Erffmeyer, 1983).

Support for the superiority of an internal imagery perspective rather than an external perspective has not been conclusive. Ungerleider and Golding (1991) found that Olympic track and field athletes used an external imagery perspective more often than their non-Olympic counterparts. This directly contrasts the findings of Mahoney and Avenier (1977) who reported a higher incidence of internal imagery usage among Olympic gymnasts. However, some support for this finding was provided by Burhans, Richman and Bergey (1988) who reported beneficial effects of external imagery on running times after four weeks of training.

Epstein (1980) found that subjects frequently switched between imaginal styles, and therefore cast doubt on the utility of categorizing individuals as strictly 'internal' or 'external' imagers. However, it was found that male subjects who reported kinesthetic sensations when imaging, were more skilled at dart throwing than those who did not report such sensations (Epstein, 1980). McFadden (1982) found no significant differences between imaginal styles in hockey goaltending performance, and a study by Mumford and Hall (1985) revealed no differential effects of imagery style on figure-skating performance. However, in the latter study, senior skaters, who significantly outperformed novice skaters on the performance task, were also found to have higher kinesthetic imagery ability, a finding which the researchers interpreted as providing some support for the superiority of internal over external imagery.

According to Smith (1987), the use of an internal imagery style is not a prerequisite for effective imagery practice, and the relative effects of either imaginal style may be overridden by the emotional components of imagery production, such as increased confidence and anxiety reduction.

In order for imagery training to be effective in enhancing performance, individuals should imagine themselves successfully performing the skill (Suinn, 1985). A study by Woolfolk, Parrish and Murphy (1985), using golf putting

performance, found that individuals who imagined themselves correctly performing putts, improved their performance over a no-treatment control group, whereas an incorrect-performance group demonstrated a performance decrement when compared to the control group. Similar results were found by Woolfolk, Murphy, Gottesfeld and Aitken (1985), using a similar task, and studies by Gould, Weinberg and Jackson (1980), Johnson (1982), Meyers, Schleser, Cooke and Cuvillier (1979), and Powell (1973) have also demonstrated that imagery that is incongruent with successful task performance is associated with poorer performance. Denis (1985) noted that "exactness of reference" was an essential property of mental imagery if the procedure was to facilitate performance enhancement. Images should not only be vivid and controllable, but it was also necessary "...that the figural content of the image accurately depicts what it is supposed to refer to" (Denis, 1985, p. 9S). Indeed, the use of "incorrect" images during the recall of a previously learned movement could systematically bias any performance effects, according to Denis (1985).

2:3 Task Characteristics that Enhance Imagery's Effect on Performance.

The classification of tasks as either primarily cognitive or motor, and as open or closed, has been reported as having a differential effect on the degree to which

imagery is able to enhance performance. Feltz and Landers (1983) reported that subjects in tasks with high cognitive or symbolic elements have demonstrated greater improvements with imagery training, over those which have low cognitive and high motor components. This notion has been supported by Denis (1985), and demonstrated experimentally by Ryan and Simons (1981) and Wrisberg and Ragsdale (1979). In their meta-analysis, Feltz and Landers (1983) found that this breakdown of tasks into primarily motor or cognitive was the most important consideration when examining imagery's effect on performance. Much larger effects were reported for cognitive tasks over those that were essentially motor or involved strength, and these larger effects were usually achieved in less practice time and with less trials.

With regard to the effect of imagery on motor skill performance, closed skills have been studied more extensively than open skills. Closed skills are those in which the critical cues for task performance are static or fixed (Poulton, 1957), whereas open skills are performed in an environment where the conditions under which the skill is performed are continually changing position in space (Marteniuk, 1976). Only ten of the 85 studies analysed by Feltz and Landers (1983) investigated open skills, and the effect sizes between studies that used one or other skill type showed a trend towards mental practice being more effective with closed skills. McFadden (1982) however,

suggested that the performance of closed skills might benefit more from kinesthetic imagery, whereas visual imagery might be more appropriate for open skills.

2:4 Subject Characteristics that Facilitate Imagery's Effect on Performance.

Previous experience with the actual task, a belief in the effectiveness of the imagery program, and a certain degree of imagery proficiency have been identified as influential factors in the degree to which imagery can enhance performance.

Some researchers have proposed that imagery is more effective for individuals with a greater level of experience of the performance task, because they have a clearer internal representation of the skill (Denis, 1985; Mumford & Hall, 1985; Suinn, 1985). Hall and Erffmeyer (1983) have supported this notion, in demonstrating that more highly skilled basketball players exhibited significant improvement scores in foul-shooting performance following VMBR training. Moreover, Smith (1987) reported that athletes with more experience at the particular performance skill will especially benefit from imagery rehearsal.

In contrast to these views, Zeigler (1987) found that inexperienced basketball players demonstrated larger performance improvements in foul-shooting following imagery training than their more experienced counterparts.

Similarly, McIntyre (1987) demonstrated that non-elite basketball players improved the consistency of their foul-shooting performance following imagery training. Also, Feltz and Landers (1983) concluded that mental practice effects were demonstrable with experienced and inexperienced performers, and suggested that it was too simplistic to think that mental practice effects operated with only one type of performer. In their later meta-analysis, Feltz et al. (1988) reported that other researchers have not found any significant differences in effect sizes between novice and experienced performers. Other researchers (Minas, 1980; Weinberg, 1982) have suggested that minimal levels of task experience, or experience with the specific movement components of a novel task, might be necessary for imagery rehearsal to produce positive performance effects. Indeed, Zecker (1982) has suggested that imagery may not have much impact on performance if it is introduced too late in the learning process, since a well formed internal representation of the task will already exist. At the opposite end of the learning process, Denis (1985) proposed that negative performance effects may result from imagery rehearsal that is introduced after insufficient experience in the task has been obtained.

The importance of believing in the effectiveness of any cognitive intervention was considered by Girodo and Wood (1979) to be an important prerequisite to the effective

implementation of such an intervention. Seventy subjects underwent a pretest-posttest cold pressor test under four intervention conditions. Results showed that subjects who were provided with a rationale for the use of a particular intervention procedure demonstrated more successful coping responses for the task. Girodo and Wood (1979) proposed that it was the belief in the effectiveness of the coping strategy that mediated successful task performance. Similarly, Smith (1987) suggested that the attitudes and expectations that individuals bring into an imagery training session are an important factor in the effectiveness of such training. Specifically, he proposed that imagery training is most effective for those who believe in its ability to enhance performance. Accordingly, he felt that individuals who are about to participate in an imagery program should be taught the basic concepts of imagery training, and understand what to expect from such a program. Vealey (1986b) has supported this notion.

The ability to evoke vivid, controllable, and successful movement imagery is regarded as an important factor in the degree to which imagery can enhance motor skill performance (Howe, 1991). Although some studies have not shown a difference between high and low ability imagers in task performance (Eby, 1987; Epstein, 1980; Start & Richardson, 1964; White et al., 1979), numerous investigators have attested to the superiority of high

ability imagers over low ability imagers in their ability to perform motor skills (Clark, 1960; Housner, 1984; Housner & Hoffman, 1981; Isaac, 1990; Ryan & Simons, 1982).

Intuitively it is attractive to believe that individuals who are better able to imaginably represent correctly executed movements would be better able to translate these images into actual skill performance, but the research evidence would suggest that imagery ability alone cannot predict the level of such performances. A combination of factors including prior task experience, belief in the effectiveness of imagery to enhance performance, the nature of the task, task ability, and the relative accuracy of the various measures of imagery ability may have contributed to the equivocacy of research results on the relative effect of imagery ability on task performance.

2:5 Measurement of Movement Imagery Ability.

Hall, Pongrac and Buckolz (1985) have argued that many of the tests used to measure imagery ability have not been concerned with movement, which may account for the lack of a consistent relationship between reported imagery ability and motor skill performance reported in the literature. Indeed, Isaac (1990) noted the importance of ensuring the validity of measures of imagery ability when investigating the relationship between individual differences in imagery ability and mental practice. According to Isaac (1990), the

relatively recent development of movement imagery questionnaires by Hall and Pongrac (1983) and Isaac, Marks and Russell (1986) has meant that research has been better able to focus on different kinds of imagery ability and their use in various kinds of mental practice. Specifically, Isaac (1990) has shown that individual differences in the ability to visually and kinesthetically image movements can have differential effects on motor skill performance, for individuals with varying levels of skill and experience. This may account for some of the inconsistencies in the findings of studies which have purported to have investigated the relationship between imagery ability and motor skill performance, but failed to adequately measure movement imagery ability.

The Movement Imagery Questionnaire (MIQ), developed by Hall and Pongrac (1983) was designed to measure individual differences in visual and kinesthetic imagery of movement. According to Hall et al. (1985), the MIQ possesses a stable internal structure and respectable reliability levels, thereby indicating that the instrument may be useful in examining the relationship between imagery ability and motor skill performance. However, the requirement to actually perform the movement to be imaged immediately prior to the imaginal rehearsal of the movement, may confound the measure of imagery ability as this may then become a factor of memory recall rather than actual imagery ability.

According to Isaac et al. (1986), the Vividness of Movement Imagery Questionnaire (VMIQ) comprises 24 items relevant to visual and kinesthetic movement imagery. Respondents are required to image each item as if they were performing the movement themselves, and as if they were watching somebody else perform. The items relate to movement situations ranging from basic body movements (e.g., running, jumping) to "...movements demanding precision and control in upright, unbalanced and aerial situations" (Isaac et al., 1985, p. 24). Research has shown that the VMIQ is a reliable, stable and valid measure of an individual's imagery ability (Isaac et al., 1986).

2:6 Theories of Imagery

According to Bird and Cripe (1986) the most easily understood description of imagery is based on that proposed by Paivio's (1971) Dual Code Theory. This theory suggests that information is stored in memory as either verbal codes or visual images. The verbal memory would store symbolic information derived from auditory or articulatory stimuli, such as a hand clap or units of speech. In contrast, the visual memory would store symbolic information about spatial relationships and organizations. To use this system to imagine the performance of a sport skill, an individual must recall previously stored information regarding that skill from memory. The two memory systems are thought to be

connected directly to their relevant sensory modalities and, although they are independent of each other, they are able to act jointly during imaginal rehearsal. This theory proposes that the symbolic verbal and visual codes are the most dominant in memory, but does not discount the existence of memory systems associated with the other sensory modalities (Bird & Cripe, 1986).

Dual Code Theory has been criticized on the basis of evidence that suggests that both verbal and visual information is not stored in its original form (which would require enormous memory capacity) but rather in more general or abstract forms known as propositional networks. These have also been termed motor programs (Keele, 1977), generalized schema (Schmidt, 1975), or conceptual representations (Carroll & Bandura, 1982), and refer to information, including imaginably based information, that is coded in memory in an abstract form rather than as separate mental pictures or verbal representations. Thus, Propositional Theory suggests that propositional networks stored in long-term memory contain modality-specific information. This means that visual, kinesthetic, auditory, tactile, and/or gustatory representations can be retrieved from long-term memory to produce an appropriate imaginal representation.

The use of propositional networks in accounting for imagery's effectiveness in enhancing motor skill performance

has been elucidated using the Symbolic Perceptual Theory. This theory proposes that during imagery rehearsal of a motor skill, a propositional network is retrieved from long-term memory and information concerning the skill is processed and coded symbolically, thus allowing alterations to be made to the network. According to Bird and Cripe (1986) these alterations can then be used as a basis for sending efferent impulses to the muscles, which may then result in more accurate task performance.

A number of other theories have been proposed to explain imagery's function in the production of overt responses. The Psychoneuromuscular Theory, which proposes that subthreshold muscular contractions occur during imagery in the muscle fibres to be used in actual task performance, has received support from studies by Bird (1984), Hale (1982), Harris and Robinson (1986), Jacobsen (1931), and Suinn (1976). In contrast, the Attention-Arousal Theory posits that imagery causes a general increase in muscle action potentials in all muscle groups, thereby causing an increase in arousal levels which acts to physically and mentally prepare the performer for action (Feltz & Landers, 1983; Schmidt, 1982). According to Weinberg (1982), this theory may have application for elite athletes by functioning as a psych-up strategy for performance.

Hecker and Kaczor (1988) have suggested that each of the theories dealing with imagery's effect on motor

performance has been found lacking. The symbolic perceptual theory, although able to account for the finding that mental practice facilitates early skill acquisition, cannot account for the positive effects of imagery on the performance of well-learned skills. In addition, the psychoneuromuscular theory is at best a description of an important aspect of effective imagery, and not an adequate explanation of the processes involved in improved performance. Finally, the attention-arousal set explanation has not been empirically tested and therefore critical evaluation of its accuracy is impossible (Hecker & Kaczor, 1988)

The general dissatisfaction with the inability of these theories to effectively explain the effect of imagery on performance (Feltz & Landers, 1983; Weinberg, 1982) led Paivio (1985) to develop a more comprehensive theoretical framework from which to determine imagery's effectiveness in enhancing performance. Paivio's (1985) 2 X 2 classification of imagery function suggested that imagery mediated performance through both motivational and cognitive roles, each operating at either a general or specific level. The general motivational level was associated with the amount of physiological arousal generated by an image, and the emotion that might accompany it, while the specific motivational level referred to specific goal-oriented responses and the arousal levels produced by these images. The general cognitive level was associated with strategies for overall

task performance, and the specific level dealt with motor skill development (Paivio, 1985).

The motivational aspects of mental imagery with regard to motor skill performance have largely been ignored in the research literature, with most studies focusing on the cognitive aspects of imagery (Feltz & Landers, 1983; Paivio, 1985). Despite this, Paivio (1985) believed that imagery may enhance motor performance by influencing an individual's motivation to perform. Indeed, recent studies have reported that athletes use imagery for improving self-confidence, motivation, and emotional and arousal control (Gould et al., 1989; Hall et al., 1990). In support of this, Van Gyn (1989) suggested that cue dependent or emotive imagery, which incorporates images that are not directly related to the task, may serve to enhance performance through their influence on the affective components of performance. This notion has been supported by Howe (1991).

2:7 Imagery's link to Self-Efficacy.

Imagery's effect on motor skill performance may be mediated by its influence on an individual's perceived self-efficacy (Bandura, 1986; Howe et al., 1990; McKenzie & Howe, 1991). Bandura (1977) proposed that individuals derive their efficacy information from four main sources, of which vicarious experiences were one. Bandura (1977) originally based his conception of vicarious experiences on

modelling, although imagery has been acknowledged as being a type of vicarious experience by a number of investigators (Feltz, 1988; Hardy & Fazey, 1987). Indeed, McCullagh et al. (1989) have suggested that a conceptual link between imagery and modelling may exist, and outlined the similarity between the processes which govern both techniques. Both are forms of covert rehearsal which symbolically code task components and thus provide the internal standard upon which actual task performance is based (McCullagh et al., 1989). Imagery rehearsal of a motor skill then, would function as a form of vicarious experience and therefore would be capable of enhancing an individual's self-efficacy for task performance. Moreover, a number of researchers have acknowledged that imagery may function to enhance performance through its influence on other cognitive factors such as emotion, arousal and motivation (Hall et al., 1990; Paivio, 1985), as well as self-efficacy.

Few studies have specifically investigated the influence of imagery training on self-efficacy for task performance. Munson, Stadulis and Munson (1986) found that recreation students who were exposed to an imagery training program for decision-making counselling skills, enhanced their self-efficacy for, and actual performance of, those skills. Subjects in the imagery training group received no actual physical practice of the task between the pre- and post-test. Munson et al. (1986) concluded that vicarious

experience through mental practice may be equally effective as mastery experiences in enhancing competence and self-efficacy for decision-making counselling skills.

A study by Feltz and Riessinger (1990) investigated the relative effects of emotive imagery and performance feedback in enhancing both self-efficacy and performance of a muscular endurance task. A control group was compared to a group who received feedback alone, and a group that received mastery imagery plus performance feedback. Results showed that those subjects who received the imagery treatment demonstrated greater self-efficacy scores and better task performances than the feedback only or control groups. Feltz and Riessinger (1990) interpreted these findings as suggestive of imagery's ability to enhance both self-efficacy and performance of a muscular endurance task. However, most of the significant mean differences between groups were less than their respective standard deviations, which led the authors to suggest that the results be interpreted conservatively.

According to Bandura (1986), further research is needed to determine whether the cognitive rehearsal strategies such as imagery benefit performance by either creating the appropriate cognitive set for task performance, diverting attention to task relevant cues and thoughts, or by elevating perceived self-efficacy.

Section 3: Research Design.

Because of the widespread use of group design research in sport psychology, this review will not provide any detailed description of its characteristics. Rather, a more comprehensive analysis of single-subject design research in sport psychology is warranted. As such, this section will include a review of the literature advocating the use of single-subject designs, a description of the basic characteristics of such designs, a description of the use of multiple-baseline designs in particular, traditional methods of data analysis of single-subject designs, and a review of the relative strengths and weaknesses of single-subject and group design studies.

3:1 The Use of Single-Subject Designs in Sport Psychology

Single-subject designs for research investigating intervention effects in clinical and behavioural psychology have been well documented. Indeed, a cursory glance through the Journal of Applied Behaviour Analysis will testify to the acceptance of such research as an accepted research methodology. Despite this, sport psychology research has relied on more traditional group design studies to investigate the effects of interventions on aspects of motor and sport performance. However, a number of investigators have advocated the use of single-subject design research in sport psychology (Bryan, 1987; Elko & Ostrow, 1991; Howe,

1991; Wollman, 1986). Indeed, Elko and Ostrow (1991, p. 237) stated that the "...single-subject research design may be more appropriate than the group design in evaluating the effectiveness of interventions employed in the real world of sport competition". In support of this, Bryan (1987) reported that such designs were a relatively simple and practical alternative to group designs for the evaluation of sport psychology interventions.

Wollman (1986) has advocated the complementary use of single-subject methodologies with traditional group design research when investigating the effect of imagery on motor and sport performance. He reported several advantages of this type of research over group design studies. Firstly, a more easily identifiable link between imagery and its effects/noneffects on performance would be revealed. In addition, the detection of successful effects for some subjects who might otherwise have had their success masked in a nonsignificant group design, could lead to the identification of particular subject characteristics or factors that may be causally linked to improved motor performance through imagery. Such characteristics or factors could then be varied in subsequent studies in order to test their effects (Wollman, 1986). In addition, small but consistent changes in performance as a result of imagery training may be detected in a single-subject study, but may not emerge as significant in a group design. Moreover,

individualised imagery training programs could be monitored and altered during the course of a single subject methodology until the most successful routine is detected, according to Wollman (1986).

3:2 Basic Characteristics of Single-Subject Designs.

In reviewing the literature regarding the basic characteristics of single-subject designs, it became evident that there was considerable agreement among authors (Barlow & Hersen, 1984; Kazdin, 1982; Kratochwill, 1978). However, one of the most comprehensive and clear outlines of these characteristics was provided by Kazdin (1982). Accordingly, except where otherwise noted, all statements are acknowledged as originating from this source.

Single-subject designs are a particular type of research methodology that permits the experimental evaluation of treatments and interventions for individuals, single groups, or multiple groups of subjects. Within clinical psychology they provide an alternative to more traditional case-studies which are an uncontrolled means of evaluating interventions applied to single subjects.

Current single-subject designs emerged from research within the realm of behavioural psychology. The basic characteristics of such research led directly to the underlying characteristics of single-subject design studies. Behavioural psychologists were traditionally interested in

studying the frequency of particular behavioural measures using one or a few subjects, and directly observing the effects of certain procedures on performance over time. These characteristics formed the most basic identifying features of single-subject designs; continuous assessment of performance before, during and after treatments have been applied; the investigation of individual (or individual group) changes in performance rather than the "average" group performance at any single stage; and the use of visual inspection of graphed data to determine the effectiveness of treatment procedures, rather than statistical analysis (Martin & Pear, 1988).

Single-subject research designs then, are implemented to demonstrate that a particular intervention is the sole cause of an increase or a decrease in some performance measure over what are termed "baseline conditions". Experiments are designed in such a way that all other extraneous factors are ruled out as possible causes for any change in the performance measure. Implicit in this rationale, is the use of directional hypotheses.

In order to make inferences about the effect of interventions on performance measures, certain requirements of all single-subject designs must be met. The most basic requirement is that repeated observations of performance over time are made. Typically, subjects' performances are recorded on a daily basis, or at least on multiple occasions

during a week. This allows the researcher to examine the pattern and stability of performance before the intervention is implemented. Once the intervention has been applied, continued observation of the performance allows an examination of whether the performance changes in response to the onset of the intervention.

The initial period of observation before the treatment is implemented is known as the "baseline phase". This phase serves two functions. First, the descriptive function is to provide information about the current level of performance, and second, the predictive function is to provide a basis for predicting the level of performance that would be evident if the intervention had not been applied. The level of performance during the baseline phase thus serves as the criterion for evaluating whether the intervention has led to a change in performance.

Because of its important predictive function, baseline data are more useful if they show stability, that is, the absence of a trend (or slope) in the data, and relatively little variability in performance. Ideally, baseline data are collected until stability is established. However, practical restrictions often mean that this criterion is unable to be met. A minimum of five to ten data points is a generally accepted criterion for baseline data.

Baseline data trends may not be problematic in determining whether or not an intervention has caused a

performance change, provided that the baseline trend is in the opposite direction to the predicted intervention effect. If the trend however is in the same direction as the predicted intervention effect, such an effect must be very strong in order to conclude that the treatment has surpassed the projected baseline level.

Variability, in the context of single-subject designs, refers to the fluctuation in a subject's performance over time. Excessive variability during the baseline phase can interfere with drawing conclusions about the effect of the intervention. As a general rule, the greater the variability, the more difficult it is to draw conclusions about the intervention effect. However, the impact of data variability on drawing such conclusions is relative to each individual study. Initial levels of performance during baseline, and the magnitude of the performance change during the intervention must be taken into account when assessing the relative impact of data variability. If the intervention effect is so powerful that, despite variability in baseline performance, the performance of the subject during intervention totally exceeds the range of scores exhibited during the baseline phase, then baseline variability does not interfere with drawing conclusions about the intervention effect. This becomes problematic however, when a large degree of overlapping data is evident between the baseline and intervention phases. In such

cases, conclusions are more difficult to draw.

If a variable yet clear pattern of data is demonstrated during the baseline phase, then the intervention might be implemented in order to determine if that pattern is altered by the intervention. Conclusions about the effect of the intervention could then be made on the basis of whether or not the intervention changed or diminished the range of such a pattern. Similarly, an intervention might be implemented following a baseline phase in which no clear pattern has emerged, and large variability is evidenced, in order to determine whether the intervention is able to bring some order to the performance. Ideally however, baseline data that shows little or no variability provides a more effective basis for evaluating any intervention effects.

The most basic of all single-subject research designs is known as an "ABAB design", in which the baseline phase (A) is repeatedly alternated with an intervention phase (B) to complete four or more phases. The effect of the intervention is clear if performance improves during the first intervention, reverts to or approaches the original baseline levels of performance when the treatment is withdrawn, or reversed, and improves again when the treatment is reapplied at the second intervention phase. Generally at least three phases are necessary to draw conclusions about the causal relationship between the intervention and the performance change. However,

additional phases that continue to show the expected pattern of performance can strengthen the argument for the causal effect of the intervention on performance.

An example of such a design in the motor performance literature is a study by Allison and Ayllon (1980, study 1), in which the effects of a behavioural coaching intervention for the performance of blocking skills of a youth football player were evaluated. After baseline performance was recorded for 12 sets of 10 trials, the intervention was implemented for 9 sets of trials, during which performance was markedly improved. The treatment was then withdrawn for 5 sets of trials, during which time the performance decreased to baseline levels, and then implemented again for a further 11 sets of trials. Again, performance improved markedly over baseline levels. The study clearly demonstrated that the intervention was responsible for the performance improvements, and did not result from other uncontrolled factors.

Problems occur with ABAB designs if the reinstatement of baseline conditions does not result in a return to baseline performance levels. In such cases it is not clear whether the intervention was responsible for the change in behaviour, and so alternative methods of evaluating the intervention effect may be appropriate. Multiple-baseline designs are an example of such an alternative.

3:3 Multiple-Baseline Studies.

With multiple-baseline designs, the effect of a particular intervention is demonstrated by its introduction to different baselines at different points in time. Each baseline might represent different behaviours, persons, or settings. If the performance in each baseline changed when, and only when, the intervention was introduced, then the effect could be attributed to the intervention and not to other extraneous factors (Kazdin, 1982). A feature of such designs, when compared to ABAB designs, is that the intervention need not be withdrawn. Thus, this type of design escapes some of the practical and ethical criticisms levelled against ABAB designs. As Baer, Wolf, and Risley (1968) have reported, multiple-baseline designs are of particular value when a behaviour seems irreversible or when reversing the behaviour is undesirable.

According to Bryan (1987), the multiple-baseline-across-behaviours and across-subjects is probably the most useful design for applied sport psychology research. Bryan (1987) stressed that such designs require independence of behaviours, settings, or subjects, in that interventions applied to one baseline should not produce performance changes in any untreated baseline. In addition, Kazdin and Kopel (1975) have advocated the use of at least four or more baselines. This is done so that the effects of the intervention can still be inferred, despite the possible

finding that some baselines may show no indication of any intervention effects. Indeed, Kazdin and Kopel (1975, p. 606) stated that "those behaviours which remain unaffected can still show the specific effect of the intervention as they are sequentially subjected to the intervention. The specific effect of the intervention can be observed in the usual manner across baselines which did not reflect generalized changes".

Within the sport and motor performance literature there are several examples of the use of multiple-baseline designs (Allison & Ayllon, 1980; Komaki & Barnett, 1977; Koop & Martin, 1983; Wilcox & Gordon, 1991; Zeigler, 1987). Allison and Ayllon (1980) used a multiple-baseline-across-subjects design to evaluate a behavioural coaching strategy on gymnastics and tennis performance (studies 2 & 3). In study 2 the intervention program was introduced to six female gymnasts at different points in time. Results showed that gymnastics performance improved relative to baseline levels upon the introduction of the intervention. Similar results were found in study 3, indicating that behavioural coaching was effective in increasing the performance of the forehand, backhand, and serve for 12 tennis players. Performance levels were shown to increase successively for each player at the point where the intervention was introduced, thus satisfying the requirements for the evaluation of the intervention using a multiple-baseline-

across-subjects design.

Zeigler (1987) also investigated the effect of an intervention program on the acquisition of forehand and backhand return strokes in tennis for 24 beginning tennis players. A multiple-baseline-across-subjects design was used to evaluate the effects of a stimulus cueing technique on the performance of these strokes. Three groups of subjects were evaluated on their technique by two independent and reliable observers. The intervention was implemented to subjects in each group following sets of 5, 10, and 16 trials respectively. The results showed that marked increases in the number of forehand and backhand returns were demonstrated following the implementation of the intervention for each group.

A multiple-baseline-across-settings design was used in a study by Komaki and Barnett (1977) to evaluate the effectiveness of an intervention program on the performance of three independent football plays for five nine- and ten-year old males on a Pop Warner football team. The intervention was introduced for each play at intervals of 10 observation days (Play A), 14 days (Play B), and 18 days (Play C). Results showed that the performance of each play improved on average by 20% after the introduction of each intervention.

3:4 Data Analysis of Single-Subject Designs.

The most commonly used method of evaluating whether the intervention has had an effect on the target behaviour for single-subject research is through visual inspection of the graphically displayed data (DeProspero & Cohen, 1979; Kazdin, 1982; Matyas & Greenwood, 1990; Wampold & Furlong, 1981). Occasionally, this method is replaced by statistical evaluation to determine the reliability of the findings (Kazdin, 1982).

The term "visual inspection" refers to the manner in which a judgement is reached about whether the data pattern reflects a systematic intervention effect, according to Kazdin (1982). The underlying rationale for such a method is that researchers should seek only those interventions that produce the most powerful and reliable changes in performance. Such changes should then be readily observable from simply inspecting the data (Sidman, 1960). Kazdin (1982) therefore regarded visual inspection as a relatively unrefined and insensitive criterion for deciding the efficacy of an intervention effect, but believed this to be an advantage of the method in that it acts as a screening device that allows only powerful strategies to be interpreted as producing reliable effects. In supporting this view, Parsonson and Baer (1978) have extended the argument to posit that visual inspection encourages researchers to strengthen weak interventions to the stage

where larger effects are produced. Researchers who rely on visual inspection are thus seen as relatively conservative judges, and therefore more likely to commit Type II errors, that is, to conclude that an intervention has had no effect when in fact an effect exists. However, inconsistencies in the judgements of visual analysts were reported in studies by DeProspero and Cohen (1979) and Wampold and Furlong (1987).

In further contrast to the notion of conservativeness on the part of visual analysts, a study by Matyas and Greenwood (1990) found that graduate students who had received instruction in visual analysis techniques, but were relatively inexperienced in such assessments, were more likely to commit Type I (false alarm) than Type II errors, when exposed to a number of AB panels that were representative of published cases. The authors proposed that the assumption of conservativeness for visual analysts does not necessarily hold for beginning practitioners employing AB designs, under conditions of moderate to high variability and serial dependence. However, as predicted by Parsonson & Baer (1978), these visual analysts were successful in detecting intervention effects if indeed they did exist.

Matyas and Greenwood (1990) have argued for the use of statistical procedures in analyzing single-subject data, in order to control for the relatively high occurrence of Type

I errors through visual inspection. In doing so, such procedures will probably result in more conservative judgements regarding intervention effects, based on the results from this study. Matyas and Greenwood (1990) however, have recommended that similar research be conducted which investigates the effectiveness of visual analysts in determining treatment effects for other single-subject methodologies such as multiple-baseline designs. They do not rule out the possibility that improved visual techniques for determining intervention effects, or special training programs for visual analysts, may lead to more accurate assessments of the results from single-subject research.

In addressing the relative lack of explicitly outlined criteria for assessing whether or not intervention effects are consistent and reliable, Parsonson and Baer (1978) identified ten properties of graphically displayed data that might be considered. These included stability of baselines, variability within and between phases, overlap between scores of adjacent phases, the number of data points in each phase, changes in trend within and between phases, changes in level (means) between phases, the analysis of data across similar phases, and evaluation of the overall pattern of the data. Although not denying the utility of all of these measures, Kazdin (1982) reported that the most salient features of the data are those that pertain to the magnitude of changes across phases and to the rate of such changes.

These two general categories can be further divided into changes in mean and level, which relate to the magnitude of changes, and changes in trend and latency, which pertain to the rate of changes.

A shift in the average rate of performance between phases constitutes a **change in mean**, and consistent changes in this measure can signify whether the data pattern demonstrates an intervention effect. Independent from this measure are **changes in level**, which are discontinuities in performance from the end of one phase to the beginning of another. Measures of this factor can further aid researchers in making a decision as to whether an intervention has produced a reliable effect. Answers to questions of this type are more readily obtained if a change in mean is accompanied by a change in level in the same direction. However, it is possible to obtain changes in one measure without the accompanying changes in the other measure (Kazdin, 1982).

When phases are altered during the course of a single-subject design, the direction of behaviour may change as an intervention is applied or withdrawn. This phenomenon is referred to as a **change in trend**, and is an important feature of visual analysis (Kazdin, 1982). Several methods exist to determine trends in graphically presented data, ranging from the rather unreliable freehand method to the more stringent method of least squares. According to

Parsonson and Baer (1978), strong indications of treatment effects are demonstrated when trend changes between phases are observed.

Kazdin (1982) described **latency of change** as the period between the onset or termination of one condition, and the change in performance. Intervention effects are more clearly demonstrated the closer to the time of the phase alteration that the change occurs. With longer latency periods between the onset of the intervention and the behaviour change, the likelihood of intervening influences accounting for the change would be increased. However, as Kazdin (1982) has acknowledged, the importance of the latency period would depend upon the type of intervention and behaviour under study. Some interventions, such as those designed to treat obesity, and the application of some medications, would not be expected to result in rapid changes in behavioural measures.

Kazdin (1982) noted that measures of the changes in means, levels, and trends across phases, and variations in the latency of changes can occur separately or in combination. Ideally, an intervention would be judged as being effective if changes in means, levels and trends are clearly demonstrated, and are in the appropriate direction, with little or no latency of change in the performance measure. Visual inspection, therefore, leads to judgements about "the extent to which these characteristics are evident

across phases and whether the changes are consistent with the requirements of the particular design" (Kazdin, 1982, p. 237).

3:5 Strengths and Weaknesses of Single-Subject and Group Designs.

In the majority of cases over the last 50 years or more, psychological research has generally emphasized between-group research designs and the subsequent statistical analyses of the results. However, proponents of single-subject research designs (Barlow & Hersen, 1984; Kazdin, 1982; Kratochwill, 1978; Sidman, 1960) have outlined a number of limitations of group comparison designs, and the complementary use of both types of designs in furthering the understanding of psychological processes that govern human behaviour has been proposed. Indeed, Kazdin (1982) noted that single-subject and between-group designs represented two separate levels of analysis, each with their own set of limitations and relative advantages, but in many instances sharing the same research objectives. As Kazdin (1982, p. 295) stated,

To object or refute one type of research is to ignore sets of questions or answers that are encompassed by that approach. One type of methodology cannot address all of the questions that are likely to be of interest. And to apply any single methodology to the full gamut of research questions is to seek answers that are in some cases destined to ambiguity.

Depending upon the research question that is being investigated, single-subject and between-group research designs can provide differing but equally relevant perspectives. The unique contribution of single-subject research is that it provides the means to experimentally evaluate interventions for a single subject or client. However, questions can also be addressed at the level of groups using this type of design. On the other hand, between-group research is able to examine the separate and combined effects of different variables within the same investigation (Kazdin, 1982).

The generalizability of findings from single-subject and between-group designs can be viewed as problematic from both perspectives. An often-cited criticism of single-subject research is that the findings are difficult to generalize to other subjects, experimenters, behaviours, or settings. Indeed, Barlow and Hersen (1984) reported that this issue has been primarily responsible for slowing the development of single-subject research in applied settings, and has caused many prominent researchers and commentators to deny the utility of such an approach for any purpose other than the generation of hypotheses. This criticism has been somewhat answered however, by the use of procedures for direct and systematic replication of studies, which are able to establish generality of findings relevant to individuals (Barlow & Hersen, 1984). In contrast, Kratochwill (1978)

has identified problems of generalizability that are inherent in between-group experiments. The problem in this instance is generalizability to specific individuals. If a between-group study utilizes a truly random sample of subjects, all of the relevant population characteristics will be represented, ensuring the generalizability of findings to other groups, but lessening the relevance of the findings to specific individuals within the sample. In an applied or therapeutic setting, this could make the findings essentially useless for individual subjects (Kratochwill, 1978). In addition, if truly random samples are not drawn, the issue of generalizability becomes doubly problematic. The more homogeneous the sample, the more that generalization to other groups is limited to those that reflect similar group characteristics. In contrast, the more that the sample reflects the target population, generalization to any specific individual is limited. According to Kratochwill (1978), researchers should specify, in advance, which subjects or groups of subjects they wish to make generalizations to, and design their studies to reflect these considerations.

In addressing the limitations of group comparison designs as they applied to psychotherapy research, Barlow and Hersen (1984) identified some general problems that are relevant to other areas of applied psychological research. Firstly, an ethical problem is posed in the practice of

withholding treatment from a no-treatment control group. This is of obvious concern in a therapeutic setting, but is also relevant to other applied settings such as sport and motor performance. A second general problem associated with group research is being able to gather enough subjects for a study. This may not be as difficult in some research areas, but in some applied areas such as sport psychology, it would be difficult to gather large numbers of subjects with homogeneous characteristics or problems. Whatever the case, the practicality of acquiring the necessary number of subjects would seem more problematic for group research in comparison to single-subject research.

The practice of averaging the results from a group design is cited by Barlow and Hersen (1984) as a further limitation of between group designs. This procedure misrepresents the performance of any individual within the group and thus generalizations to specific individuals cannot be made. The general effect of a particular treatment, evidenced in the overall group effect, may not apply to a specific individual in an applied setting. A clinician could not be certain that a specified treatment would have the same effect on a certain individual as it had for the "average" person of a particular group. A related problem is that the results from heterogeneous group studies cannot inform a clinician or consultant of the particular subject characteristics that are correlated with overall

improved performance.

A final problem with group research within psychotherapy, according to Barlow and Hersen (1984) relates to intersubject variability. Group comparison designs only consider between-subject variability when dealing with the differences among individuals within a group. Subjects are usually tested on single trials (e.g., a post-test), and thus specific within-subject variability over the course of a particular treatment is ignored. This information can be of great practical significance to a clinician or consultant, but is not accounted for in many group comparison designs.

Valsiner (1986) has expressed concern regarding the importance attributed to statistical analysis within much psychological research that is conducted using group comparison designs. According to Valsiner (1986), the quality of research designs has come to be judged in terms of psychometric sophistication and complexity, and researchers must therefore demonstrate increasingly greater levels of statistical expertise in order to gain acceptability in the research domain, especially with regard to publications. This has led to a shift in the emphasis of research towards statistical significance rather than an understanding of the psychological principles or concepts that are being investigated. Indeed, Valsiner (1986, p. 99) stated that "the paradox of modern technology is that some

of the procedures that have been introduced to refine data collection and analyses may actually retard psychological understanding".

An associated problem with the increasing reliance on statistical significance is the use of probability values as indices of meaningfulness. Valsiner (1986) has commented that the inclusion of enough subjects in a between-group design can lead to the most trivial findings being significant at $p < .01$. In this manner, empirical support can be achieved for almost any proposal. As a critic of this feature of psychological research, Valsiner (1986, p. 109) has stated that

Whenever the methods of a discipline threaten to distort the phenomena they purport to clarify - because of the requirement to create an "average" view of the phenomenon by aggregating across subjects - alternative techniques should be explored and convergences determined. In the enterprise of science, no single research method or analytic tool should be permitted to become sacrosanct or an end in itself.

The systematic use of single-subject research designs as an alternative to, or an accompanying verification of, between-group findings would seem to support this perspective.

Although many research questions can be adequately addressed using either of the two types of designs, the range of questions that can be investigated using single-subject designs is somewhat more restricted, according to Kazdin (1982). Most single-case research designs compare the effect of treatment "packages" with no-treatment

baseline measures, and address the question of whether the treatment evokes a reliable behavioral change in the subject. These treatment packages usually include several components (e.g., relaxation, imagery, and positive self-talk techniques may form a particular treatment package), and if the treatment is shown to effect a reliable change in performance, the design cannot determine the relative effects of each of the aspects of the treatment package. Between-group designs, in contrast, can attempt to analyze individual aspects, or combinations of aspects of treatments that contribute to the effect (Kazdin, 1982). In addition, between-group designs are able to investigate whether treatments are differentially effective as a function of certain subject characteristics such as age, skill level, socioeconomic status, or other variables that may be relevant to the treatment. These treatment by subject interactions can be examined using factorial designs, and are indicative of an area of investigation where single-subjects designs are especially weak (Kazdin, 1982).

The relative merits of the methods of data analysis for single-subject and between-group designs is another area of concern for proponents and critics of both types of investigation. Statistical evaluation is the primary method of data analysis for between-group research, whereas visual inspection of graphically displayed data is most often used in single-subject research. Kazdin (1982) has noted that

statistical evaluation is often more sensitive in detecting intervention effects than visual inspection. Statistically significant but weak intervention effects may pass undetected by visual inspection, although this may equally be viewed as an advantage of single-subject research analysis because it encourages researchers to search for potent interventions, or to strengthen interventions until they are capable of producing large effects (Parsonson & Baer, 1978). The disadvantage of this method, however, is that consistent and potentially strong treatments may be prematurely discarded because their effects have not been detected. An additional criticism of visual inspection is that it encourages subjectivity and inconsistency on the part of investigators in the evaluation of intervention effects (Kazdin, 1982). This notion is supported in the literature through studies such as that by Matyas and Greenwood (1990). Further, a particular pattern of data within the different phases of a single-subject design is often required before any results can be interpreted by visual inspection. The criteria for visual inspection often mean that the data must show little or no trends, or trends in the opposite direction from that expected in the subsequent experimental phase, and slight variability, before any inferences regarding treatment effects can be made. Unfortunately, these criteria may not always be adequately satisfied, and visual inspection may be difficult

to invoke. In such cases, it has been suggested that statistical analysis may be useful (Kazdin, 1982; Matyas & Greenwood, 1990), provided that the requirements for such analyses are met.

Barlow and Hersen (1984) have noted that in applied research there are instances where a single-subject design either cannot answer the relevant research question, or represents a less effective or efficient means of doing so. They outlined a number of situations where experimental designs involving group comparisons would provide a more effective means of investigating the particular research problem.

These researchers recommended the use of single-case research at the beginning of an investigation of an intervention in order to isolate the relevant variables that may contribute to a particular treatment package. This package can then be tested using a large between-group design, where the effects are more likely to be reliably evidenced since most sources of variability would have been identified in the preceding series of single-subject studies. Also most of the factors influencing the generality of findings would have been determined through direct and systematic replication, so it would be appropriate to test the powerful combination of treatment variables using a large group comparison design. This combination of design strategies has been termed "technique-

building" and "technique-testing" by Hersen and Barlow (1976).

Once a treatment package has been proposed, the magnitude of its effect needs to be demonstrated. If the package has been developed through a series of single-subject designs, the investigators should already know why it works, and need only be concerned with demonstrating its effect strength, through a group comparison design. The demonstration of a powerful treatment effect is important from a political perspective, according to Barlow and Hersen (1984), because if funding agencies and society in general can readily observe these effects, they are more likely to support further research.

When an applied researcher is concerned with the effectiveness of a given procedure on a well-defined group of subjects (e.g. a classroom or team), a between-group design is often more appropriate to implement. This is not to say, however, that studies of groups are limited to such designs. It can also be appropriate to use the techniques of single-subject designs (e.g., ABAB or multiple-baseline designs) in measuring the average behaviour of a group of individuals (Barlow & Hersen, 1984).

A final case where between-group designs are more appropriate to employ is when an investigator wishes to compare the relative effectiveness of two treatment packages, in which several variables are combined to form

each treatment package. Hersen and Barlow (1976) emphasized, however, that such packages would be better developed through preliminary investigations of the component variables using single-subject designs which incorporated direct and systematic replication. Superfluous variables within each treatment package could then be discarded, and the more active components combined to form a more powerful treatment package. It would then be appropriate to compare the packages using a between-group design (Hersen & Barlow, 1976). If the treatments were not reducible to component variables, then the implementation of a between-group design would be appropriate.

CHAPTER III

METHOD

This section presents the procedures used in this investigation. Two experimental designs are outlined in separate sections. Section 1 details the procedures used for the single-subject research design. Section 2 outlines the between-group experimental design. A description of the subjects, setting, personnel, equipment, experimental design, data collection procedures, and data analysis is included in each section.

SECTION 1: Single-Subject Research Design.

Subjects.

Six (n=6) subjects from the University of Victoria were recruited for the study according to selected marker variables. The minimum requirements for inclusion in the study were that each subject had participated in a university level sport, or equivalent. Also, the subjects were required to have been taught specific relaxation skills, been exposed to a mental imagery training program prior to the study, to have used a predominantly internal imagery style, and believed that imagery practice was able to improve their performance of the skills involved in their sport. An information Questionnaire (Appendix A) was used

to identify potential subjects on this basis. Subjects meeting these requirements were invited to complete the Vividness of Movement Imagery Questionnaire (VMIQ), developed by Isaac et al. (1986) (Appendix B), which measured their movement imagery ability. Based on the results from this questionnaire, six (n=6) subjects were recruited for the study.

All subjects were volunteers and were blind to the purpose of the study. The subjects were told that the study was designed to improve their imagery ability, and to determine if imagery would enhance their performance of a dart-throwing task. Prior to any data collection, each subject completed and signed an informed consent form (Appendix C) and was instructed not to communicate any details of the treatment and testing procedures, and self-efficacy ratings to any of the other subjects.

Subject 1 was a 22 year old male rugby player who had been using imagery for approximately four years. He had been exposed to approximately twelve guided imagery sessions, and strongly agreed that imagery could improve his sport performance. His score for the VMIQ subscale of "watching self" was 66, indicating a moderate imagery ability.

Subject 2 was a 24 year old female netball player who was a member of the national team. She had also played basketball at university level. This subject had been using

imagery for approximately five years, reported that she had been exposed to "many" guided imagery sessions, and strongly agreed that imagery could improve her sport performance. This subject scored 27 for the "watching self" subscale of the VMIQ, which indicated a high imagery ability.

Subject 3 was a 26 year old rugby player who had competed at the national level. During the five years that he had been using imagery he had been exposed to eight guided imagery sessions. He strongly agreed that the use of imagery could improve his sport performance, and scored 50 on the "watching self" subscale of the VMIQ, indicating a moderate imagery ability.

Subject 4, a 33 year old female volleyball player who had competed at provincial level, was an experienced imagery user (16 years), although she had only been exposed to two guided imagery sessions. She also strongly agreed that imagery could enhance her sport performance, and was classified as a moderate ability imager, with a score of 54 on the "watching self" subscale of the VMIQ.

Subject 5 was a 22 year old female rower at the university level, and had been using imagery for less than one year, although she had been exposed to four guided imagery sessions and was classified as a moderate ability imager, with a score of 44 on the "watching self" subscale of the VMIQ. This subject also strongly agreed that imagery could improve her sport skills.

Subject 6, a 22 year old male rugby player, scored more than the other subjects on the VMIQ subscale, indicating a lower imagery ability, although his score of 81 would classify him as a moderate ability imager, along with subjects 1,3,4 and 5. He had only been using imagery for one year, although in that time had been exposed to 8 guided imagery sessions. This subject agreed that imagery could improve his sport skills.

Setting and Personnel

Subjects met with the experimenter daily (Monday to Friday) at predetermined times in a testing room at the University of Victoria. Testing times were determined one day prior to each session for subjects 1,2,5 and 6, depending upon the availability of the testing room and each subject's timetable. Each session for subjects 3 and 4 was at a predetermined standardized time. A seminar room at the University of Victoria served as the location for each session. One experimenter attended each session. The experimenter was present in the testing room during all testing sessions, providing standardized instructions to the subjects and recording scores and self-efficacy ratings.

All subjects underwent treatment and testing individually.

Equipment

Five standard indoor playing darts were used during each testing session. The darts were thrown at a 44 inch (1.12m) by 36 inch (0.91m) section of particle board mounted on a wooden frame. An expanded variation of a standard indoor 40 cm FITA archery target was painted onto the particle board, with the center of the target located 57 inches above floor level, and in the center of the board. The target consisted of a series of coloured concentric circles painted onto the particle board (Appendix D). Subjects scored 1 point for hitting the board outside of the painted circles, and increments of 1 point were added for successfully landing the dart inside each additional circle. A maximum of 10 points was scored by hitting the central circle (bullseye). A strip of masking tape on the floor of the testing room seven feet away from the target, indicated where the subjects were to stand for each of their throws.

During treatment sessions, subjects observed and listened to recorded instructions which were played to them from a standardized 1/2 inch VHS colour videotape using a 1/2 inch monitor connected to a 24 inch colour television.

During testing sessions, subjects were required to wear a blindfold to prevent the availability of any visual feedback regarding task performance.

Experimental Design

A multiple-baseline-across-subjects design, with a follow-up component, was used to assess the effect of the imagery program on subjects' ratings of self-efficacy magnitude and self-efficacy strength. Baseline data were collected for all subjects for at least seven testing days. Subject 1 began the first of the minimum 15-day intervention phase of the study on testing day 8. The other five subjects remained in baseline conditions for at least 3 days following the initiation of the intervention for subject 1, at which time the intervention was implemented for subjects 2 and 3. The remaining three subjects continued in baseline conditions for another 3 days before the intervention was initiated on testing day 14. Appendix E shows a diagrammatic representation of the multiple-baseline design.

Standardized intervention procedures were used with each subject for 10 treatment days (comprising Part A of the treatment procedure) following baseline, after which time pre-selected aspects of the intervention package were employed for the remainder of the intervention phase (Part B of the treatment procedure). For all subjects, Part B of the treatment procedure was implemented for 5 consecutive days following the completion of Part A. Following this 5 day period however, subjects 1 to 3 continued to be exposed to Part B of the treatment, accompanied by the testing procedure, using a matched double probe procedure.

Following the five consecutive exposures to Part B, subject 1 was exposed to the treatment and testing procedures for consecutive 2 day periods following a 1 day no-treatment interval. These 2 day probes occurred on the same days for subjects 1 to 3, with the final double probe coinciding with the final two Part B treatments for subjects 4 to 6, so that the treatment procedures terminated for all subjects at the same time. These probes can be seen in the representation of the multiple baseline design shown in Appendix E.

A follow-up procedure was implemented for each subject on two consecutive days following a 6 day interval in which the subjects were asked not to physically or mentally rehearse the task. During each phase of the study, subjects were required to throw 10 darts at the target, using their dominant hand, while blindfolded.

Procedures.

Prior to the first baseline session, all subjects were individually pre-tested on their dart-throwing performance, using their preferred arm. Each subject threw a total of 30 darts at the target, without the blindfold, and their average score for 10 darts was recorded. This score was the basis on which their ratings of self-efficacy were reported.

Each day of the baseline, intervention, and follow-up phases, subjects were required to complete a form on which their average score for 10 darts during the pre-test was

recorded. An assessment of the magnitude and strength of their self-efficacy was obtained by asking the subjects to identify the score that they believed they were capable of scoring for that particular day, and then to identify the score that they were 100%, 75%, 50%, 25%, and 0% confident of achieving on that day (Appendix F).

During baseline sessions, each subject entered the testing room and completed an individual self-efficacy assessment form. Separate forms for each testing day were completed by each subject throughout all phases of the study. Subjects were then required to put the blindfold in place, but to raise it so that they could still see the target. They were instructed to stand at the line, facing the target, and five darts were placed in their hand. The subjects were told to fix the location of the target in their mind, and then to pull the blindfold down and to commence throwing. They were instructed to keep the blindfold in place until each set of five darts had been thrown and removed from the target. After the first five darts had been thrown and removed from the target, the experimenter asked the subjects to raise the blindfold and again fix the position of the target in their mind. The five darts were then placed in the subject's hand, the blindfold was pulled down, and the darts thrown at the target. After the remaining five darts had been thrown and removed from the target, the score was recorded, and the

experimenter instructed the subjects to remove the blindfold. This procedure was repeated for each phase of the study. Subjects were not informed of their performance scores at any stage during the course of the study.

The intervention phase of the study incorporated two portions. The initial portion of the intervention lasted for 10 sessions. Each session was designed to guide the subject through relaxation and imagery exercises, and finished with the subject standing and imaging themselves throwing their 10 darts at the target. This final portion of each session was not guided by the recorded instructions. Session 1 was an introductory session in which the experimenter outlined the order of events for each treatment session, and described the relaxation and imagery exercises that the subjects were to be exposed to over the remaining sessions. In addition, subjects were shown a videotape entitled "What you see is what you get" (Botterill, 1985), in which imagery was introduced, and prominent Canadian sporting figures talked about the effectiveness of using the technique. Sessions 2 to 10 were pre-recorded on videotape so that standardized instructions could be provided to each subject. Orally presented instructions were heard on the videotape, with an accompanying picture of the target seen from the subject's perspective as if they were standing at the line waiting to throw the darts. This perspective was consistent with an internal imagery perspective. A

transcript of each recorded session is shown in Appendix G.

For each session, individual subjects were instructed to sit in a relaxed position with both feet on the floor, and to follow all of the directions given to them on the videotape. The experimenter instructed the subject to close their eyes during the session, but to open them and look at the videotape if they experienced difficulties in imaging a particular aspect of the session that was being delivered. An excerpt from the videotape was shown to each subject during the introductory treatment session so that they would be familiar with what was to be shown and therefore be able to concentrate on generating their own images. Subjects were instructed that the videotape should only be viewed to augment their imagery if they experienced difficulties in imaging the task.

The experimenter remained in the treatment room throughout each session, which began with three minutes of relaxation instructions, followed by four minutes of guided imagery exercises while the subject was seated. The guided imagery exercises were designed to practice and further develop each subject's imagery skills in terms of self-perception, vividness (visual, kinesthetic, and auditory), and controllability (successful outcome imagery). Subjects were then required to stand and to imagine that they were at the line waiting to throw their darts. They were guided through a one-minute refocusing exercise using a

centering technique, and then instructed to imagine themselves throwing the 10 darts at the target. This portion of the treatment session was unguided, although the subjects were instructed to make their images successful, in real time, and as vivid as possible. In an attempt to make this portion of their imagery session as close to real time as possible, subjects were challenged to equate their actual performance time for throwing the 10 darts during the baseline sessions, with their imaginal rehearsal of the task. During all baseline sessions, each subject was timed from when the blindfold was pulled down over the eyes, until the time it was removed. Following each training session, subjects were informed of their imaginal rehearsal time for that session, the difference between this time and their actual performance time, and were reminded of their actual performance time before each subsequent session. Each taped session lasted approximately 10 minutes, after which the subjects were instructed to sit down and complete their self-efficacy rating form. In addition, subjects completed a modified version of the Movement Imagery Questionnaire (MIQ) (Hall & Pongrac, 1983), on which they were asked to rate their ability to kinesthetically and visually image the task (Appendix H). Upon completion of these forms, the subjects were required to physically perform the task, as outlined previously.

The second portion of the treatment phase lasted for at

least five sessions for each subject. During this portion, subjects entered the testing room, put on the blindfold, and stood at the line as if they were preparing to throw. They were then instructed to relax, using the centering technique described to them during Part A of the intervention, and to image themselves successfully throwing the 10 darts at the target. Immediately following their imagined 10th successful throw, the subject completed their self-efficacy rating form and modified MIQ, and then physically performed the task, as they did during the baseline phase. Their imagery rehearsal time for that session was told to them following the completion of the session.

During the follow-up phase of the study, subjects entered the testing room, filled out the self-efficacy rating form, put on the blindfold and physically performed the task. Upon completion of the second follow-up session, each subject was debriefed as to their scores throughout the study, and the purpose of the study. Each subject was given a post-study questionnaire (Appendix I) which they were asked to complete and return to the experimenter at a later time. This questionnaire was designed to provide subjective data regarding the subjects' thoughts and feelings about the study, and the procedures used.

Data Analysis.

The data were analyzed using visual inspection of the

graphically displayed results, which included measures of the changes in means, changes in level, and changes in trend that occurred when phases were altered. Descriptive statistics are also reported.

The trends for each phase were determined by calculation of a regression line using the method of least squares, as outlined by Parsonson and Baer (1978).

SECTION 2: Group Design.

Subjects.

The subjects were thirty eight (n=38) university level athletes who were active members of the various athletic teams from the University of Victoria, or had participated at an equivalent level. Twenty two (n=22) females and sixteen (n=16) males (mean age = 21.35 years) volunteered to participate in the study. All subjects had experience at dart throwing, had used imagery, and expressed a belief in its effectiveness in enhancing task performance. Subjects meeting these criteria were determined from the results of a subject information questionnaire administered to all athletes at the beginning of the respective seasons for each sport (Appendix A). Subjects were randomly assigned to one of two experimental groups: Imagery training (I), or a No-treatment Control group (C). Nineteen (n=19) subjects were assigned to each group. All subjects were volunteers and blind to the purpose of the study. Prior to any data

collection, each subject received a letter outlining the procedures for the study (see Appendices J and K), and a timetable of events (see Appendices L and M). All subjects completed and signed an informed consent form (Appendix C). Each subject was instructed not to communicate any details of the treatment and testing procedures, or their individual self-efficacy ratings to any other subjects.

Experimenters and Setting

One sport psychology graduate student served as the experimenter for the study. This person had been an experimenter in a preliminary study and was thus familiar with the procedures used in the study. This minimized instructor effect and maximised equivalency in the training and testing procedures.

Each group of subjects met with the experimenter at designated times in a testing room at the University of Victoria. A seminar room served as the location for each testing and treatment session. The experimenter attended each session, providing standardized instructions to the subjects, administering each treatment session, and recording scores and self-efficacy ratings.

All subjects were tested individually, however those in the imagery group were exposed to the imagery training program with other subjects from this group.

Equipment.

The same equipment described in Section 1 was used for this study.

Measures.

1. Self-efficacy - Bandura (1977) reported that self-efficacy assessments should take into account three dimensions; self-efficacy magnitude (or level), strength, and generality. In accordance with Bandura's (1977) guidelines, measures of self-efficacy magnitude and self-efficacy strength were recorded for the dart throwing task. Generality of self-efficacy for this task was not considered to be a factor in this analysis and was not included.

A self-efficacy rating form was used in which subjects were reminded of their average score for 10 darts thrown at the target with their dominant hand with visual feedback and knowledge of results (KR). An assessment of self-efficacy magnitude was obtained by asking the subjects to identify the score that they believed they were capable of scoring for that particular day. Self-efficacy strength was assessed by asking subjects to identify the score that they were 100%, 75%, 50%, 25%, and 0% confident of achieving on that day

(see Appendix F). For the purposes of data analysis, the measure of self-efficacy magnitude, and one selected measure of self-efficacy strength (75% level) was be used.

2. Imagery Ability - A modified version of the Movement Imagery Questionnaire (MIQ) developed by Hall and Pongrac (1983) was administered to each subject in the experimental group immediately following the introductory treatment session, and again immediately following the final imagery session. This assessment was used to check that the imagery treatment had successfully improved the subjects' visual and kinesthetic imagery of the task. The adaptation of the MIQ included two 7-point Likert scales on which the subjects were asked to rate their ability to kinesthetically and visually image the dart throwing task. Scores ranged from 1 (difficult to picture/feel) to 7 (very easy to picture/feel) (see Appendix H).

Procedures.

Prior to the first pre-testing session, all subjects met separately with the experimenter, who outlined the procedures for the study. In addition, all subjects in the imagery treatment group were shown a videotape entitled "Visualization: What You See Is What You Get" (Botterill,

1985), in which mental imagery was introduced, and prominent Canadian sporting figures talked about the effectiveness of the technique for enhancing performance.

During an additional session prior to their first testing session, all subjects were tested individually on their dart throwing performance, using their preferred arm. Each subject threw a total of 30 darts at the target, with visual feedback and KR, and their average score for 10 darts was recorded. This score was the basis on which their ratings of self-efficacy were reported.

During the pre-test sessions, all subjects were tested individually on their ratings of self-efficacy for the blindfolded dart throwing task (see Section 1 for a description of the task). Each subject entered the testing room and completed an individual self-efficacy rating form prior to performing the task as directed. A mean score for self-efficacy magnitude and self-efficacy strength was recorded following two testing days.

One day following the first testing period, the subjects in the imagery treatment group met with the experimenter for the first of 15 treatment sessions. Each treatment session followed the same procedures as the single-subject research design (see Section 1 for a description), except that the subjects were not required to physically perform the dart throwing task, or to complete a self-efficacy rating form.

Subjects in the control group were instructed not to rehearse the dart throwing task in any manner during the 15 days that the imagery group was receiving their treatment.

One day following the final treatment session for the experimental group, all subjects were again tested on their ratings of self-efficacy for the task, and were required to physically perform the task. As was previously obtained, a mean score for self-efficacy magnitude and self-efficacy strength was recorded after two testing days.

All subjects underwent the same testing procedure following a 5-day interval, during which time the subjects were instructed not to mentally and/or physically rehearse the task.

In summary then, following the preliminary procedures, subjects in the experimental group were pre-tested on testing days 1 and 2, exposed to the intervention program on days 3 to 17, post-tested on testing days 18 and 19, and then tested again (follow-up tests) 5 and 6 days following the final post-test session. In addition, measures of their imagery ability were recorded on day 3 and day 17, which were the first and last days of the intervention. Control group subjects were tested at the same times, but were not exposed to the intervention program, and therefore no measures were taken of their imagery ability.

Experimental Design and Data Analysis.

A between-groups design was used to test for (a) differences between the no-treatment control group and the experimental group on self-efficacy ratings for the blindfolded dart throwing task, and (b) for changes in subjects' ratings of perceived self-efficacy over the three testing phases.

Separate 2 x 3 analyses of variance were performed on the dependent variables of self-efficacy magnitude (SEM) and self-efficacy strength (SES) at the 75% level. The independent variables were Group (Control and Experimental) and Treatment Time (Pre-Test, Post-Test, and Follow-Up). Treatment Time was the repeated measure. In addition, two dependent-sample t tests were performed upon the two modified MIQ variables to determine whether the imagery treatment had significantly improved subjects' ability to kinesthetically and visually image the task.

CHAPTER IV

RESULTS

This chapter presents the results from the single subject design and group design experiments. Results from the single subject design experiment are reported in Section 1. Section 2 reports the results of the group design experiment. Descriptive data are reported first, followed by the statistical analysis of this data.

Section 1: Single Subject Design Results

The results for the single-subject design study are reported in the following manner; visual inspection of the graphic data is used to determine the changes in means, levels, and trends between phases for each subject for the variables of Self-Efficacy Magnitude and Self-Efficacy Strength (75% level). In addition, visual inspection of the graphic data for the MIQ scores (Visual and Kinesthetic) and Performance scores is reported, and changes in means, levels and trends are reported for the performance data.

The 100%, 75%, 50%, and 25% level Self-Efficacy Strength scores for each subject followed similar patterns over the three phases of the study and it was decided that one of these levels would be used for the analysis and discussion of results. The 0% level Self-Efficacy Strength scores for subjects 1-3 was 100 throughout the three phases

of the study (except Day 2 for Subject 2, which was reported as 90). No increases in score for this level of self-efficacy strength were possible for these subjects, and so these data were not included in the analysis. A table of random numbers was used to determine the level of self-efficacy strength to be used in the analysis and discussion. The 75% level was chosen. The graphic data for the 100%, 50%, 25%, and 0% levels of self-efficacy strength scores for each subject are shown in Appendix N.

The following figures have been used to illustrate the results from this study;

- Figure 1. Self-Efficacy Magnitude scores for each subject showing mean scores for baseline, intervention, and follow-up phases.
- Figure 2. Self-Efficacy Magnitude scores for each subject showing trends for baseline, intervention, and follow-up phases.
- Figure 3. Self-Efficacy Strength (75% level) scores for each subject showing mean scores for baseline, intervention, and follow-up phases.
- Figure 4. Self-Efficacy Strength (75% level) scores for each subject showing trends for baseline, intervention, and follow-up phases.
- Figure 5. MIQ Visual scores for each subject during the intervention phase of the study.
- Figure 6. MIQ Kinesthetic scores for each subject

during the intervention phase of the study.

Figure 7. Performance scores for each subject showing mean scores for baseline, intervention and follow-up phases.

Figure 8. Performance trends for each subject for baseline, intervention, and follow-up phases.

Self-Efficacy Magnitude (see Figures 1 and 2).

Subject 1.

Except for a score of 55 for Day 1, the baseline scores for self-efficacy magnitude for subject 1 ranged from 70 to 80 with a mean score of 72.86. The intervention was implemented after seven days of baseline, during which the subject exhibited a stable negative trend in baseline scores. The implementation of the intervention resulted in a change in level of 10 points, and throughout the intervention self-efficacy magnitude scores ranged from 75 to 85, with a mean of 79.74. Following a 6-day rest interval in which no measures of self-efficacy magnitude were recorded, and the task not performed, subject 1 recorded a mean follow-up self-efficacy magnitude rating of 80 points.

A positive change in level (10 points) and mean score (6.88 points) between the baseline and intervention phases was shown. A negative change in level of 5 points and a positive mean change of 0.26

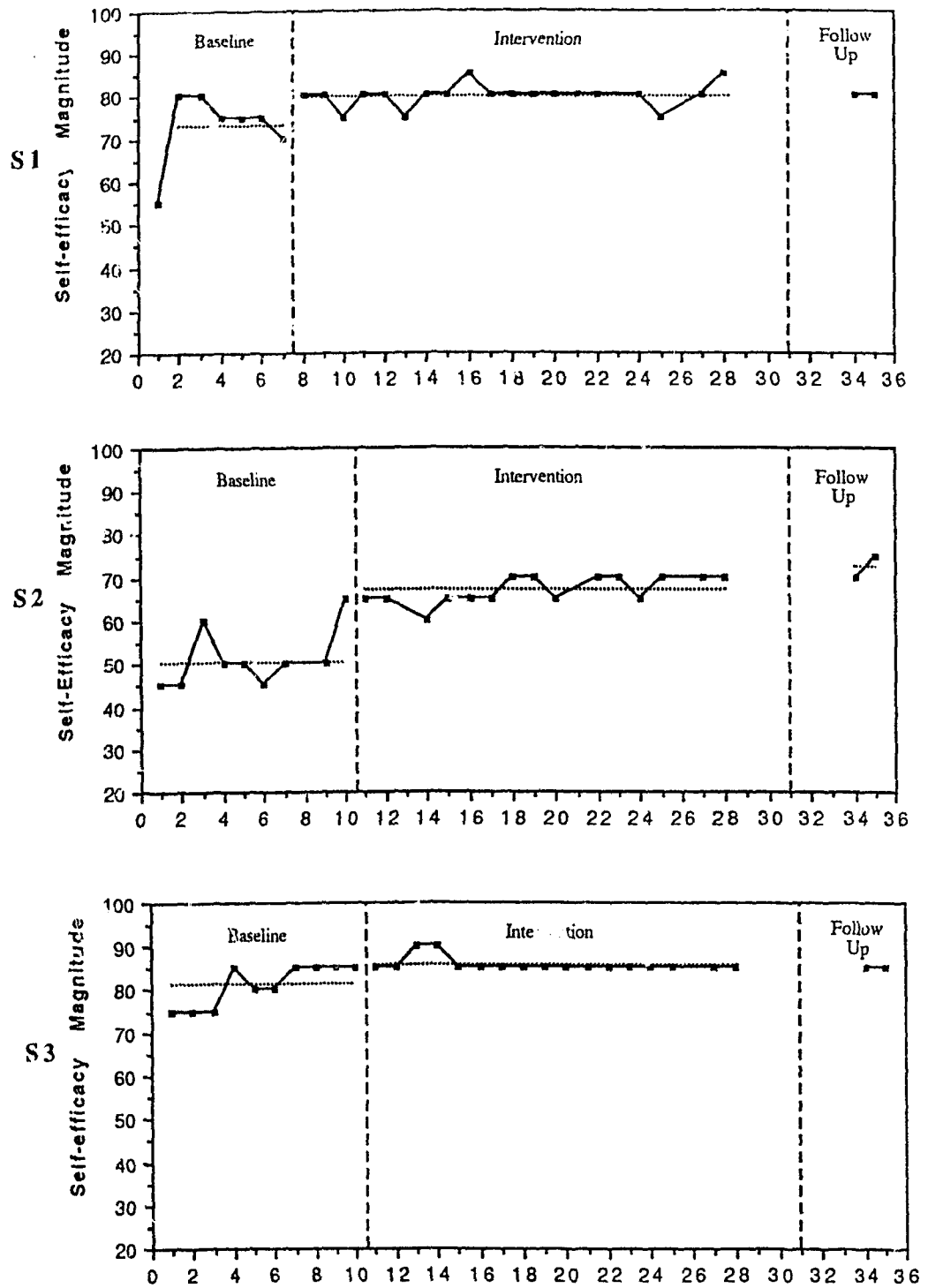


Figure 1. Self-Efficacy Magnitude scores for each subject showing mean scores for baseline, intervention, and follow-up phases.

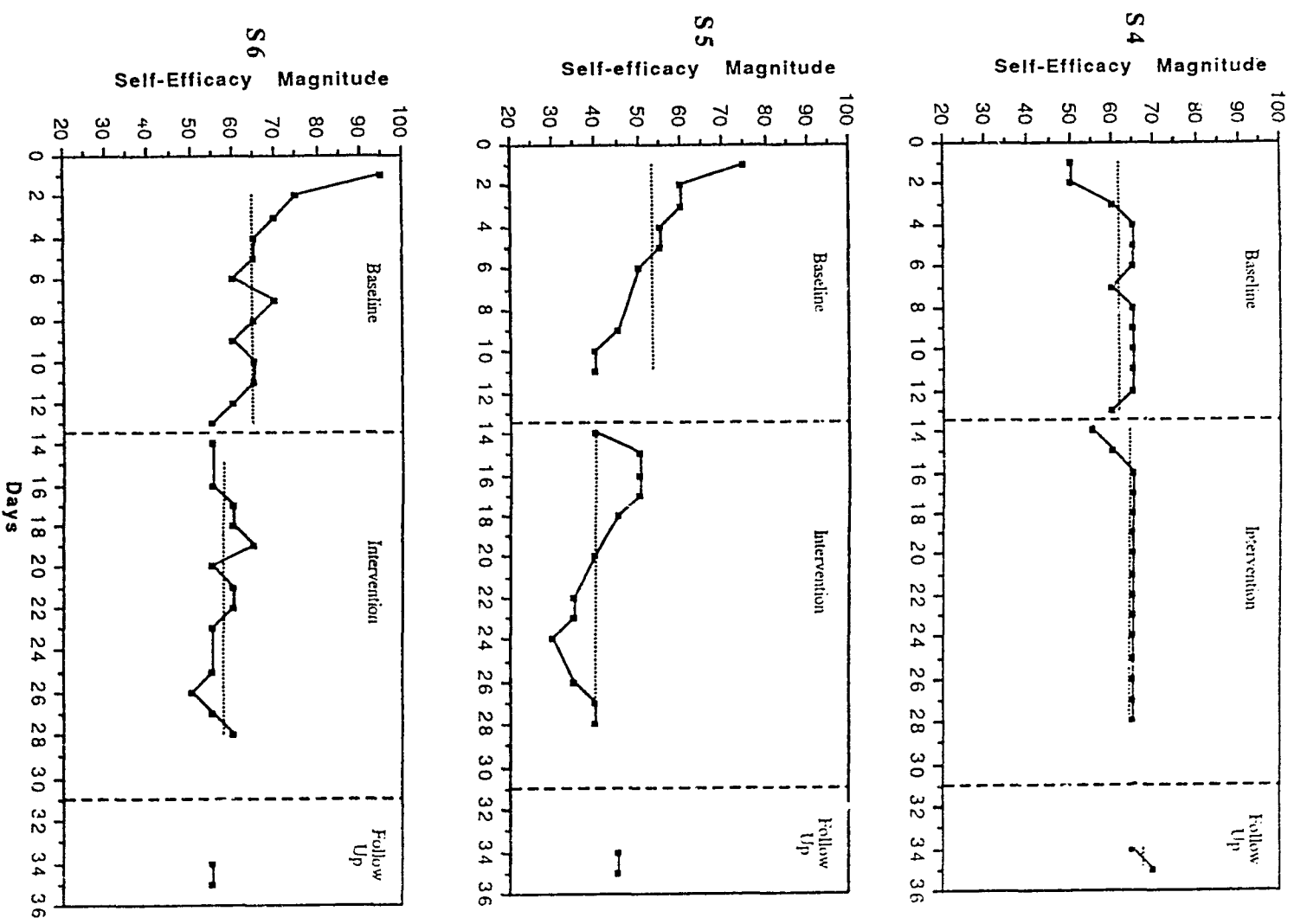


Figure 1 (continued).

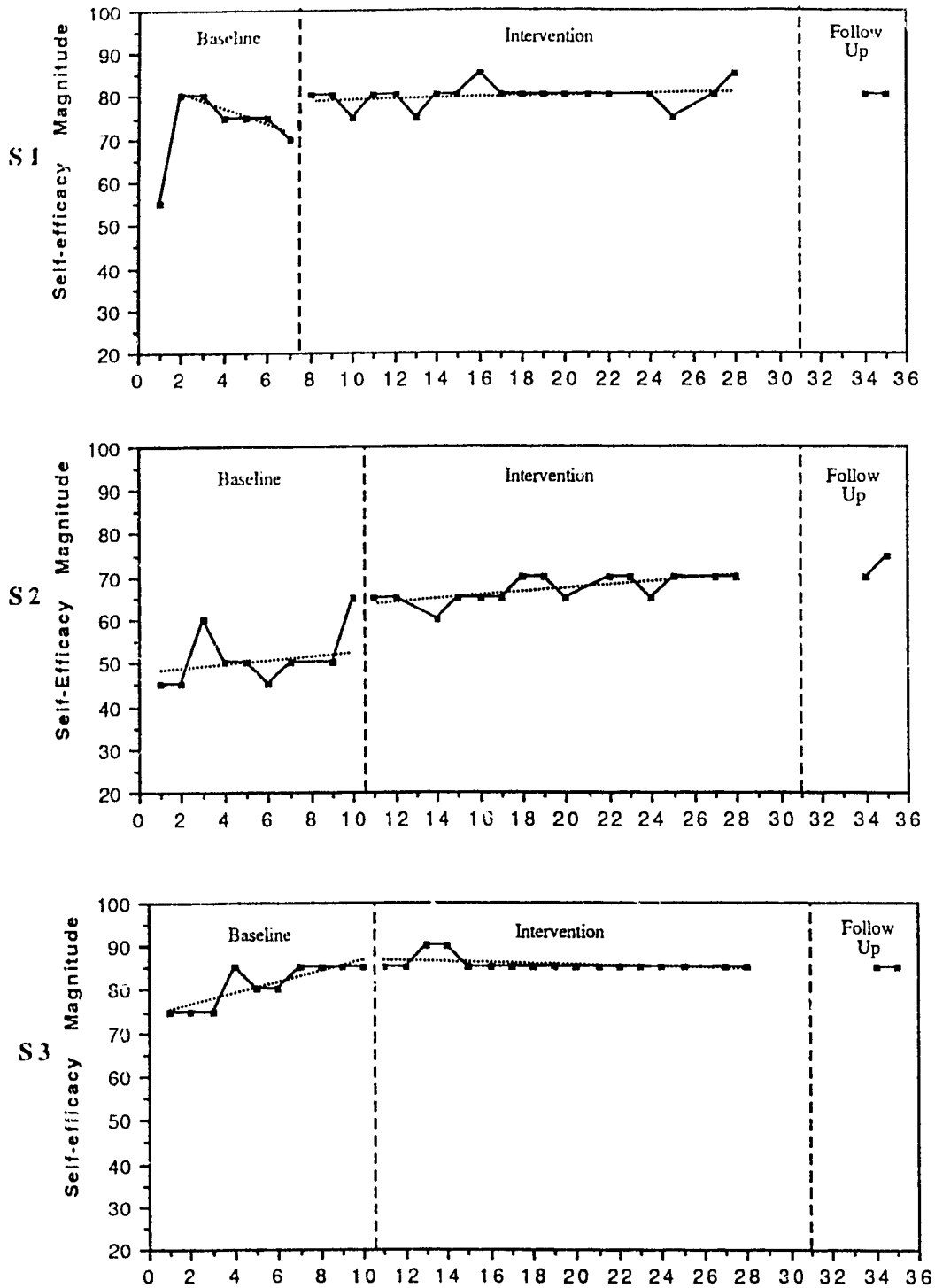


Figure 2. Self-Efficacy Magnitude scores for each subject showing trends for baseline, intervention, and follow-up phases.

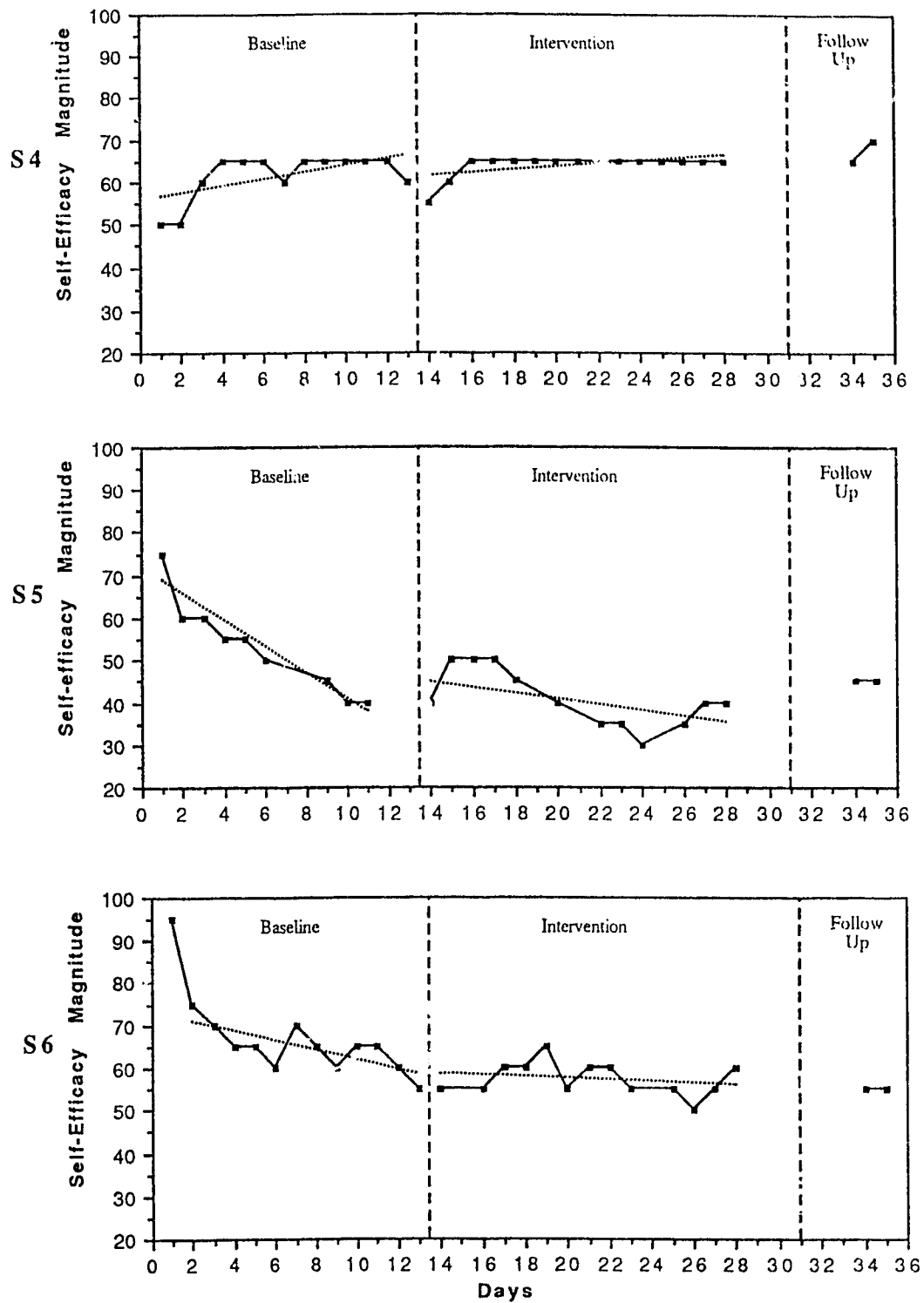


Figure 2 (continued).

points was revealed between the intervention and follow-up phases of the study (see figure 1). Visual inspection of the change in trends between phases showed that a definite change in trend was evident between the baseline and intervention phases, but not between the intervention and follow-up phases of the study (figure 2)

The 10 point change in level from Day 7 (Day 7 of baseline) to Day 8 (Day 1 of intervention) of the study did not coincide with increases in self-efficacy magnitude scores for subjects 2,3,5 and 6, who remained in baseline conditions. Subject 4 reported an increase in self-efficacy magnitude for these days while remaining in baseline conditions.

Subject 2.

A relatively stable baseline was exhibited for subject 2 in which scores for self-efficacy magnitude ranged from 45 to 60 with a mean of 50.00. The nine days of baseline revealed that all but one of the self-efficacy magnitude scores were within 10% of the mean score. Only the score for Day 3 was beyond this range. A slightly positive trend was evident for scores during this phase of the study. A 5 point change in level occurred on Day 11 when the intervention was introduced. Self-efficacy magnitude scores ranged from 60 to 70 during intervention, with a mean rating of

67.00. Scores of 70 and 75 were recorded during the follow-up phase, producing a mean score of 72.50 points.

Positive changes in level (5 points) and mean scores (17 points) were demonstrated between the baseline and intervention phases. There was no change in level between the intervention and follow-up phases, but a change in means of 5.5 points was evident. All three phases of the study showed positive trends in self-efficacy magnitude scores. The slope of the trend lines for baseline and intervention phases was almost identical, however a much steeper trend was evident for the follow-up phase.

The change in level between the end of the baseline and the beginning of the intervention phase was not accompanied by any increase in self-efficacy magnitude for subjects 4, 5, and 6, who remained in baseline conditions.

Subject 3.

With scores ranging from 75 to 85 over the 10 days of baseline, subject 3 demonstrated a mean self-efficacy magnitude rating of 81.00. All baseline scores were within 10% of the mean score. During the intervention phase all but two of the reported scores for self-efficacy magnitude were 85. For Days 13 and

14, scores of 90 were recorded, which brought the overall mean score for this phase up to 85.6. Scores of 85 were also recorded for both follow-up days ($X = 85.00$). Although an increase in mean scores of 4.6 was evidenced between the baseline and intervention phases, the last four baseline scores were stable at 85, which was the score recorded for 15 of the 17 days of the intervention, and for both follow-up days. No change in level between any of the phases was demonstrated. Examination of the trends for each phase showed that a positive trend occurred during baseline. This changed to a slight negative trend during the intervention phase, and no trend was evident for the follow-up phase.

Subject 4.

The pattern of scoring for this subject was similar to that of subject 3 in many respects. After showing an increase in self-efficacy magnitude for the first four days of baseline, scores during this phase remained relatively stable at around 65, with only two scores falling below this level (scores of 60 were reported for Days 7 and 13). The mean score for the baseline phase was 61.54.

The intervention was implemented after 13 days of baseline. A change in level of -5 points from baseline

to intervention was followed by an increase in self-efficacy magnitude for days 15 and 16 before scores stabilized at 65 points. The mean score for the intervention phase was 64.00. The follow-up phase produced scores of 65 and 70, which translated into a mean score of 67.50. Thus, mean changes were 2.46 between baseline and intervention, and 3.5 between intervention and follow-up. No change in level was evident between the intervention and follow-up phases.

Examination of the trend lines revealed that positive trends were demonstrated for all three phases of the study for subject 4. Similar trends for baseline and intervention phases were followed by a more positive trend for the follow-up phase.

Subject 5.

A large range in scores, from 75 to 40, characterised the baseline scores for subject 5. Although a mean score of 53.30 was recorded, the data were best represented by a stable negative trend (see Figures 2 and 3). At no point during the baseline phase did self-efficacy magnitude scores increase. Upon implementation of the intervention, which was not accompanied by any change in level, the self-efficacy magnitude scores increased from Day 14 to Day 15, stabilised at 50 for three days, and then showed a

steady negative trend, reaching 30 on Day 24, before increasing again to 40 on the final two days of the intervention. The overall mean score for self-efficacy magnitude for the intervention phase was 40.00, although the pattern of scoring was best represented by a negative trend. Scores during the follow-up phase were reported as 45 for both days, which meant that a change in level of 5.00 points was demonstrated.

Changes in means between baseline and intervention phases, and between intervention and follow-up phases were -13.3 and 5.00 respectively (see Figure 1). Figures 2 and 3 however, show that the pattern of results is better represented by examination of the trends. For both the baseline and intervention phases, strong negative trends were evident. There was no trend in the follow-up data.

Subject 6.

A similar pattern of results to subject 5 was revealed for subject 6. Self-efficacy magnitude scores during baseline ranged from 95 to 55 with a mean of 64.60, although scores during this phase were closer to the negatively sloping trend line. The score for Day 1 of the baseline phase was not used in calculation of the mean or the regression line indicating the trend, because this score was 20 points greater than it's

adjacent score and was therefore regarded as an outlier.

After 13 days of baseline the intervention was implemented. No change in level was evidenced between the baseline and intervention phases. Over the first five intervention sessions (Days 14-19) self-efficacy magnitude scores showed an increasing trend before declining steadily over the next six intervention sessions, and then showing a steady increase for the final three days of the intervention. Overall, a mean score of 57.30 was evidenced. Self-efficacy magnitude scores during the follow-up phase were stable at 55.

The change in mean score between the baseline and intervention phase was -7.3, and -2.3 between the intervention and follow-up phase. A negative trend during baseline was followed during intervention by a weaker negative trend, and no trend was evident during the follow-up phase.

Self-Efficacy Strength (75% level) (see Figures 3 and 4)

Subject 1.

Aside from Day 1, where a score of 55 was recorded, the self-efficacy strength scores for subject 1 remained relatively stable, ranging from 65 to 75 with a mean of 70.00. The self-efficacy strength score for Day 1 was regarded as an outlier, and not included

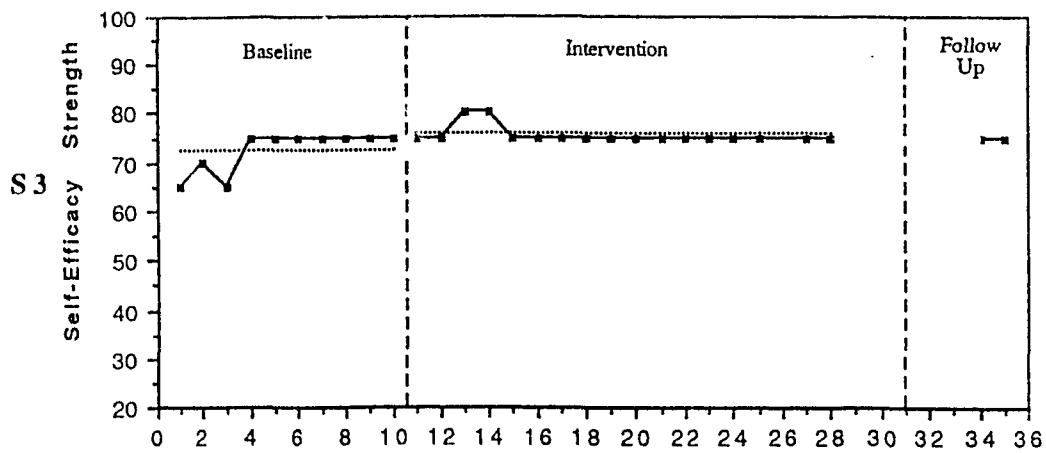
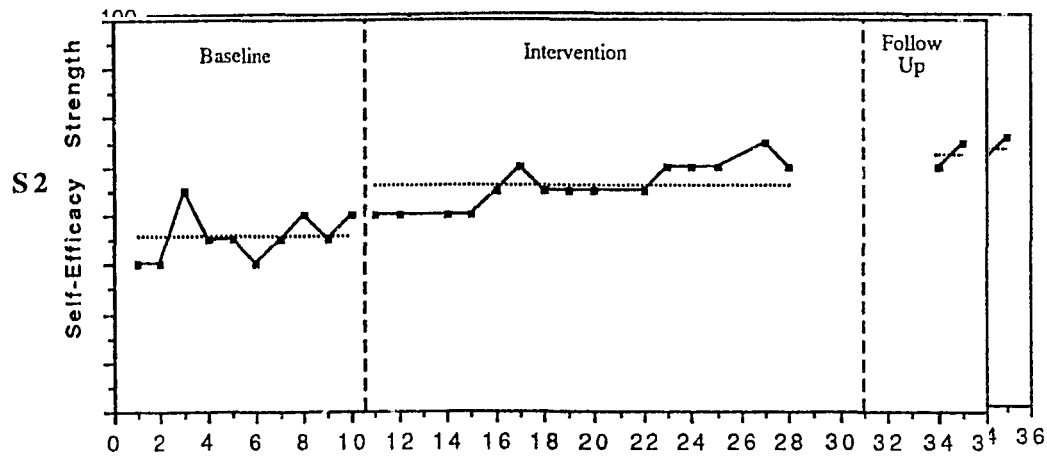
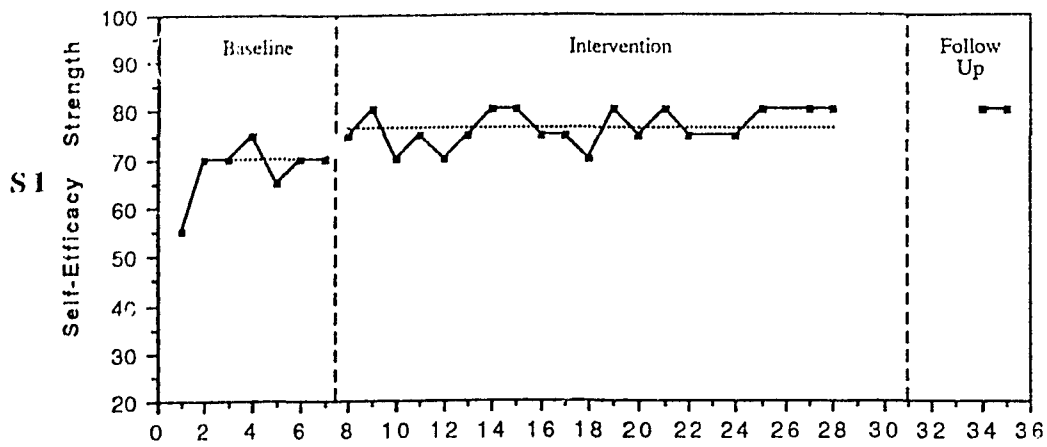


Figure 3. Self-Efficacy Strength (75% level) scores for each subject showing mean scores for base'line, intervention, and follow-up phases.

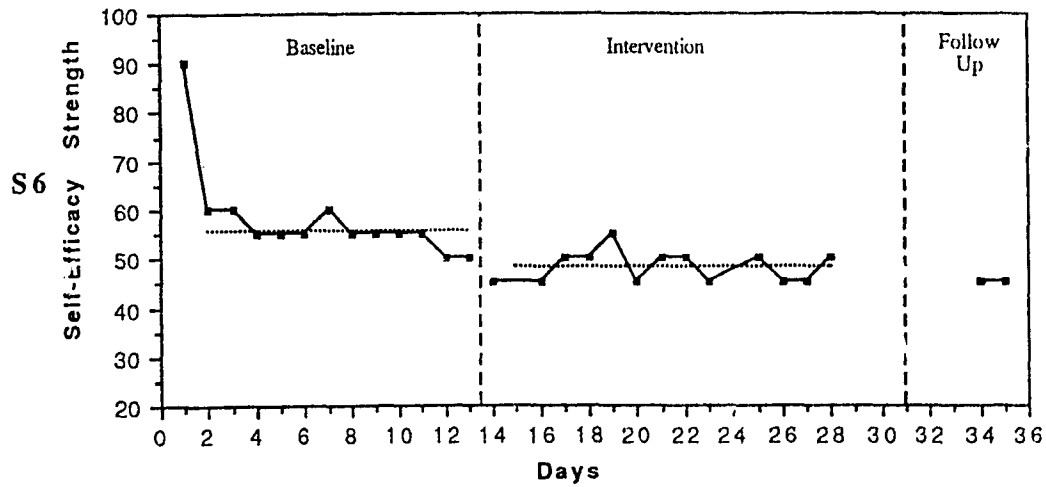
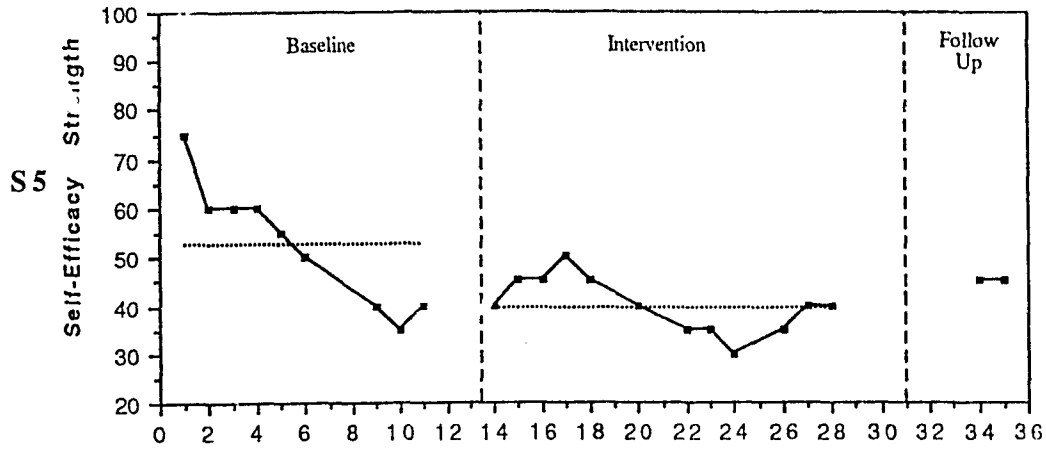
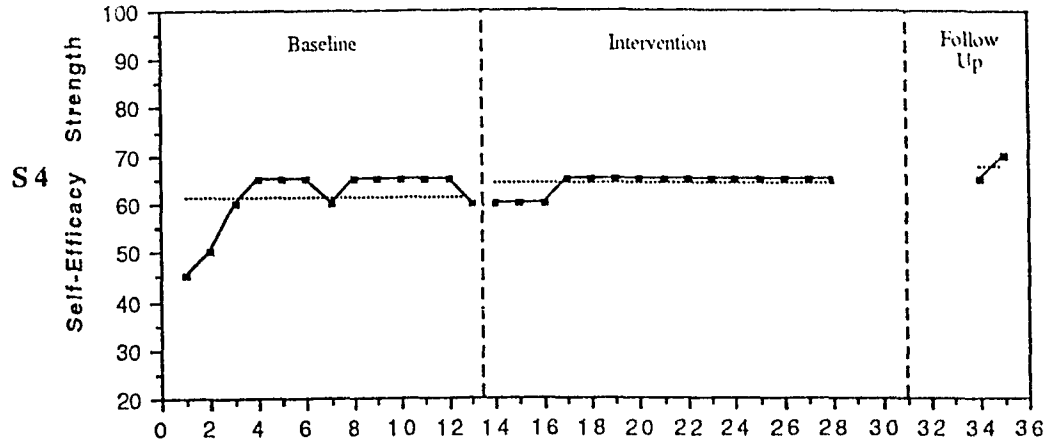


Figure 3 (continued).

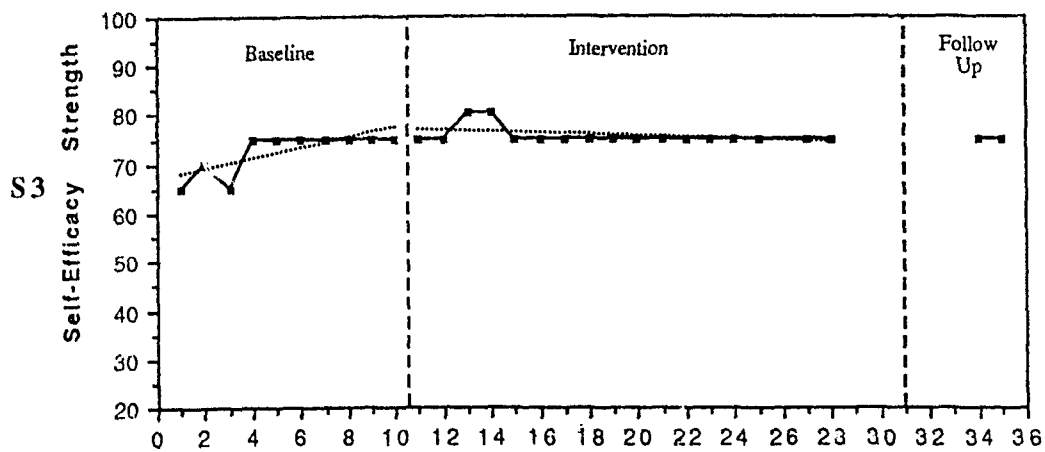
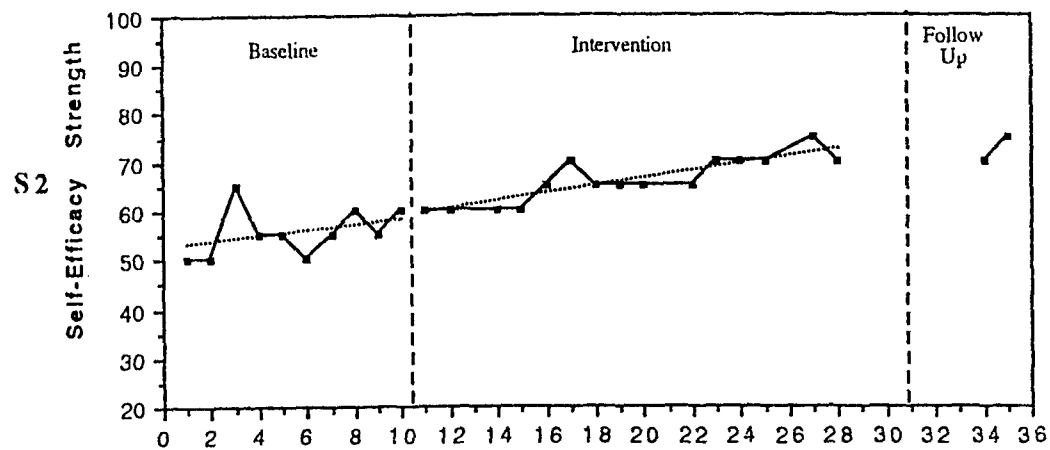
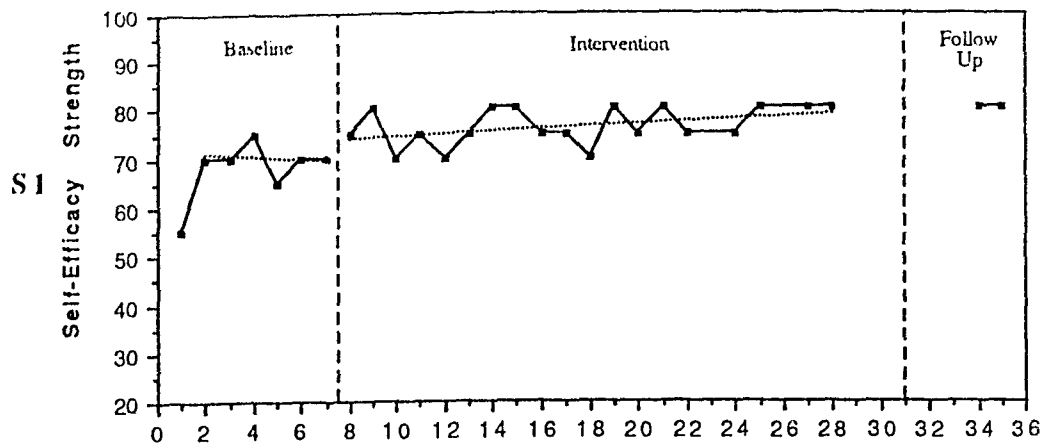


Figure 4. Self-Efficacy Strength (75% level) scores for each subject showing trends for baseline, intervention, and follow-up phases.

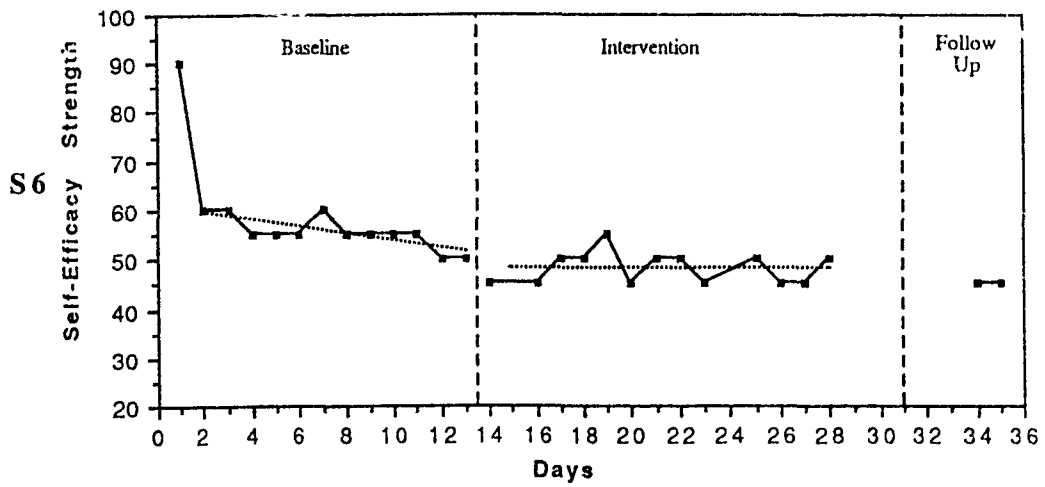
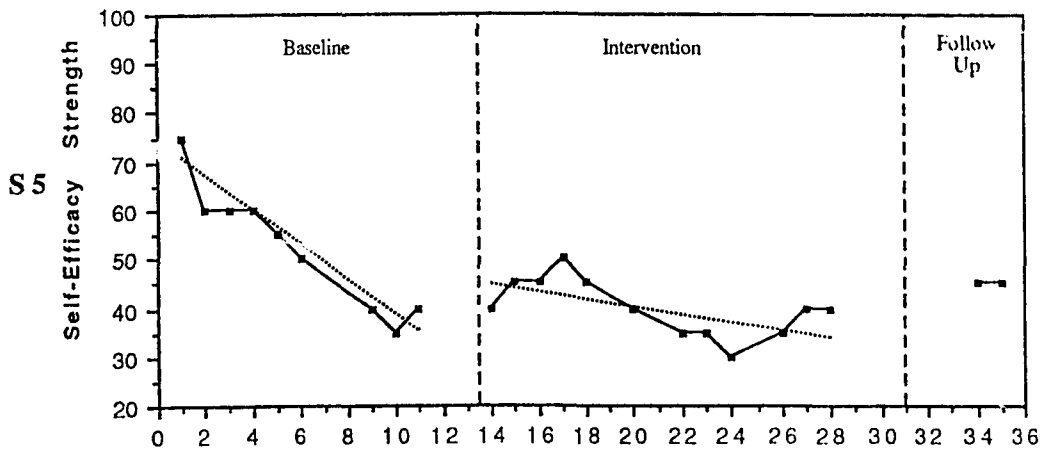
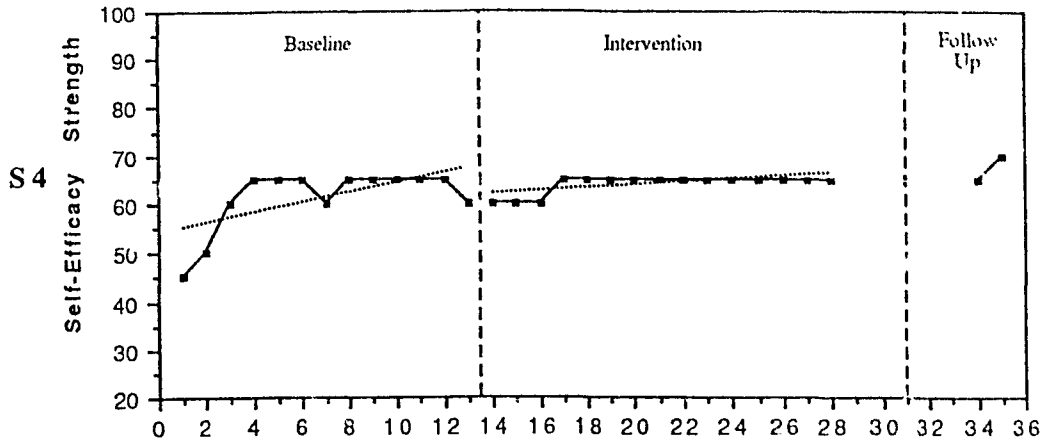


Figure 4 (continued).

in any calculations of means or trends. Upon implementation of the intervention, which was accompanied by a 5 point change in level, a mean score of 76.30 was recorded, with scores ranging from 70 to 80. This was a relatively stable effect, with all scores remaining within 10% of the mean. No change in level occurred between the intervention and follow-up phases, and both follow-up sessions recorded self-efficacy strength scores of 80. Positive changes in means were recorded between baseline and intervention phases (mean change = 6.3 points) and between intervention and follow-up phases (mean change = 3.7 points).

Visual inspection of the data trends revealed that a slight positive trend was evidenced for the intervention phase, whereas neither the baseline nor the follow-up phases showed any trend.

The increase in self-efficacy strength from Day 7 to Day 8 (the last day of baseline and the first day of the intervention) was accompanied by increases in self-efficacy strength for subjects 2 and 4, but not for subjects 3, 5 and 6. All of these subjects remained in baseline conditions during this time.

Subject 2.

Self-efficacy strength scores that ranged from 50 to 65 were evidenced during the 10 baseline sessions for subject 2, with a mean of 55.50. Except for a

score of 65 for Day 3, all baseline scores were within 10% of this mean. Figure 5 shows that an upwardly sloping, or positive trend approximated the pattern of this baseline data.

No change in level was evidenced between the baseline and intervention phases, and the data during the intervention phase continued to demonstrate an upward trend of approximately the same rate. However, four intervention sessions were completed before any increase in self-efficacy strength was evidenced. After this point, a relatively steady increase in self-efficacy strength scores was found, with the data only decreasing in level from the previous session on two occasions during the 15 intervention sessions. Self-efficacy strength scores ranged from 60 to 75 during the intervention phase, with a mean score of 66.00. All scores except those of Day 27 were within 10% of the mean, showing that very little variability was evident about the mean. There was no change in level between the intervention and follow-up phases, and the follow-up self-efficacy strength scores of 70 and 75 produced a mean of 72.50.

Overall, the change in mean from baseline to intervention was 10.5, and 6.5 from intervention to follow-up. No change in the positive trend was evident between the baseline and intervention phases of the

study, however a stronger positive trend was demonstrated in the follow-up phase.

Subject 3.

After a variable first four baseline sessions, the self-efficacy strength scores for subject 3 stabilised at 75 for the remaining six baseline sessions. The variation in scores during the initial period meant that the mean score for this phase was 72.50.

Implementation of the intervention produced no change in level, and only on Days 13 and 14 did the self-efficacy strength scores rise above 75. A score of 75 was also recorded for the two follow-up sessions.

75.63 was calculated as the mean score for the intervention phase. Examination of the data trends shows a positive trend for the baseline phase followed by a slight negative trend for the intervention phase. There was no trend during the follow-up phase.

The changes in mean scores were 3.13 for the baseline to intervention phase, and -0.63 for the intervention to follow-up phase. No changes in level were found between any of the phases.

Subject 4.

In similar fashion to subject 3's baseline data, the self-efficacy strength scores over the baseline

phase for subject 4 became relatively stable at 65 following a steady increase over the first four days from 45 to 65. On only two other occasions during baseline (Days 7 and 13) did the scores drop below 65. The mean baseline score was 61.15, with only the data for Day 1 and Day 2 lying beyond 10% of this score. Figure 5 shows that a positive trend was evidenced during this phase.

No change in level occurred between data points for the last baseline and the first intervention sessions. During the intervention phase, the self-efficacy strength scores remained stable at 65 after the three initial intervention sessions where scores of 60 were recorded. The mean score for this phase was 64.00.

There was also no change in level from the intervention to follow-up phase. The mean follow-up score was 67.50. The changes in means from baseline to intervention, and from intervention to follow-up were 2.85 and 3.5 respectively. All three phases were characterised by positive data trends.

Subject 5.

Although a mean score of 52.78 was recorded over the nine baseline sessions for subject 5, the data were

better represented by a strong negative trend, with scores steadily decreasing from 75 on Day 1 to 35 for session 8. Only a score of 40 for baseline session 9 represented any increase in self-efficacy strength over a previous session. No change in level occurred between the last baseline session and the first intervention session.

The initial four intervention sessions witnessed a relatively steady increase in self-efficacy strength, however this was followed by a steady decline in scores until session 24 of the study, after which the self-efficacy strength scores increased to 40 from a low of 30. The mean self-efficacy strength score for this phase was 39.20, although Figure 5 shows that an overall negative trend was evident throughout the intervention phase. A 5 point change in level occurred between the intervention and follow-up phases of the study. A mean score of 45.00 was recorded for the follow-up phase.

Changes in means were -13.58 between the baseline and intervention phases, and 5.8 between the intervention and follow-up phases. There was no trend in the follow-up data, but both the baseline and intervention phases showed negative trends.

Subject 6.

The 12 baseline recordings of self-efficacy strength for subject 6 produced a mean score of 55.20, with all scores occurring within 10% of this measure, indicating little variability in the data. However, Figure 5 shows that a steady negative trend could be detected during this phase. A change in level of -5 was evidenced between the baseline and intervention phase. Following the introduction of the intervention, self-efficacy strength scores climbed steadily to a high of 55 before falling back to remain fairly consistent about the mean score for this phase of 43.10. A very slight negative trend in the data was found for the intervention phase. A further level change of -5 was found between the intervention and follow-up phases, with scores of 45 recorded for both follow-up sessions.

The changes in means between phases were -7.32 and -3.1 for the baseline to intervention and intervention to follow-up phases respectively. No marked change in trend was found between the baseline and intervention phases.

Mental Imagery Questionnaire (MIQ Visual) (see Figure 5)

Subject 1.

After showing a relatively steady improvement in MIQ Visual scores over the first five intervention days, subject 1's ratings of visual imagery stabilized at a rating of 2 ("Easy to picture") for all but one of the remaining intervention days. A rating of 3 ("Somewhat easy to picture") was recorded on Day 11 of the intervention. Overall, subject 1 reported an improvement in the rating of visual imagery from Day 1 to Day 19 of 2 rating points. This represented a change in rating from 4 ("Neutral") to 2 ("Easy to picture") over the course of the intervention.

Subject 2.

The ratings of visual imagery for subject 2 fluctuated over the course of the intervention. The lowest ratings of 5 ("Somewhat hard to picture") were reported on Days 5 and 6 of the intervention, whereas ratings of 2 ("Easy to picture") were recorded on Days 13, 15 and 16. A 1 point rating difference between the first and last days of the intervention was demonstrated. Ratings of 4 ("Neutral") and 3 ("Somewhat easy to picture") were recorded for these days (see Figure 5). The pattern of scores for this

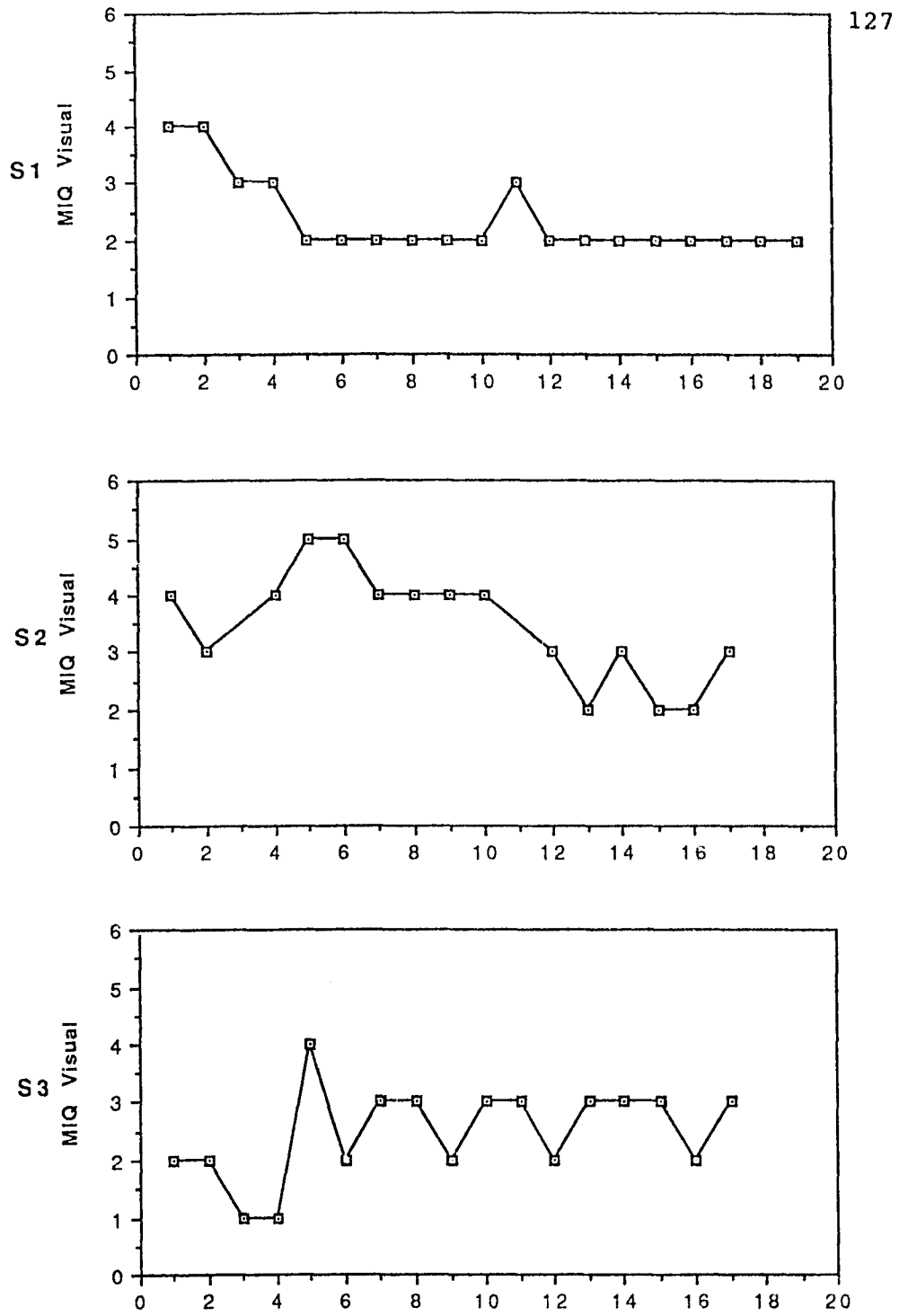


Figure 5. MIQ Visual scores for each subject during the intervention phase of the study.

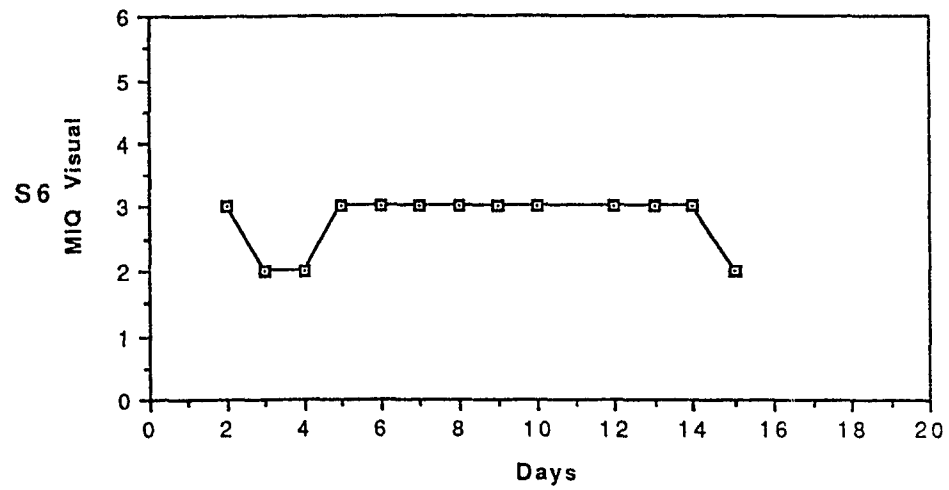
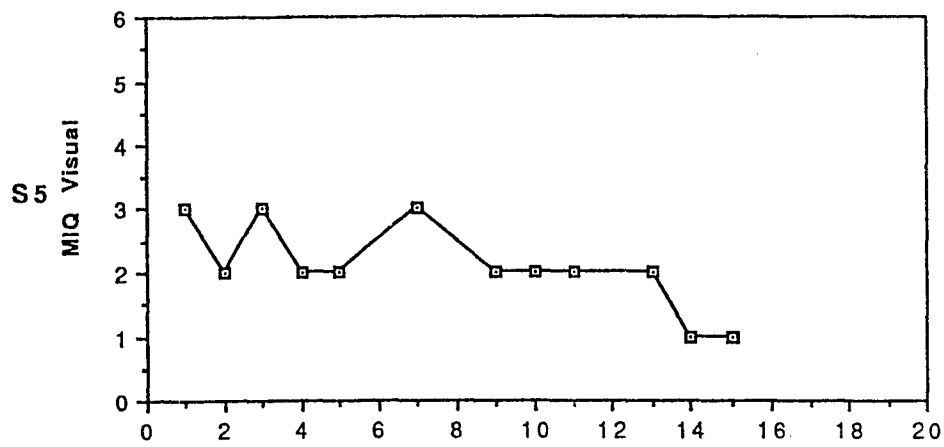
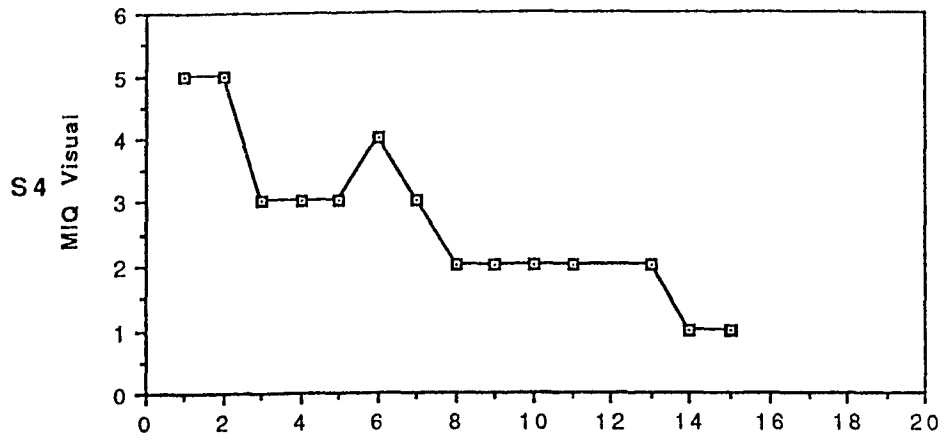


Figure 5 (continued).

measure did not reflect any correspondent changes in ratings of self-efficacy magnitude or self-efficacy strength.

Subject 3.

Visual imagery ratings for subject 3 were the only ones to show an overall decline from the first to last intervention session. Although subject 3 reported that the images were "Easy to picture" (Rating = 2) at the beginning of the intervention, a rating of 3 ("Somewhat easy to picture") was reported for the final session on Day 16. Ratings ranged from 1 ("Very easy to picture") on Days 3 and 4, to 4 ("Neutral") on Day 5. The highest ratings of visual imagery on Days 3 and 4 coincided with the highest ratings of self-efficacy magnitude and strength for this subject.

Subject 4.

An overall improvement in visual imagery of 4 rating points was recorded for subject 4. After reporting that the images were "Somewhat hard to picture" (rating = 5) on Days 1 and 2, the ratings showed a relatively steady improvement until the highest ratings of 1 ("Very easy to picture") were recorded on the final two intervention days. Apart from an improvement in visual imagery of 2 rating

points coinciding with an increase in self-efficacy magnitude from Day 2 to Day 3 of the intervention, no similarity between the pattern of results for self-efficacy magnitude, self-efficacy strength, and MIQ Kinesthetic scores was evident.

Subject 5.

Ratings of visual imagery for subject 5 ranged from "somewhat easy to picture" (rating = 3) on Days 1, 3 and 7 of the intervention, to "very easy to picture" (rating = 1) during the last two intervention days. This overall improvement in visual imagery over the course of the intervention did not correspond with any overall improvements in self-efficacy magnitude or strength for this subject. However, improvements in visual imagery from Day 1 to Day 2 corresponded to improvements in both self-efficacy measures for these days. Similarly, a decline in visual imagery between intervention sessions 5 and 6 was reflected in a decrease in self-efficacy magnitude and strength for these sessions.

Subject 6.

Despite showing a 1 point improvement in visual imagery ratings from the first to last intervention day, subject 6 reported generally stable ratings of

visual imagery. For 10 of the 13 intervention sessions in which visual imagery was measured, a rating of 3 ("Somewhat easy to picture") was reported, and on only three occasions (Sessions 2, 3 and 13) did this rating improve to 2 ("Easy to picture"). These stable ratings of visual imagery were reflected in the relatively stable measures of self-efficacy magnitude and strength during the intervention phase for this subject. All self-efficacy magnitude and self-efficacy strength scores were within 10% of the mean for this phase.

Mental Imagery Questionnaire (MIQ Kinesthetic)

(see Figure 6)

Subject 1.

A less variable range than those for MIQ Visual were obtained for the ratings of kinesthetic imagery for subject 1. An initial rating of 2 ("Easy to feel") was maintained for most of the intervention phase. The only variation from this rating was on Day 8 and for five of the final six days of the intervention, where a rating of 1 ("Very easy to feel") was reported. There was no corresponding pattern of results for measures of self-efficacy magnitude or self-efficacy strength during this phase, although both measures remained

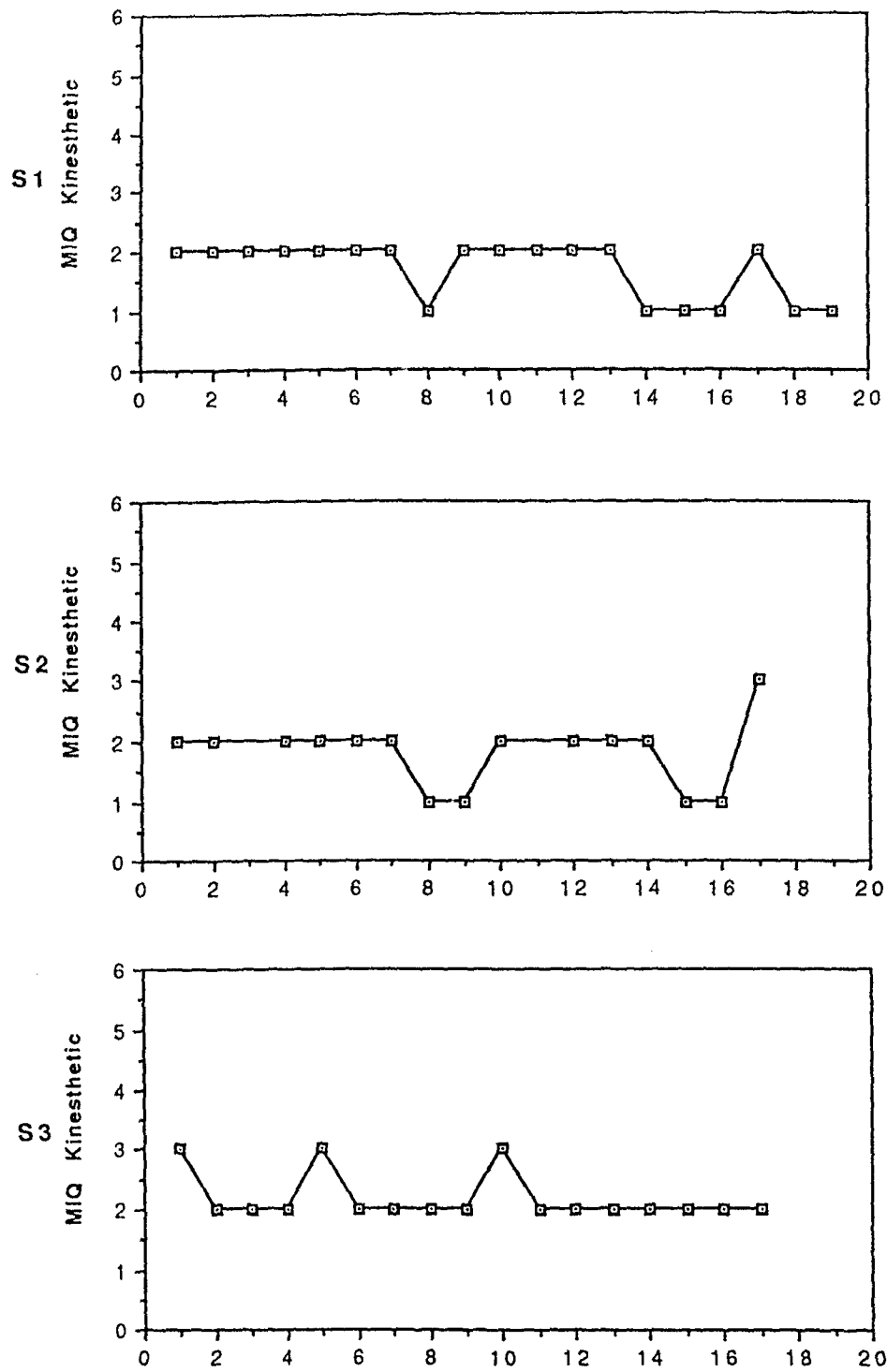
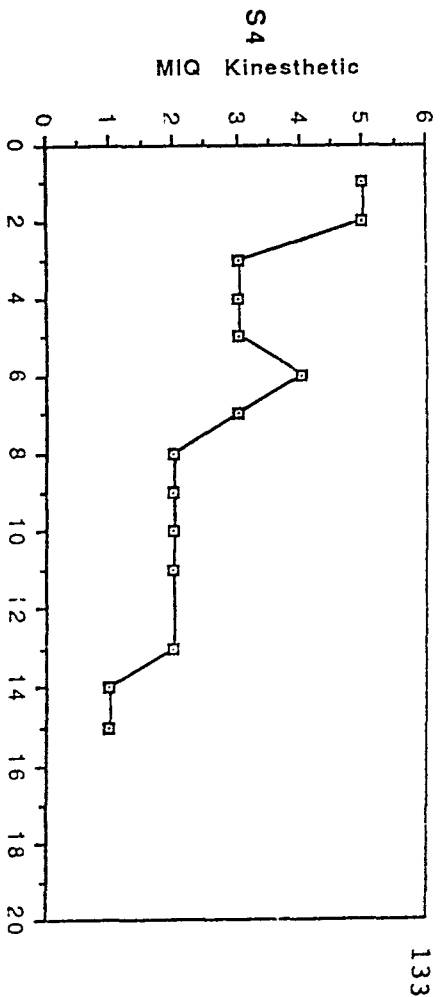


Figure 6. MIQ Kinesthetic scores for each subject during the intervention phase of the study.



133

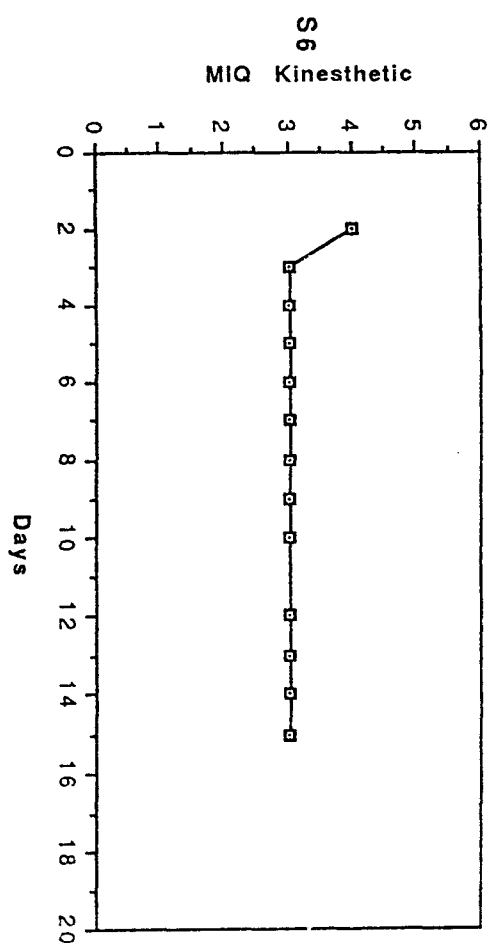
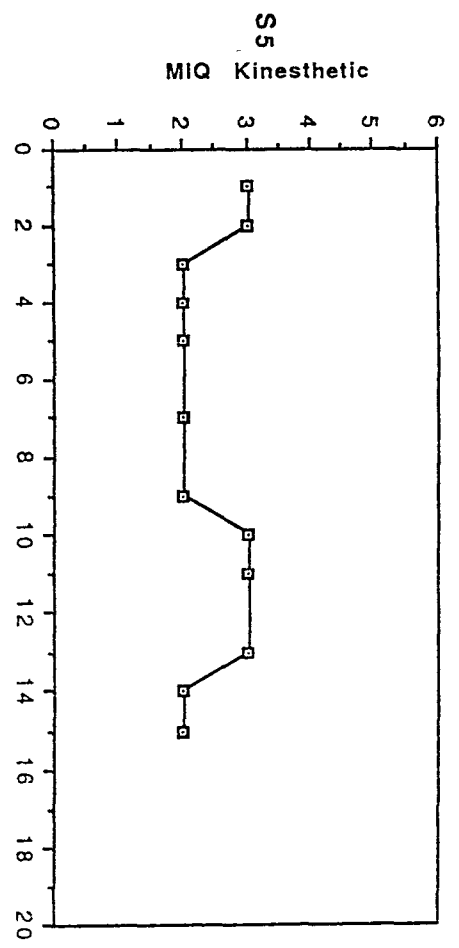


Figure 6 (continued).

relatively stable, with all measures recorded within 10% of the mean score. There was no noticeable similarity with the pattern of scoring for visual imagery.

Subject 2.

A rating of 3 ("Somewhat easy to feel") for the final intervention session meant that subject 2 recorded an overall decrease in kinesthetic imagery from the first day of the intervention. Prior to the last session, the ratings for 10 of the remaining 14 sessions were 2 ("Easy to feel"), with sessions 7, 8, 13 and 14 recording ratings of 1 ("Very easy to feel"). The sharp decrease in kinesthetic imagery for session 15 was accompanied by a corresponding decrease in self-efficacy strength for that day. No change in self-efficacy magnitude was detected for this period, and the overall pattern of results for the kinesthetic imagery ratings was not indicative of the pattern for both measures of self-efficacy, nor for the ratings of visual imagery.

Subject 3.

More stable ratings of kinesthetic imagery were revealed for subject 3 than were reported for visual imagery. Days 1, 5 and 10 of the intervention were

associated with ratings of 3 ("Somewhat easy to feel"), while for the rest of the intervention sessions, a rating of 2 ("Easy to feel") was reported. These scores were more reflective of the ratings obtained for self-efficacy magnitude and self-efficacy strength than the visual imagery ratings, although no corresponding decreases in either of the self-efficacy measures were found for Days 5 and 10 when the image was more difficult to bring to mind.

Subject 4.

The ratings of kinesthetic imagery for subject 4 were exactly the same as those for visual imagery. An overall improvement of 4 rating points from the first to last day of the intervention was evident, with scores ranging from 5 ("Somewhat hard to feel") to 1 ("Very easy to feel") being reported.

Subject 5.

Initial ratings of 3 ("Somewhat easy to feel") during the first two days of the intervention for subject 5 were followed by five ratings of 2 ("Easy to feel"). A subsequent decrease again to 3 for sessions 8 to 10 was followed by a rating of 2 for the final 2 intervention sessions. An overall improvement of 1 rating point was recorded from the first to the last

intervention session for this subject, and the overall pattern of scoring was not reflective of that reported for visual imagery, and was not representative of any pattern in the data for self-efficacy magnitude or strength.

Subject 6.

Following an initial rating of 4 ("Neutral") for the first intervention session, subject 6 recorded a rating of 3 ("Somewhat easy to feel") for all subsequent sessions. This rating was also reported for visual imagery in the majority of sessions, and corresponded to relatively stable measures of self-efficacy magnitude and strength, although the actual pattern of ratings was decidedly dissimilar.

Performance Scores (see Figures 7 and 8)

Although the actual performance scores for the dart-throwing task were not the primary focus of the study, scores were recorded for interest, and the data graphed for analysis by visual inspection. Despite the large variability in performance for all subjects which precludes any definitive conclusions being drawn from the results, some noteworthy data patterns emerged. Four positive level shifts occurred between baseline and intervention phases, whereas four negative level shifts were evident between the

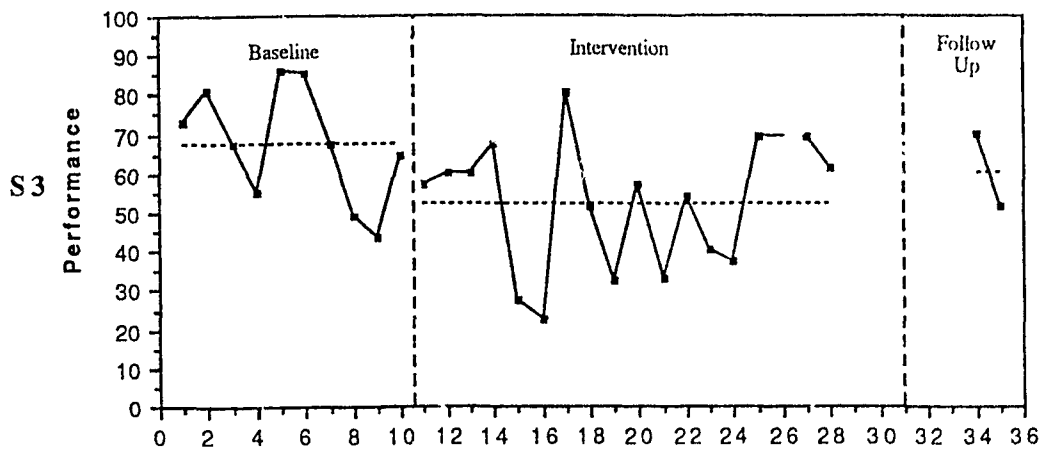
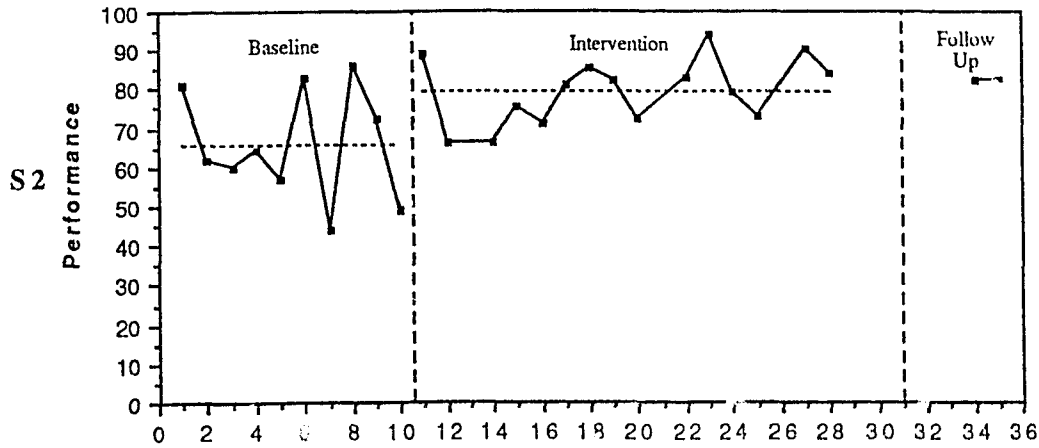
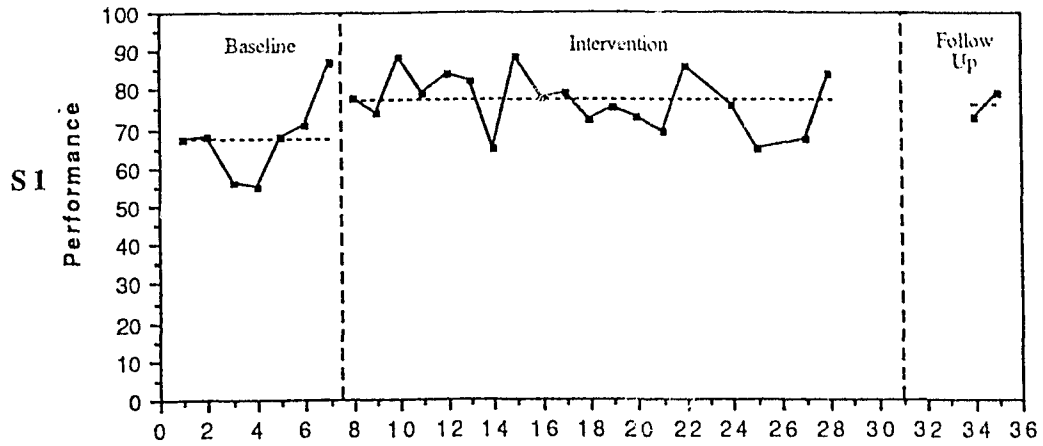


Figure 7. Performance scores for each subject showing mean scores for baseline, intervention, and follow-up phases.

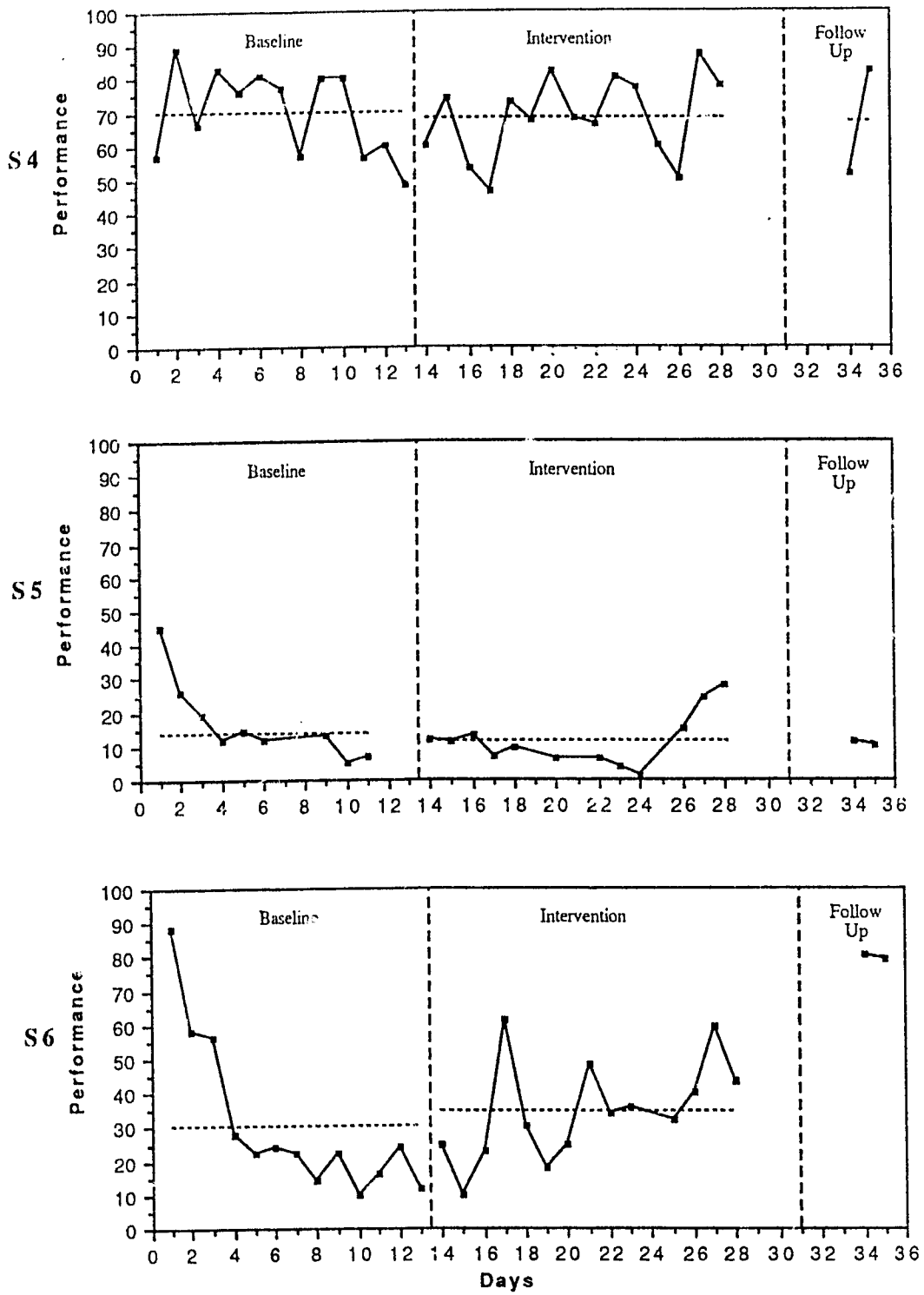


Figure 7 (continued).

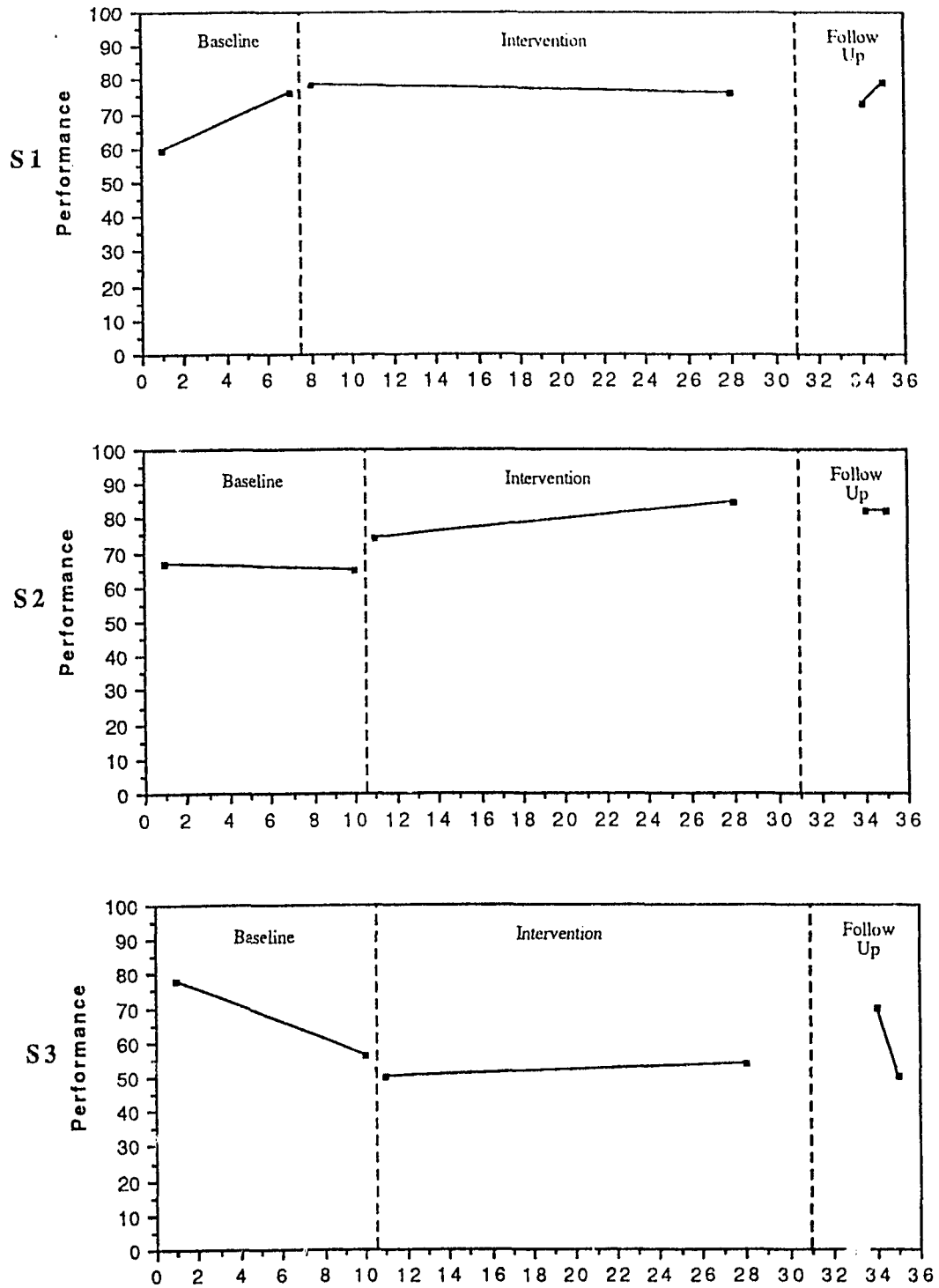


Figure 8. Performance trends for each subject for baseline, intervention, and follow-up phases.

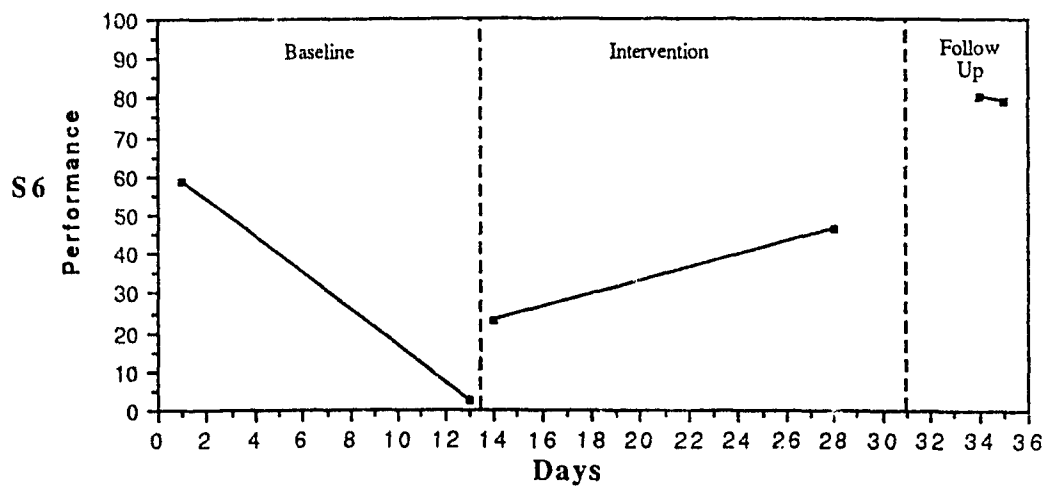
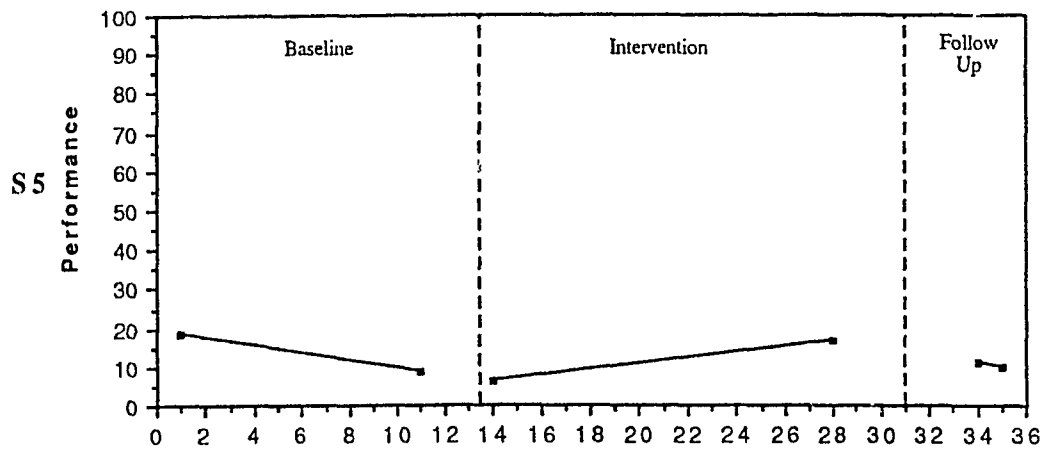
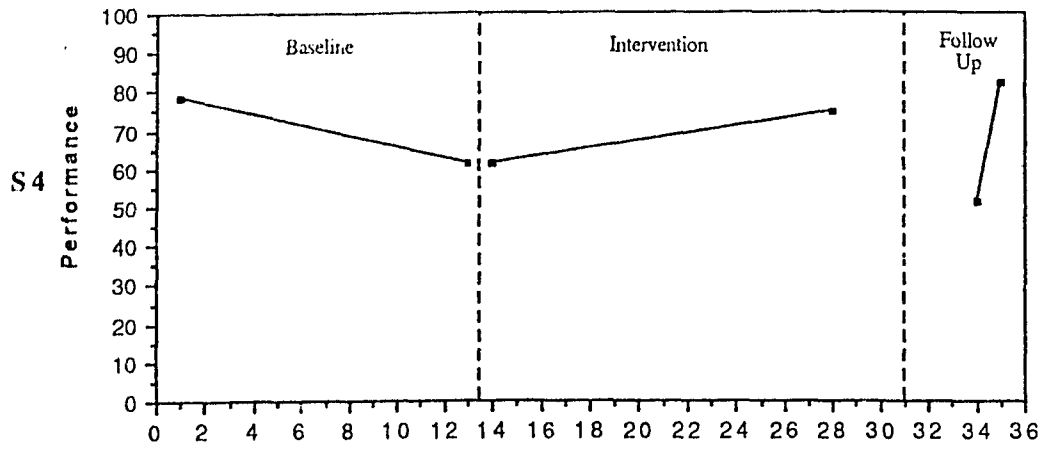


Figure 8 (continued).

intervention and follow-up phases. Three positive mean changes between baseline and intervention phases, and between intervention and follow-up phases were apparent. There were five negative to positive changes in trends from the baseline to intervention phases.

Subject 1.

During the baseline phase, scores ranged between 55 and 87 for subject 1, with a mean of 67.43. The pattern of scoring for this phase was represented by a strong positive trend. A change in level of -9 was found between Day 7 of the baseline and the first intervention session on Day 8 of the study. Throughout the course of the intervention, performance scores ranged from 65 to 89, with a mean of 77.00. Despite their continued variability, the range of performance scores for this phase (23) was considerably less than the 32 recorded for the baseline phase, and the overall pattern of the data was represented by a slight negative trend. A further negative change in level of -11 points occurred between the last intervention and the first follow-up session. The mean follow-up score was 76.00.

A change in mean of 9.57 was observed between the baseline and intervention phases, and a change of -1 between the intervention and follow-up phases of the

study. The change in trend between baseline and intervention was positive to negative, and a change from negative to positive was evident between the intervention and follow-up phases. During the positive baseline trend, all other baselines showed an overall negative trend.

Subject 2.

Large variability in performance scores during the baseline phase for subject 2 was observed, with scores ranging from 44 to 86, with a mean of 65.70. An overall negative trend was calculated, despite the large variability. A large positive level shift of 50 points was revealed between the last baseline score and the first intervention session score. During the intervention phase, the performance scores were considerably less variable, ranging from 64 to 94, with a mean over the 15 sessions of 79.30. The data for this phase of the study described an overall positive trend. A negative level shift of -2 was observed between the last intervention day and the first follow-up session. The mean performance score during follow-up was 82, with the subject scoring 82 on both days.

Between the baseline and intervention phases the change in mean scores was 13.6, and between the intervention and follow-up phases this value was 2.7.

Examination of the trend lines for subject 2 shows that the negative trend evidenced during baseline changed to a stronger positive trend over the intervention phase. This change was accompanied by a large change in level and mean score. There was no trend in the data for the follow-up phase. At the time of the observed change in trend at the onset of the intervention phase, continued negative trends in performance were observed for subjects 4, 5 and 6, who remained in baseline conditions (see Figure 8).

Subject 3.

Performance scores during baseline for subject 3 exhibited large variations, ranging from 86 on Day 5 to 43 on Day 9, with a mean of 67.00. The pattern of scoring during this phase was in the form of a strong negative trend. The introduction of the intervention on Day 11 was accompanied by a negative level change of -7, and continued variability in performance scores. However, over the course of the intervention, the variability in performance decreased around the mean score of 51.81, and a slight positive trend was determined. The change from intervention to follow-up phases of the study produced a change in level of 9 points, with a mean score of 60 observed during the follow-up phase.

Overall, there was a negative change in mean scores of -15.19 between the baseline and intervention phases, and a positive change of 8.19 between the intervention and follow-up phases. The overall change in trend from baseline to intervention was from negative to positive, and like subject 2, the onset of the positive trend corresponded to continued negative trends in the baseline data for subjects 4, 5 and 6.

Subject 4.

The characteristic pattern of scoring during the baseline phase for subject 4, despite the variability of the data, was a strong negative trend. Performance scores ranged from 89 to 48 during this phase of the study, with a mean of 69.92. Upon implementation of the intervention, a change in level of 12 points was observed. Large variability in the data was still apparent (scores ranged from 46 to 87), however a strong positive trend was calculated for the intervention phase. A mean score of 68.07 was determined. The change from the intervention to the follow-up phase produced a change in level of -27 points. The mean follow-up score was 66.5.

A change in mean scores from baseline to intervention of -1.85 was followed by a further negative change in mean scores of -1.57 points between

the intervention and follow-up phases. The overall pattern of performance trends however, showed that a strong negative trend during the baseline was replaced by an equally strong positive trend during the intervention. A very strong positive trend occurred during the follow-up phase, despite a large negative level change.

Subject 5.

Performance scores for subject 5 were considerably lower than all of the other subjects in the study. During the baseline phase, scores ranged from 45 on Day 1, to 5 on Day 10 of the study, with a mean of 13.67. These scores produced an overall negative trend for the baseline phase. The onset of the intervention witnessed a change in level of 5 points, with a mean score of 11.33 being determined for this phase. Overall, however, a strong positive trend in performance emerged for the intervention phase. A change in level of -17 was revealed between the intervention and follow-up phases, and the two follow-up scores produced a mean of 10.5.

The changes in mean scores between the three phases of the study were -2.34 and -0.83 for the baseline to intervention, and intervention to follow-up phases respectively. However, Figure 8 shows that an

overall change in trend from negative to positive was found between the baseline and intervention phases, and from positive to negative between the intervention and follow-up phases.

Subject 6.

The performance results for subject 6 produced the clearest evidence of the changes in trends that were also observed for the other subjects. A range of scores from 88 to 10 was observed during the baseline phase, with a mean of 30.46. A clear negative trend in performance was observed. A positive change in level of 13 points was shown between the last baseline and first intervention session. A mean score of 34.60 was calculated for the intervention phase, but the data showed a clear positive trend, despite its variability. A further positive change in level of 37 points was observed between the intervention and follow-up phases, and a mean score of 79.5 was found during the follow-up phase.

Positive mean changes of 4.14 and 44.9 were revealed between the baseline and intervention phases, and between the intervention and follow-up phases. A very strong negative performance trend during baseline was followed by a strong positive trend during the intervention phase. This change in trend was

accompanied by a change in both level and means between the two phases. A slight negative trend was observed for the follow-up phase, which meant that a further change in trend was evidenced between this and the intervention phase.

Section 2: Group Design Results

The means and standard deviations for each group's measure of self-efficacy magnitude (SEM) and self-efficacy strength (SES) at the 75% level are shown in Tables 1 and 2. Table 3 shows the means and standard deviations for measures of imagery ability (MIQ Visual and MIQ Kinesthetic) at Day 1 and Day 15 of the Treatment phase for the experimental group.

Separate 2 x 3 analyses of variance were performed on the two dependent variables; self-efficacy magnitude (SEM) and self-efficacy strength (SES) at the 75% level. Independent variables were Group (Control and Experimental) and Treatment Time (Pre-Test, Post-Test, and Follow-Up).

An SPSS MANOVA program was used for the analysis. Subject numbers were reduced from n=38 to n=33 for the analysis of the self-efficacy magnitude (SEM) data, and from n=38 to n=34 for the analysis of the self-efficacy strength (SES) data, following the deletion of cases with missing values for one or more treatment times.

With the use of Wilks' criterion, it was determined

Table 1: Means and standard deviations for self-efficacy magnitude (SEM) scores for each group during pre-test, post-test, and follow-up phases.

GROUP	n	Pre-Test SEM	Post-Test SEM	Follow-Up SEM
Control	16	60.00 (16.41)	65.47 (15.06)	62.50 (15.25)
Expt'l	17	61.91 (12.45)	63.09 (14.02)	61.18 (15.41)

Table 2: Means and standard deviations for self-efficacy strength (75% level) scores for each group during pre-test, post-test, and follow-up phases.

Group	n	Pre-Test SES	Post-Test SES	Follow-Up SES
Control	17	51.03 (18.09)	58.82 (16.56)	54.85 (20.79)
Expt'l	17	53.82 (17.03)	58.53 (15.51)	55.15 (19.31)

Table 3. Means and standard deviations for MIQ Visual and MIQ Kinesthetic scores at Day 1 and Day 15 of the intervention phase.

Measure	Day 1	Day 15
MIQ Visual	3.07 (1.03)	2.47 (1.27)
MIQ Kinesthetic	2.93 (0.80)	2.47 (0.92)

that the dependent variable of self-efficacy magnitude (SEM) was not significantly affected by Treatment Time, $F(2,30) = 2.93$, $p > .05$, by Group, $F(1,31) = .02$, $p > .05$, nor by the interaction of these two factors, $F(2,30) = .53$, $p > .05$. Table 4 shows the results of the ANOVA for the self-efficacy magnitude scores.

An examination of Table 1 reveals that the mean scores for self-efficacy magnitude (SEM) for both groups increased from Pre-Test to Post-Test, and decreased from the Post-Test to Follow-Up phase of the study.

A similar procedure was used on the self-efficacy strength (SES) scores at the 75% level. Wilks' criterion determined that this dependent variable was not significantly affected by Group, $F(1,32) = .03$, $p > .05$, nor by the interaction of Group by Treatment Time, $F(2,31) = .28$, $p > .05$. However, a significant main effect for Treatment Time was evidenced, $F(2,31) = 5.07$, $p < .05$. Table 5 shows the results of the ANOVA for the self-efficacy strength scores.

Table 2 shows that the mean scores for self-efficacy strength (SES) at the 75% level increased from pre-test to post-test for both groups, and decreased from the post-test to follow-up phases of the study.

Two dependent sample t-tests were conducted to test for differences between the scores for mental imagery ability (MIQ Visual and MIQ Kinesthetic) at Day 1 and Day 15 of the

Table 4: Results from the repeated measures ANOVA conducted upon self-efficacy magnitude (SEM) scores for each group at pre-test, post-test, and follow-up phases.

Effect	F	p
Group	.02	.899
Time	2.93	.069
Group x Time	.53	.593

Table 5: Results from the repeated measures ANOVA conducted upon self-efficacy strength (SES) (75% level) scores for each group at pre-test, post-test, and follow-up phases.

Effect	F	p
Group	.03	.871
Time	5.07	.012 **
Group x Time	.28	.758

** $p < .05$

treatment phase for subjects in the experimental group. Significant improvements in both measures of imagery ability; MIQ Visual, $t(14) = 2.36$, $p < .05$ (1-tailed), and MIQ Kinesthetic, $t(14) = 2.42$, $p < .05$ (1-tailed), were found. Table 3 shows the extent of these improvements.

CHAPTER V

DISCUSSION

This chapter discusses the results of the study with reference to the relevant research and literature. The discussion is presented in three sections. In section 1, the results from the single-subject design study are discussed. Results from the group design study are discussed in section 2, and in section 3 results of these two research designs are compared.

Section 1: Single-Subject Design Study.

(a) Self-Efficacy Magnitude

Overall support for the prediction that imagery training for a dart throwing task could increase an individual's self-efficacy magnitude for that task was demonstrated for two subjects, according to the criteria used to determine an intervention effect. This was determined by noting a positive change in mean score from the baseline to intervention phase of the study for subjects 1 to 4. In addition, subjects 1 and 2 showed a positive change in level between these two phases. However subjects 3, 5 and 6 demonstrated no change in level, and subject 4 showed a negative change in level. For subjects 1 and 2, the positive level shift occurred at the onset of the intervention, and was not accompanied by any matching level shifts from the other subjects, thus satisfying the criteria

for determining an intervention effect for a multiple-baseline-across-subjects design, as reported by Kazdin (1982), and Kazdin and Kopel (1975). Figure 1 (page 93) shows the changes in means and levels for each subject, and clearly demonstrates this effect for subjects 1 and 2.

An examination of the changes in trends between phases (figure 2, page 94) shows a clear intervention effect for subject 1. The overall baseline trend for this subject was clearly negative when the score for day 1 (an outlier) was ignored. However the onset of the intervention produced a slight positive trend, with an accompanying positive level shift of 10 points. Figure 2 shows that the baseline trends for all other subjects continued without any accompanying positive shifts from day 7 to 8, when the intervention was introduced for subject 1. The combination of positive changes in mean, level, and trend at the onset of the intervention for this subject, without any accompanying changes in these measures for the other subjects, is indicative of a clear intervention effect for this subject.

The elevated self-efficacy magnitude for subject 1 was maintained during the follow-up phase, with the mean score for this measure remaining at around 80 points. This suggested that the effect of imagery on self-efficacy magnitude for this subject was lasting. Indeed, the follow-up measures of self-efficacy magnitude for all subjects was within 5 points of the mean intervention phase scores,

except for subject 2 where this difference was 5.5 points.

The positive change in means from baseline to intervention, and from intervention to follow-up phases for subject 2, suggested an effect of the intervention on this subject's self-efficacy magnitude. The positive mean and level shifts between the baseline and intervention phases for this subject were not accompanied by any similar shifts for any of the other subjects who were still in baseline conditions, thus strengthening the case for an effect of the intervention. The fact that there was only one overlapping data point between these phases further strengthens this conclusion. Figure 2 (page 94) shows that the trends for the first two phases of the study demonstrated almost identical slopes, although an approximate 10 point difference in level was also shown, enhancing the evidence of an intervention effect. Clearly, imagery training for the dart-throwing task was able to markedly improve subject 2's self-efficacy magnitude. This self-efficacy was further improved during the follow-up phase, suggesting that once established, self-efficacy magnitude for a skill is maintained for at least six days following the completion of that task.

The positive effects of imagery training on self-efficacy magnitude were not evidenced for subjects 3 to 6. Despite a positive mean change from baseline to intervention phase for subjects 3 and 4, there was no accompanying

positive change in level, and no clearly positive change in trend in the expected direction. The change in trend for subject 3 was probably indicative of a ceiling effect on self-efficacy magnitude for this subject. A score of 85 out of 100 while blindfolded was near maximum, and to have demonstrated a clearly positive intervention effect, subject 3 would have had to have consistently scored 90 or more.

The negative changes in mean scores between baseline and intervention phases for subjects 5 and 6 suggested that the imagery program acted to decrease these subjects' self-efficacy magnitude for the dart throwing task. However, it was noted that these subjects consistently missed the target altogether when physically performing the task. The sound of the darts hitting the target was clearly distinct from that of the wall behind the target, and subjects 5 and 6 were able to distinguish between them. In this manner, these two subjects received auditory feedback indicating poor performance of the task. Both subjects reported in the post-study questionnaire (Appendix I) that the sound of the darts hitting the wall affected their responses on the self-efficacy rating form. As Bandura (1977, 1986) noted, performance accomplishments are the most powerful source of efficacy information, and the negative feedback from this source appears to have overridden any positive effects that the imagery training program may have had on the self-efficacy magnitude ratings for these subjects.

Although only two subjects could be said to have demonstrated a clearly positive intervention effect, the variability in self-efficacy magnitude scores for all subjects decreased from the baseline to the intervention phase. This would suggest that imagery training may have resulted in more consistent ratings of self-efficacy magnitude for the dart throwing task. As Kazdin (1982) noted, a diminished range of scoring during an intervention, when compared to baseline conditions, can indicate an effect of the intervention.

In summary then, the reported results for self-efficacy magnitude indicated that imagery training was able to enhance this aspect of self-efficacy for subjects 1 and 2, no effect was evidenced for subjects 3 and 4, and the interference of negative auditory feedback for subjects 5 and 6 meant that the effect of the intervention was masked by the overriding effect provided by the feedback. The positive changes in means, levels, and trends between phases for subjects 1 and 2 at the onset of the intervention without any accompanying changes in these measures for subjects still in baseline conditions, meant that the effect of the intervention was clearly demonstrated. The additional decrease in variability for reported self-efficacy magnitude adds weight to this conclusion.

The reasons for the failure of the intervention program to elevate self-efficacy magnitude for all but subjects 1

and 2 are not immediately clear. The decrease in self-efficacy magnitude for subjects 5 and 6 can be accounted for by the strong negative effect of the auditory feedback of the darts hitting the wall rather than the target, but the same cannot be said of subjects 3 and 4. Given the fact that the imagery program was standardized for all subjects, an examination of the particular subject characteristics was warranted.

The characteristic that differentiated subject 1 from all other subjects was performance on the goal-setting task of equating imagery time with actual performance time. The mean difference between this subject's imagery time and actual performance time was 3.14 seconds, indicating a high degree of congruence between these two times. The differences ranged from 9.59 seconds to 0.06 seconds for this subject. In contrast, the average difference for all other subjects ranged from 6.63 seconds (subject 4) to 14.31 seconds (subject 5). This measure however, could not differentiate subject 2 from those subjects who did not demonstrate an improvement in self-efficacy magnitude over the course of the intervention. A mean difference of 10.83 seconds was evidenced for this subject, with differences ranging from 2.38 seconds to 27.89 seconds; the largest range of all the subjects.

Subject 2 however, was the only subject with an imagery ability rating of 27 for the "watching self" subscale of the

VMIQ (Isaac et al., 1986), a score which classified her as a "high" ability imager (A. Isaac, personal communication, June 19, 1992). All other subjects were classified as moderate ability imagers prior to the beginning of the study, as measured by the VMIQ.

It may also have been possible that subjects 1 and 2 were more experienced dart players than the other subjects, which could have been a factor in accounting for the finding that imagery improved their self-efficacy magnitude. Indeed, studies by Denis (1985), Hall and Erffmeyer (1983), Mumford and Hall (1985), Smith (1987), and Suinn (1985) reported that increased task experience was related to performance improvements following imagery training. Therefore if imagery mediates performance improvements through self-efficacy enhancement, this factor may account for this finding. All subjects had played darts recreationally prior to the commencement of the study, but because this was not their primary sporting focus, a more comprehensive measure of their dart throwing experience was not possible.

The fact that subject 1 was best able to equate imagery time with actual performance time for the task would seem to indicate that this subject possessed superior imagery ability, despite relatively poor imagery ability when compared to other subjects in terms of VMIQ scores obtained prior to the start of the study. An examination of figures

5 and 6 shows that the visual and kinesthetic imagery for this subject improved over the course of the intervention, suggesting that imagery ability had also improved. Coupled with the markedly superior reported imagery ability of subject 2, as indicated by the VMIQ score for this subject, the results from this aspect of the study would suggest that a superior imagery ability is related to improvements in self-efficacy magnitude as a result of mental imagery training. This is consistent with the findings of Clark (1960), Housner (1984), Housner and Hoffman (1981), Isaac (1990), and Ryan and Simons (1982), who attested to the superiority of high ability imagers over low ability imagers in their ability to perform motor skills. However, it should also be remembered that this higher imagery ability occurred in conjunction with several other subject characteristics, notably experience with relaxation and imagery rehearsal, task experience, a certain level of athletic ability, and a strong belief in the potential for imagery to enhance motor skill performance. The distinguishing characteristic however, was imagery ability as measured by VMIQ scores and accuracy in equating imagery time and actual performance time. Unfortunately, clearer measures of prior task experience were not ascertained, and so this conclusion remains speculative until further research can control for this variable.

(b) Self-Efficacy Strength (75% level).

A similar pattern of results to that of self-efficacy magnitude was evidenced for self-efficacy strength (75% level), although this effect was not as strong. Changes in mean levels of self-efficacy strength between baseline and intervention phases were demonstrated for subjects 1, 2, 3 and 4, with decreases shown for subjects 5 and 6. However, only subject 1 demonstrated a positive change in level between these two phases, although this change was accompanied by increases in self-efficacy strength for subjects 2 and 4, who were still in baseline conditions, which makes it more difficult to conclude that the intervention was the sole cause of this improvement. However, a clear change in trend direction from that of the baseline was demonstrated for subject 1, a finding which is indicative of an intervention effect (Kazdin, 1982).

Despite a 10.5 point increase in the mean level of self-efficacy strength (75% level) for subject 2 between the baseline and intervention phases, no positive level shift was demonstrated, and an examination of the trends for this measure shows no clear intervention effect. According to Kazdin (1982), if the trend is in the same direction as the predicted intervention effect, such an effect must be very strong in order to conclude that the treatment has surpassed the projected baseline level. This was not evidenced for subject 2, and coupled with the fact that four intervention

sessions were completed before any increase in self-efficacy strength was shown, it is difficult to conclude that imagery training improved self-efficacy strength for the dart throwing task.

Of the remaining subjects, similar conclusions could be drawn from the results of the self-efficacy strength and self-efficacy magnitude scores. The decreases in self-efficacy strength from baseline to intervention phases for subjects 5 and 6 could be accounted for by the effect of auditory feedback i: indicating poor performance when the subjects heard the darts hitting the wall instead of the target. This performance-based source of efficacy information could have overridden any positive effect that the imagery training might have had on these subjects' reports of self-efficacy strength. The results from subjects 3 and 4 indicated that imagery training had no effect on these subject's perceptions of self-efficacy strength, and only subject 1 could be said to have demonstrated a positive intervention effect. It remains then, to identify the reason(s) why only this subject showed such an effect. As mentioned previously, the only clearly distinguishable difference between this subject and the other five subjects was the accuracy with which subject 1 could equate imagery rehearsal time with actual performance time for the task, a characteristic which would seem to indicate an aspect of superior imagery ability when compared

to the other subjects. The possibility also remains that this subject possessed superior dart throwing experience. This factor however, was not accurately determined, although it would seem likely that increased task experience would correlate well with task performance, and a record of each subject's performance scores without the blindfold was kept. The average score for 10 darts without the blindfold for subject 1 was 91, which ranked third in terms of task performance during this part of the study, behind subject 2 and subject 6 who each recorded scores of 94. Thus, given the premise that task performance would provide an indication of task experience, subject 1 could not be said to have shown any clear superiority over the other subjects. Therefore, in terms of recorded subject characteristics, only the measure of accuracy between imagery and actual performance times clearly differentiated subject 1 from the other subjects. If this could be regarded as an indication of imagery ability, then the combined subject characteristics of high imagery ability (as determined by this measure), previous task experience, relaxation and imagery experience, a high level of athletic ability, and a strong belief in the potential for imagery to enhance task performance, might have resulted in imagery training improving self-efficacy strength for the dart throwing task.

For all subjects, the follow-up scores for self-efficacy strength were relatively consistent with the final

measures of self-efficacy strength for the intervention phase, suggesting that self-efficacy strength for a dart throwing task is maintained over time. For 4 subjects, the mean follow-up measure of self-efficacy strength was higher than the mean level attained during the course of the intervention. Only subjects 3 and 6 showed a decrease in mean self-efficacy strength from the intervention to follow-up phase, and this decrease was negligible.

(c) Ratings of Visual Imagery (MIQ Visual)

All subjects except subject 3 reported an improvement in their ability to visually image the dart throwing task from the first to the final intervention session. This finding indicates that the imagery training program was successful in improving visual imagery ability for subjects 1, 2, 4, 5 and 6 for the task. Subject 3 however, reported a decrement in visual imagery ability from the first to last imagery session. The finding that imagery training did not improve this subject's ratings of self-efficacy magnitude or self-efficacy strength, is consistent with this result.

However, the most marked improvement in visual imagery ability was shown by subject 4, whose visual images were rated as "somewhat hard to picture" for the first two intervention sessions, and "very easy to picture" for the final two intervention sessions. Despite this improvement in visual imagery ability, which was matched exactly by the

ratings of kinesthetic imagery ability, no improvement in self-efficacy ratings was evident for this subject. Increased imagery ability then, had no effect on ratings of self-efficacy for the task for subject 4.

Subject 4 provided a possible reason for this finding by indicating in the post-study questionnaire that the lack of feedback or knowledge of results was her sole concern when reporting self-efficacy magnitude and strength. The consistent lack of knowledge of results was reflected in consistent self-efficacy ratings. It would seem that for this subject, performance accomplishments were the only source of positive efficacy information. Subject 4 was unwilling to consider that an enhanced ability to image the task might improve her self-efficacy for the task, despite indicating a strong belief in the power of imagery to enhance actual performance. Bandura's (1977) statement then, that psychological variables, whatever their form, can alter the strength and level of individual's self-efficacy, is not supported for subject 4. The psychological variable of improved imagery ability was unable to alter self-efficacy magnitude and strength for the dart throwing task, thus contradicting Bandura's (1977) contention.

(d) Ratings of Kinesthetic Imagery (MIQ Kinesthetic).

Apart from subject 2, who demonstrated a decrement in kinesthetic imagery ability, all other subjects reported

that their ability to kinesthetically image the task improved over the course of the intervention. In conjunction with the reported improvements in visual imagery ability, this result indicates that overall, the imagery training program was successful in improving subjects' imagery ability. At the end of the intervention phase of the study, all subjects reported that their images were at least "somewhat easy to feel". Subjects 3 and 5 reported that their images were "easy to feel", and the images for subjects 1 and 4 were "very easy to feel" by the final intervention session.

(e) Overall Imagery Ability (MIQ Visual and MIQ Kinesthetic)

Apart from subject 4, whose imagery ability was reported to have no influence on self-efficacy ratings, and subjects 5 and 6, whose efficacy information was most powerfully influenced by the feedback received from the sound of the darts consistently missing the target, an examination of the overall imagery ability of the remaining three subjects lends weight to the suggestion that imagery ability may mediate self-efficacy ratings. When the combined ratings of imagery ability are examined, subject 1 is clearly superior to subjects 2 and 3 using this measure. Throughout most of the intervention phase, subject 1 reported that his images were "easy to picture", and on five of the last six intervention sessions, images were "very

easy to feel". In contrast, the ratings of visual imagery for subjects 2 and 3 varied between "somewhat easy to picture" and "easy to picture" for the final six intervention days for both subjects. For kinesthetic imagery, an examination of figure 6 (page 112) shows that a rating of "easy to feel" was most often reported for subjects 2 and 3 over the final seven intervention sessions. Using the modified MIQ ratings as indicators of imagery ability then, subject 1 clearly demonstrated a higher ability to image the task. Combined with the finding that this subject showed an improvement in self-efficacy magnitude and strength during the intervention phase, and was better able to equate the times for imagery and actual performance of the dart throwing task, further evidence is demonstrated that a high ability to image a task might improve an individual's self-efficacy for performance of that task.

This result might also highlight the need for using task-specific measures of imagery ability when investigating the effect of imagery on self-efficacy for a motor skill. The VMIQ score for this subject, in comparison to the modified MIQ measures and the measure of the degree of congruence between imagery and actual task performance time, provided no indication that this subject possessed higher imagery ability for this specific task. It is suggested that a combination of task-specific and general measures of

imagery ability should be employed to more accurately assess imagery ability, when investigating its effect on specific task performance.

(d) Performance Scores.

Although not an original target for analysis, the performance scores for all subjects were recorded and graphed. The large variability in scoring during all phases of the study for all subjects precludes any definitive conclusions being drawn regarding the effect of imagery on dart throwing performance, although some interesting trends are suggested.

Figure 7 (page 115) shows that improvements in mean dart-throwing performance were evidenced between the baseline and intervention phases for subjects 1, 2, and 6, and mean decrements in performance demonstrated for subjects 3, 4, and 5. The decrements for subjects 4 and 5 however, were negligible. The average performance scores during the intervention phase were maintained following a six day period of no practice for all subjects except subject 6, who demonstrated a marked improvement from the intervention to follow-up phase. However, given the high variability in performance within phases, and the large degree of overlap in performance scores between baseline and intervention phases, no definite conclusions can be drawn regarding imagery's effect on dart throwing performance.

When the trends for each phase are examined (see Figure 8, page 116), a definite pattern of change emerges, despite the high degree of variability within, and overlap between, phases. The trends for subjects 2-6 indicate a steady decline in performance during baseline, followed by a definite overall increase in performance during the intervention phase. According to Kazdin (1982), an intervention effect can be determined if the performance scores during the intervention phase show a clear deviation from the projected pattern of scoring from the baseline phase. The performance trends during the intervention phase for all subjects differed markedly from the projected baseline trends. For subjects 2-6, this change in performance trend from the baseline to intervention phase would be consistent with the prediction of a positive effect on performance as a result of imagery training for the task. Ironically, subject 1, who was the only subject to show a positive effect of imagery on self-efficacy magnitude and strength, demonstrated trends in the opposite direction to all the other subjects, suggesting a decrement in performance of the dart throwing task as a result of imagery training.

If these trends had not been characterised by large variability, or overlapping data between phases, then it could be concluded that imagery training was able to enhance the performance of a blindfolded dart throwing task. This

finding is consistent with existing research (Feltz & Landers, 1983; Feltz et al., 1988) regarding imagery's effect on sport performance. However, the results are inconsistent with the proposals by Bandura (1986), Howe et al. (1990), and McKenzie and Howe (1991) that imagery's effect on motor skill performance may be mediated by its influence on perceived self-efficacy. The positive influence of imagery on actual task performance suggested by these results was not matched by a corresponding increase in self-efficacy perceptions for the task. Indeed, no substantial changes in self-efficacy were evident for subjects 3 and 4, and subjects 5 and 6 demonstrated a marked decrease in self-efficacy perceptions over the course of the intervention. The conclusion from this finding would be that imagery's effect on motor skill performance is independent of its effect on self-efficacy for subjects 3, 4, 5 and 6. However, such conclusions are merely speculative given the variable nature of the performance results.

Section 2: Group Design Results.

The results from the repeated measures ANOVAs conducted upon the self-efficacy magnitude and self-efficacy strength scores, indicated no significant differences between the control and experimental groups for either of these measures at any stage of the study. Therefore it is concluded that

imagery training did not significantly improve subjects ratings of self-efficacy magnitude and strength for a dart throwing task. Hypotheses 1 and 2, therefore, cannot be rejected. An examination of Table 2 (page 124) shows that the significant effect of "Treatment Time" for self-efficacy strength indicated that this measure improved significantly from pre- to post-test for both groups. However, there was no significant difference between the control and experimental groups, and so this improvement cannot be attributed to the effect of the intervention. This result does not demonstrate Bandura's (1977) contention that psychological variables, whatever their form, can alter the strength and level of self-efficacy.

The reasons for the overall improvements in self-efficacy strength for both groups are unclear. If the improvements were due to the subjects increased experience at performing the task, then improvements from the post-test to follow-up phase would also be expected. However, Table 2 shows that both groups demonstrated an overall decrease in self-efficacy strength from post-test to follow-up. These changes therefore, must be attributed to events that occurred at the time of the experiment that were not part of the outlined procedures, but were able to significantly influence the subjects' self-efficacy strength (75% level).

The significant improvements in the experimental group's visual and kinesthetic imagery ability from day 1 to

day 15 of the intervention suggested that the imagery training program was successfully implemented. However, an examination of Table 3 shows that these improvements were, on average, of a magnitude of less than one point value on the 7-point Likert scale. In real terms, this improvement was negligible, and the imagery program could not be considered as successful as the statistical analysis would suggest. Ideally, after 15 days of imagery training, a larger improvement in imagery ability would have been expected.

Section 3: Comparison Between the Single-Subject and Group Design Studies.

Both studies represented different methods for answering the same research question, namely, was imagery training able to enhance self-efficacy for a motor skill? In doing so, an attempt was made to utilize methods that were considered representative of the two research perspectives, which meant that some of the experimental procedures differed between the studies. These were mainly due to practical reasons which were considered realistic within the realm of applied research using human subjects. These differences were as follows;

- (a) Subjects who participated in the group design study did not complete the Vividness of Movement Imagery Questionnaire (VMIQ) (Isaac et al., 1986) prior to

their recruitment for the study. It was logistically impossible to obtain the required number of subjects for the group design had any attempt been made to match subjects according to their imagery ability as measured by this questionnaire.

(b) For similar reasons (the unavailability of sufficient numbers of subjects), not all of the recruited subjects ($n = 9$) for the group design reported that they had any experience at relaxation techniques.

(c) The respective design methodologies meant that subjects in the group design study were asked to perform the task, to rate the magnitude and strength of their self-efficacy for the task, and to report the ease with which they were able to visually and kinesthetically image the task, on only six occasions; two each for the pre-test, post-test, and follow-up phases of the study. In comparison, subjects in the single-subject design study were asked to complete these requirements on at least 5 days prior to the implementation of the intervention, at least 15 times during the course of the intervention, and on two occasions during the follow-up phase.

(d) Subjects in the experimental group for the group design study did not receive the treatment individually. Groups of up to approximately eight

subjects were in the treatment room listening to the taped imagery instructions during the intervention. This was a practical consideration, based on the availability of individual subjects, and the treatment room, at various times during the day. Being student athletes, these subjects were restricted by course timetabling and practice schedules, so it was impractical to administer the imagery training program to subjects individually each day.

(e) During the intervention period, subjects in the experimental group of the group design study were not required to physically perform the task, nor to complete the self-efficacy rating forms or modified Movement Imagery Questionnaire (MIQ) forms. It was reasoned that this was representative of a typical group design study in which subjects are tested prior to the intervention, the intervention is implemented, and the subjects are then tested again. In contrast, the subjects in the single-subject design study performed these activities each day of the intervention.

(f) Subjects in the experimental group for the group design study were not asked to equate their imagery times with their actual performance times for the task. Since these subjects were not required to physically perform the task during the intervention, and were only

tested on two occasions prior to the implementation of the intervention, it was reasoned that this requirement would have less meaning for these subjects.

It was recognised that these methodological differences meant that the two designs were not equated in terms of the number of times that the subjects actually performed the task. However, it was reasoned that each methodology was representative of how the research question would have been investigated.

Given these procedural differences, the results from the two studies provide some conflicting conclusions. Firstly, the group design study found no evidence that imagery training was able to enhance self-efficacy for the dart throwing task, for male and female university-level athletes who had some experience of imagery and dart throwing, who believed in the power of imagery to enhance performance, and who improved their ability to visually and kinesthetically image the task. In contrast, several issues emerged from the results of the single-subject design study. Some support for imagery's effect on the self-efficacy of individuals was found, in that subjects 1 and 2 demonstrated an increase in self-efficacy magnitude during the imagery training program which could be attributed to the intervention program, whereas self-efficacy strength appeared to increase for subject 1 as a result of the imagery training program. In contrast, two subjects showed

no effect of the imagery training program on self-efficacy, and both measures of self-efficacy decreased during the intervention for two other subjects. If an "average" result were reported for these six subjects, no overall effect would have resulted, and the conclusion drawn that imagery was unable to enhance self-efficacy for the dart throwing task. Yet a positive effect was evidenced for at least one subject, a finding which would have been masked by a group design analysis such as that which was conducted. As Barlow and Hersen (1984) noted, the practice of averaging the results in a group design misrepresents the performance of any individual within the group, and thus generalisations to individuals cannot be made. In addition, if subject 1 had been in the experimental group of the group design study, not only would this effect not have been revealed, but identification of the characteristics of the subject that might have caused this improvement would have been impossible.

The more detailed descriptions of subjects that are characteristic of single-subject designs, and the more comprehensive monitoring of subject performances, provided some possible reasons for subject 1's results. This characteristic of single-subject designs also provided possible reasons why the other subjects performed as they did. A higher level of imagery ability, as indicated by the combined MIQ ratings over the course of the intervention,

and the congruence between imagery times and actual performance times for the task, were offered as possible reasons for the evidenced intervention effect for subject 1. The overriding effect of negative auditory feedback from the sound of the darts consistently missing the target was proposed to account for the decrease in self-efficacy over the course of the intervention for subjects 5 and 6. Finally, it was proposed that for subject 4, an improvement in self-efficacy ratings would only have been possible through performance-based sources of efficacy information. This finding, although supportive of Bandura's (1977, 1986) contention that performance accomplishments are the most powerful source of efficacy information, is not consistent with the view that psychological variables, such as imagery, can alter the strength and level of self-efficacy. Despite a strong belief in the power of imagery to enhance task performance, and a marked improvement in visual and kinesthetic imagery for the task, no marked increase in either measure of self-efficacy was evidenced for subject 4 over the course of the intervention.

The more detailed analysis of individual subjects' performances that was permitted by the use of the single-subject design methodology, provided some insights into the possible effects of imagery on self-efficacy for a motor task, and also supplied some avenues for prospective research. This was not possible on the strength of the

group design results, which must therefore be considered a weakness of this design in investigating imagery.

Consistent with Wollman's (1986) comments regarding the use of single-subject designs in imagery research, the detection of successful effects for some subjects who might otherwise have had their success masked in a nonsignificant group design, could lead to the identification of particular subject characteristics or factors that may be causally linked to improved performance through imagery.

Critics of single-subject research designs have argued that visual inspection is a subjective and inconsistent means of evaluating intervention effects, in comparison to statistical methods. For example, DeProspero and Cohen (1979), Matyas and Greenwood (1990), and Wampold and Furlong (1987) found inconsistencies in assessments of intervention effects using visual inspection. However, Matyas and Greenwood (1990) noted that improved visual techniques for determining intervention effects may lead to more accurate assessments of the results from single-subject research. For the single-subject design used in this study, the employment of several criteria for analysis by visual inspection ensured that only clear improvements in reported self-efficacy measures, according to those criteria, were interpreted as denoting an intervention effect. For example, if the only criterion used to determine the effect of the intervention was the change in mean ratings for self-

efficacy strength, subject 2 could have been said to have shown a clear intervention effect, which was further improved during the follow-up phase (see figure 3, page 100). However, the combined use of several criteria (change in means, change in level, change in trends, and latency of change) provided a more effective and objective analysis, which determined that this change could not be attributed to the effect of the intervention. No change in level or trend was evident between the baseline and the intervention phase for subject 2, and four intervention sessions were completed before any improvement in self-efficacy strength was evident. Thus, the visual analysis criteria used to assess intervention effects for this single-subject design, provided an effective and objective means for evaluating the results.

According to Valsiner (1978) the reliance on statistical significance in much group design research has often led to the use of probability values as indices of meaningfulness, which are often misleading. An example would be the significant differences in MIQ scores at day 1 and day 15 of the intervention phase for the experimental group in the group design study. This result could be interpreted as confirming the effectiveness of the imagery training program in enhancing imagery ability for the dart throwing task. However, an examination of the mean MIQ scores at day 1 and day 15 of the intervention phase showed

that such a conclusion would have been misleading. The improvement of approximately one half of a point value on the 7-point Likert scale is meaningless in practical terms. Further, individual subjects were not able to report such a rating on the scale used in this study, and so the individual assessments of imagery ability reported in the single-subject design study provided a more meaningful indication of the effect of the program in improving imagery ability. Also, by comparing each individual's results for these ratings with those for self-efficacy magnitude and strength, more comprehensive assessments of the effect of the intervention could be made with reference to imagery ability. Thus, the single-subject design study provided a more meaningful and effective assessment of the effect of the intervention in improving imagery ability, and the relationship between this and the intervention's effect on self-efficacy.

Conclusions.

The results from the two studies provided contrasting conclusions. It was concluded from the group design study that imagery training had no effect on self-efficacy for the dart throwing task, whereas the single-subject design study provided some evidence to support the proposal that imagery could positively influence self-efficacy for particular individuals on this task.

A more comprehensive and detailed analysis of the reported results and their implications was possible from the single-subject design study, which highlighted the effectiveness of this design in more fully investigating imagery's effect on various aspects of motor skill performance. In particular, the potential for nonsignificant group design studies to conceal possible intervention effects by averaging results was demonstrated well by the combined analysis of both studies. If an "average" rating of self-efficacy across the six subjects in the single-subject design study was reported for self-efficacy magnitude, no effect of the imagery training would have been evidenced (which was the result of the group design analysis), yet individual analyses revealed a clear intervention effect for subjects 1 and 2. An examination of the characteristics that differentiated these subjects from those who did not show a positive effect, provided some clues as to why this may have occurred, and in doing so, offered some suggestions for future research. It was also demonstrated that visual inspection of the graphically displayed data when subjected to rigid criteria, provided an effective and objective analysis of the results, and that the reported statistical significance of results from group design studies may not have provided realistic or meaningful conclusions.

A number of avenues for further research were offered

as a result of the analysis of the single-subject design . These included further investigations of the importance of high imagery ability in improving task performance through imagery training, the use of more task specific measures in determining imagery ability, and the possibility that performance-based sources of efficacy information may be the only avenue for enhancing self-efficacy for certain individuals.

The systematic use of single-subject designs then, is recommended as a more practical, relevant and potentially more revealing method of investigating the effect of imagery on aspects of motor skill performance. Consistent with the views of Barlow and Hersen (1984), when relatively little is known about the influence that certain variables may have on subjects' abilities to effectively use imagery, such designs provide a more realistic means of identifying and controlling for these factors. However once identified, these factors can be tested using a group design, where the effects are more likely to be detected, as many of the possible sources of variability would have already been identified in the preceding single-subject design studies. Systematic replication of the findings through such studies will make it possible to identify most of the factors influencing the generality of any findings. Thus, the complementary use of both types of designs is recommended.

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APPENDIX A
Information Questionnaire

INFORMATION QUESTIONNAIRE

Name: _____ Phone Number _____
 Age: _____ Male _____
 Female _____
 Main Sport: _____
 Highest Level played: _____

1. Have you ever been taught specific relaxation skills before?

YES _____

NO _____

2. Have you ever been exposed to a mental imagery/visualisation program before?

YES _____

NO _____

If YES, (a) for how many years have you been using imagery? _____

(b) Approximately how many structured or guided imagery sessions have you been exposed to? _____

When imaging, do you mainly see yourself from a spectator's perspective, i.e., as if watching yourself on television (this is known as an 'external imagery style')?

OR

Do you mainly see yourself as if you are actually within your body, performing the task (this is known as an 'internal imagery style')?

OR

Do you use both styles?

Predominantly External Style _____

Predominantly Internal Style _____

Both Styles _____

Do you believe that by practicing mental imagery skills you can improve your performance of the skills involved in your sport?

1
Strongly
Disagree

2
Disagree

3
Neutral

4
Agree

5
Strongly
Agree

APPENDIX B

Vividness of Movement Imagery Questionnaire (VMIQ)

Think of each of the following acts, and classify the images according to the degree of clearness and vividness as shown on the rating scale.

<u>Item</u>	<u>Watching</u>	<u>Doing it</u>
	<u>somebody else</u>	<u>yourself</u>
13. Catching a ball with two hands	_____	| _____
14. Throwing a stone into water	_____	| _____
15. Kicking a ball in the air	_____	| _____
16. Hitting a ball along the ground	_____	| _____
17. Running downhill	_____	| _____
18. Climbing over a high wall	_____	| _____
19. Sliding on ice	_____	| _____
20. Riding a bike	_____	| _____
21. Jumping into water	_____	| _____
22. Swinging on a rope	_____	| _____
23. Balancing on one leg	_____	| _____
24. Jumping off a high wall	_____	| _____

Rating Scale.

The image aroused by an item might be:

Perfectly clear and as vivid as normal vision	.....	Rating 1
Clear and reasonably vivid	.....	Rating 2
Moderately clear and vivid	.....	Rating 3
Vague and dim	.....	Rating 4
No image at all, you only "know" that you are thinking of the skill	.....	Rating 5

APPENDIX C
Informed Consent Form

CONSENT FORM

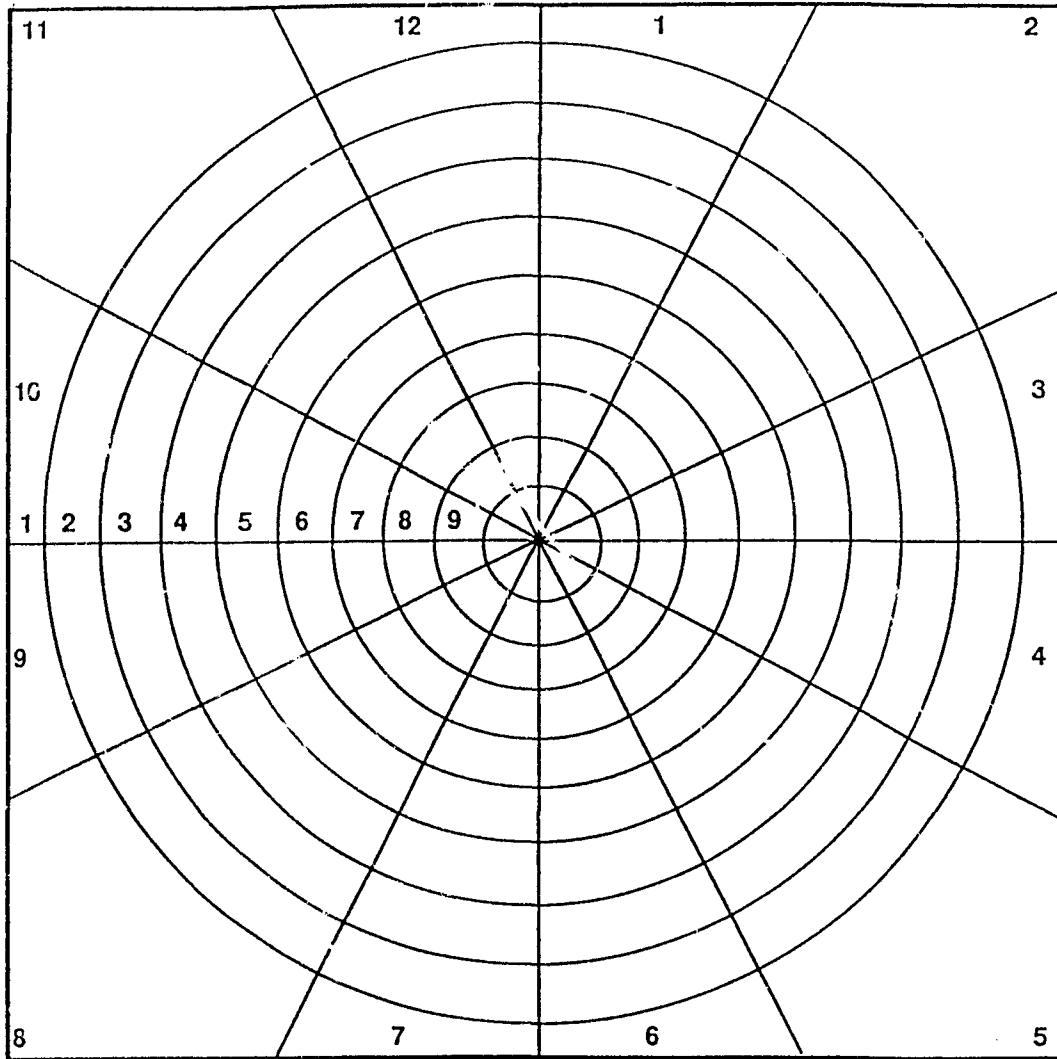
I _____, have understood the nature of the study in imagery in sport being directed by Alex. McKenzie and Dr. B. L. Howe and am willing to participate. I am aware of the fact that I can withdraw at any time, and understand that any recorded individual data will be confidential to the research group and destroyed at the conclusion of the study.

Signed: _____

Date: _____

APPENDIX D

Illustration of Target



APPENDIX E

Diagram of Multiple-Baseline Design

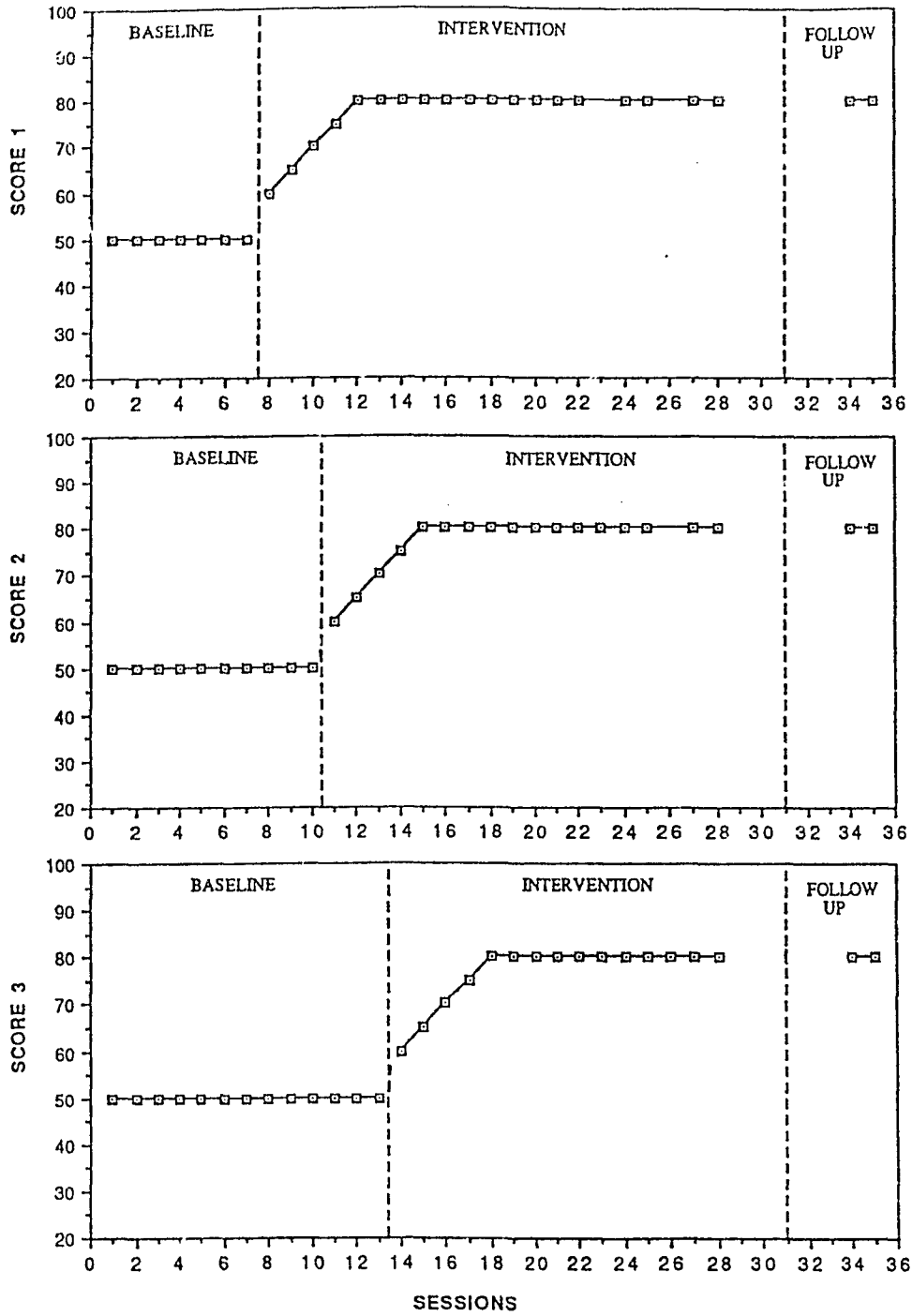


Diagram of Multiple-Baseline-Across-Subjects Design

APPENDIX F
Self-Efficacy Rating Scale

Name : _____ Date : _____
 (Please print)

TASK:

You will be required to throw 10 darts at the target from a distance of 7 feet, with your preferred arm. The maximum possible score is 100 points. You will be blindfolded, and will not be informed of your score at any stage during your performance of the task.

PLEASE ANSWER THE FOLLOWING QUESTIONS AS ACCURATELY AS POSSIBLE.

* Remember you are blindfolded and using your preferred arm.

Your average score for 10 darts without the blindfold was _____.

100	_____
95	_____
90	_____
85	_____
80	_____
75	_____
70	_____
65	_____
60	_____
55	_____
50	_____
45	_____
40	_____
35	_____
30	_____
25	_____
20	_____
15	_____
10	_____
5	_____
0	_____

1. Place a circle around the score (at left) that you believe that you are capable of scoring TODAY.

2. In the right hand column, indicate the scores that you are;
 100% confident,
 75 % confident,
 50 % confident,
 25 % confident,
 and 0 % confident of achieving
 TODAY.

APPENDIX G

Transcript of Imagery Instructions

TAPED IMAGERY INSTRUCTIONS

Relaxation Instructions.

You are going to relax....to relax....I want you to breathe slowly and deeply....slowly and deeply....I want you to breathe in through your nose....down deep to your stomach....and out through your mouth....Breathe slowly and deeply....Focus on that deep deep breath to your stomach ...feel your stomach expand....and then contract....breath slowly and deeply....you become more and more relaxed, with every breath you take....you feel no tension in your bodyyour shoulders are loose....so loose....your arms and legs are relaxed....relaxed....you breathe slowly and deeplyFocus on that deep deep breath....focus on that contraction, and expansion, and then contraction of your stomach....breath slowly and deeply....you feel more and more relaxed with every breath you take.

Self-Perception Imagery Instructions

Now, I want you to imagine, in your mind....a situation in the past....a situation where you were successful....it can be anything you like...something you did, you did well....and you were successful....focus hard on how you felt....what were your feelings?....did you feel good?....excited?....relieved? ...satisfied?....happy?....I want you to bring those feelings to life, right now....focus hard on them....make them happen....feel them throughout your whole body....bring those feelings to life....Now, I want you to imagine that you're going to do the task again....you're going to do it in a few moments time....bring those feelings to life....I want you to feel it, right now....what are those feelings?confident? ...excited?....do you feel sure?....do you feel good in yourself?....bring those feelings to life....feel them throughout your whole body....you feel ready to perform...you feel good....you feel confident....very confident....Now, I want you to imagine....the situatio where you have one dart to throw....one dart....and you're going to throw it right in the centre of the target....focus hard on those feelings of confidence....you feel good....you know you're going to put the dart in the centre of the target....bring those old feelings to life....confidence....excitement....sure in the knowledge that you can put the dart in the centre of the target....focus hard on those feelings.

Vividness Imagery Instructions.

(A) Now, I want you to pick a friend, and imagine that that friend is standing right in front of you....try to get a real, sharp image of that person....a real, clear, sharp, vivid image....what do they look like?....are they tall?short?thin?....heavy?....what do you notice about their facial features?....what colour are their eyes?....their hair?....is it dark?....light?curly?straight?long?short? ...what kind of clothes are they wearing?....focus on the colours....see them clearly....now focus on the person's face....imagine them talking....they may be talking to you or to someone else....try to hear the person's voice....try to imagine all their facial expressions as they talk....do they smile?....frown?....grin?....grimace?....think about you self....try to create the emotions that you feel towards this person....do you feel friendship?admiration?respect?....recreate....in your mind....all of your feelings towards this person.

(B) Now....I want you to see yourself standing at the line facing the target....you're ready to throw your darts at the target....recreate, in your mind, those feelings of satisfaction....those feelings of confidence that go with a successful performance....focus hard on those feelings....make them come to life....see yourself standing at the line....pick out as many details as you can....create a clear, sharp, vivid image of the target....see each ring clearly....see the different colours....focus on the darts....feel them in your hand....notice their texture....feel their weight....focus on the sights and sounds in the room....try to hear the sound of the dart hitting the target....pull everything togetherpull all the sights and sounds together....see the target....see and feel the darts....hear the dart hitting the target....see yourself throwing the dart....feel the dart in your hand....feel the dart leave your hand as it goes towards the centre of the target....focus on the arm action as you throw each dart....see the shot over and over in your mind....focus on the feelings in the rest of your body....as you throw the darts....combine all the different sensations....create a clear, sharp, vivid, real image.

Controllability Imagery Instructions.

(A) Now, I want you to pick a friend....the same friend as you picked earlier....I want you to imagine that person standing in front of you....see them clearly....recreate a sharp, vivid image....see all their features clearly....notice their clothing....focus on the different

colours....imagine that person talking....they may be talking to you....or to someone else....look at the person's face....try to hear the person's voice....notice the different expressions as they talk....Now, I want you to imagine that you and your friend are in a room full of people....it may be a party....watch your friend....they are walking around the room talking to different people....watch them closely....can you see the different expressions....look at their body....sometimes they're relaxed....sometimes they seem uptight....what kinds of gestures are they making?....are they using their hands as they talk to other people?....watch them walk from one group of people to another....can you see all these different things clearly?....can you see them standing, then walking....stopping....can you see them talking....moving their hands....leaning forwards....leaning sideways....can you see all these different things?....watch them closely....see that image clearly in your mind....see all the different things that they are doing.

(B) Now, I want you to create, in your mind....those feelings of success....feelings of success....and confidence....the feeling that you know you're going to do well....focus on those feelings, right now....make them come to life....make them happen....see yourself standing at the line....focus on the target....look at the darts in your hand....feel their weight....their texture....see yourself performing the task....but above all....see clear, sharp, vivid imagescreate, or image, the target....look at the target closely....focus on the colours....focus only on the white....now look at the yellow circles....now add the green circles....now the red....and finally the orange....now, I want you to see, in your mind....all your darts, in a cluster, within the red and orange circles....now, I want you to imagine that all your darts are in a group to the left of the orange circle....now your darts are in a group to the right of the orange circle....now, see all your darts within the yellow, green, red, and orange circles....now, see all your darts within the green, red, and orange circles....now, see your darts within the red and orange circles....and finally, all your darts within the orange circle.

Centering and Imagery Instructions while Standing.

Now, I'd like you to stand up....I want you to imagine that you're standing at the line facing the target....breathe slowly and deeply....slowly and deeply....focus on that deep breath to your stomach....focus on that contraction, expansion, and contraction....keep your shoulders and arms relaxed....keep your knees slightly bent,

jaw slightly open....you are going to throw, 10 darts, one at a time, at the target....when I ask you to....If you want to physically go through the action of throwing the darts....that's fine....focus hard on your image....image in real time....not in slow-motion....feel the dart in your hand....feel it leaving your hand....see it going to the target....make sure each throw is a success....when you have thrown all 10 darts....you can sit down....you can now begin to image the task.

APPENDIX H

Modified Movement Imagery Questionnaire (MIQ)

Name: _____ Date: _____

VISUAL IMAGERY SCALE

1	2	3	4	5	6	7
I	I	I	I	I	I	I
Very Easy to picture	Easy to picture	Somewhat easy to picture	Neutral	Somewhat hard to picture	Hard to picture	Very Hard to picture

KINESTHETIC IMAGERY SCALE

1	2	3	4	5	6	7
I	I	I	I	I	I	I
Very Easy to feel	Easy to feel	Somewhat easy to feel	Neutral	Somewhat hard to feel	Hard to feel	Very Hard to feel

APPENDIX I
Post-Study Questionnaire

POST-STUDY QUESTIONNAIRE

1. What was the main basis for your ratings of self-confidence (i.e. the scores that you identified each day on the form that you filled out)?

2. How were your responses to the items on the form affected by events outside of the imagery sessions?

3. Did the sound of the darts hitting the board or the wall affect your responses to the items on the form? If YES, how ?

4. Did you think that the imagery training program was effective in improving your imagery skills?

5. Did the presence of the tester affect your performance and/or your responses in any way?

APPENDIX J

Subject Letter: Experimental Group

School of Physical Education
University of Victoria
Box 1700
Victoria
V8W 2Y2.

Dear

Thank you for agreeing to act as a subject in my Ph.D. study aimed at improving imagery skills and performance of a dart throwing task. I am confident that you will find the experience interesting and valuable, and that you will be able to apply the skills learned in this study to your own sporting interests.

Please find enclosed an informed consent form, which I would ask you to complete and bring with you to the first session on January 6. Also, please read carefully the enclosed timetable of events for the study, which outlines the procedures for each day. Please note the brief time commitment for each session.

The first two sessions (January 6 and 7) will simply involve becoming familiar with the use of the rating scale that you will be asked to complete during the pre-testing, post-testing, and follow-up phases of the study. During these phases you will be required to throw 10 darts at a large target located 7 feet directly in front of you, while blindfolded. You will not be informed of your scores until after the completion of the final follow-up session, at which time your scores will be made available to you.

During the first treatment session on January 13 the procedures for all 15 treatment sessions will be described to you. In addition, you will be shown a videotape about imagery and its use in sport, and will be asked to visualize your performance of the dart throwing task. A rating scale designed to assess the quality of your imagery of the task will be administered at this time. Please note that this session will be the longest of all sessions, lasting approximately 40 minutes.

During treatment sessions 2-10 (January 14-24) you will simply listen to the videotape, and follow all of the instructions given to you on the tape. There are five different tapes, each lasting approximately 10 minutes. Again you will finish each session by visualizing your performance of the task.

Treatment sessions 11-15 (January 27-31) will involve performing a brief relaxation exercise (which will be taught to you during the previous treatment sessions) and then visualizing the task. An assessment of the quality of your imagery will be administered on the last treatment day (January 31).

I will be conducting familiarisation sessions in McKinnon room 152 between 7:30am and 4:30pm on January 6, and at the following times on January 7 in the same room;

7:30 - 8:30am
10:30 - 11:30am
12:30 - 4:30pm

Please remember to bring your completed informed consent form, and a copy of your timetable for the spring session, so that we can arrange times for each daily session.

Once again, thank you for agreeing to participate in my study. These experiments are an important part of graduate work, and I very much appreciate your participation. If you have any questions regarding the study, please do not hesitate to phone or to drop by my office in the McKinnon building (room 115)

Sincerely,

Alex McKenzie,
Phone 721 8392 (UVic)
477 2161 (Home)

APPENDIX K

Subject Letter: Control Group

School of Physical Education
University of Victoria
Box 1700
Victoria
V8W 2Y2.

Dear

Thank you for agreeing to act as a subject for my Ph.D. study in sport psychology. I sincerely hope that you will find the experience interesting and valuable. Please find enclosed an informed consent form, which I would ask you to complete and bring with you to the first session on January 6. Also, please read carefully the enclosed timetable of events for the study, which outlines the procedures for each day. Please note the brief time commitment for each session.

The first two sessions (January 6 and 7) will simply involve becoming familiar with the use of the rating scale that you will be asked to complete during the pre-testing, post-testing, and follow-up phases of the study. During these phases you will be required to throw 10 darts at a large target located 7 feet directly in front of you, while blindfolded. You will not be informed of your scores until after the completion of the final session on February 11, at which time your scores will be made available to you.

I will be conducting familiarisation sessions in McKinnon room 152 between 7:30am and 4:30pm on January 6, and at the following times on January 7 in the same room;

7:30 - 8:30am

10:30 - 11:30am

12:30 - 4:30pm

Please remember to bring your completed informed consent form, and a copy of your timetable for the spring session, so that we can arrange times for each daily session.

Once again, thank you for agreeing to participate in my study. These experiments are an important part of graduate work, and I very much appreciate your participation. If you have any questions regarding the study, please do not hesitate to phone or to drop by my office in the McKinnon building (room 115)

Sincerely,

Alex McKenzie,
Phone 721 8392 (UVic)
477 2161 (Home)

APPENDIX L

Timetable of Events: Experimental Group

EXPERIMENTAL GROUP - TIMETABLE OF EVENTS

January	6	Familiarisation	(5-10 mins)
	7	Familiarisation and Pre-pretesting	(10 mins)
	8	Make-Up day (if needed)	
	9	Pretesting: Blindfolded - fill out rating scale - perform task.	(5 mins)
	10	Pretesting: Blindfolded - fill out rating scale - perform task.	(5 mins)
	13	Treatment 1 Introductory session	(40 mins)
	14	Treatment 2 Tape 1	(15 mins)
	15	Treatment 3 Tape 1	(15 mins)
	16	Treatment 4 Tape 1	(15 mins)
	17	Treatment 5 Tape 2	(15 mins)
	20	Treatment 6 Tape 3	(15 mins)
	21	Treatment 7 Tape 3	(15 mins)
	22	Treatment 8 Tape 4	(15 mins)
	23	Treatment 9 Tape 5	(15 mins)
	24	Treatment 10 Tape 5	(15 mins)
	27	Treatment 11 Relaxation and Imaging	(5 mins)
	28	Treatment 12 Relaxation and Imaging	(5 mins)
	29	Treatment 13 Relaxation and Imaging	(5 mins)
	30	Treatment 14 Relaxation and Imaging	(5 mins)
	31	Treatment 15 Relaxation and Imaging	(5 mins)
February	3	Post-testing: Blindfolded - fill out rating scale - perform task.	(5 mins)
	4	Post-testing: Blindfolded - fill out rating scale - perform task.	(5 mins)
	5	Make-Up day (if needed)	
	6	Make-Up day (if needed)	
	7	Make-Up day (if needed)	
	10	Follow-Up: Blindfolded - fill out rating scale - perform task.	(5 mins)
	11	Follow-Up: Blindfolded - fill out rating scale - perform task.	(5 mins)
	12	Make-Up day (if needed)	
	13	Make-Up day (if needed)	
	14	Make-Up day (if needed)	

APPENDIX M

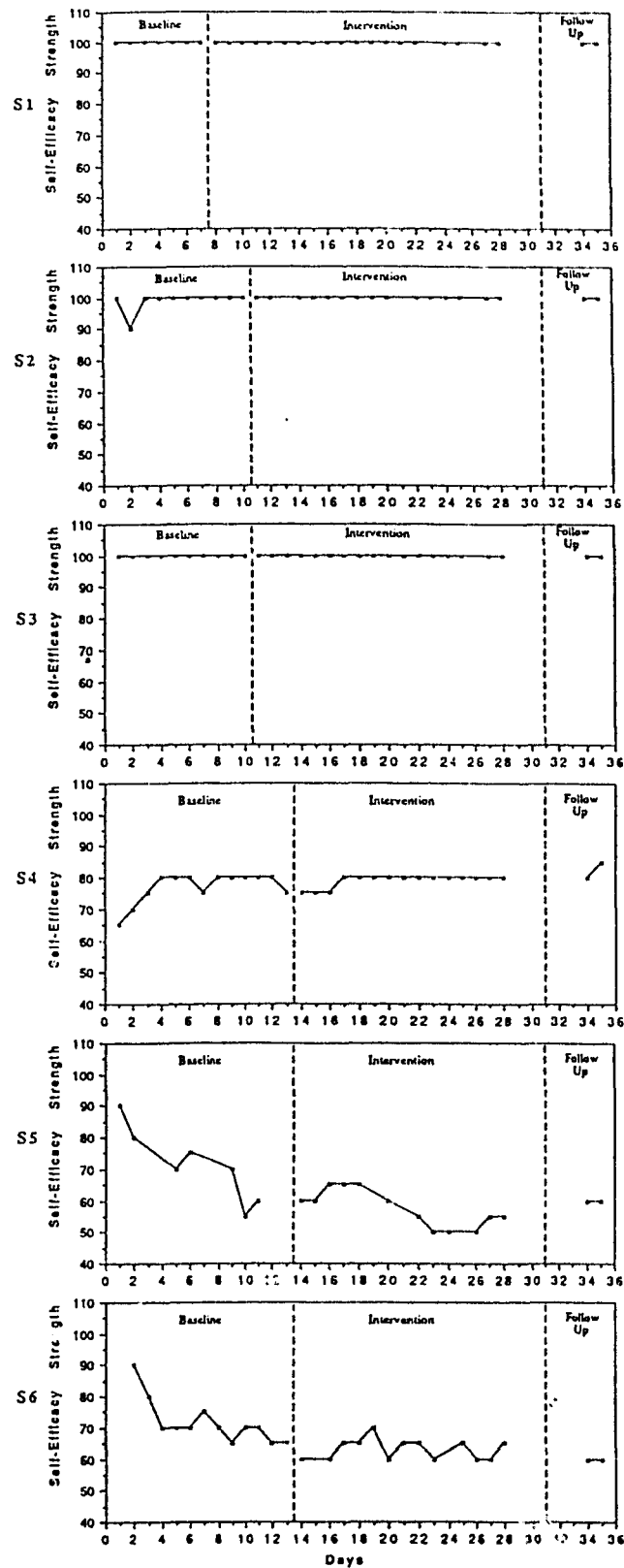
Timetable of Events: Control Group

CONTROL GROUP - TIMETABLE OF EVENTS

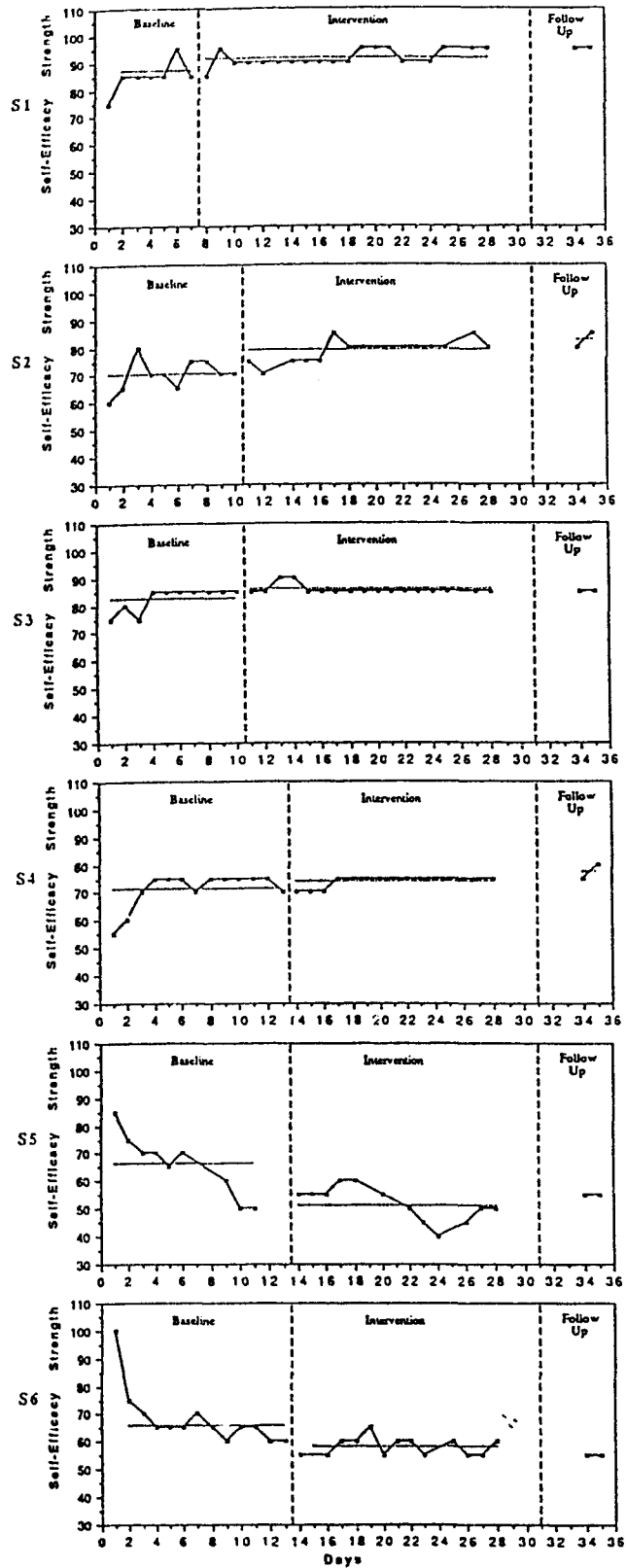
January	6	Familiarisation	(5-10 mins)
	7	Familiarisation and Pre-pretesting	(10 mins)
	8	Make-Up day (if needed)	
	9	Pre-testing: Blindfolded - fill out rating scale - perform task.	(5 mins)
	10	Pretesting: Blindfolded - fill out rating scale - perform task.	(5 mins)
	13		
	14		
	15		
	16		
	17		
	20		
	21		
	22		
	23		
	24		
	27		
	28		
	29		
	30		
	31		
February	3	Post-testing: Blindfolded - fill out rating scale - perform task.	(5 mins)
	4	Post-testing: Blindfolded - fill out rating scale - perform task.	(5 mins)
	5	Make-Up day (if needed)	
	6	Make-Up day (if needed)	
	7	Make-Up day (if needed)	
	10	Follow-Up: Blindfolded - fill out rating scale - perform task.	(5 mins)
	11	Follow-Up: Blindfolded - fill out rating scale - perform task.	(5 mins)
	12	Make-Up day (if needed)	
	13	Make-Up day (if needed)	
	14	Make-Up day (if needed)	

APPENDIX N

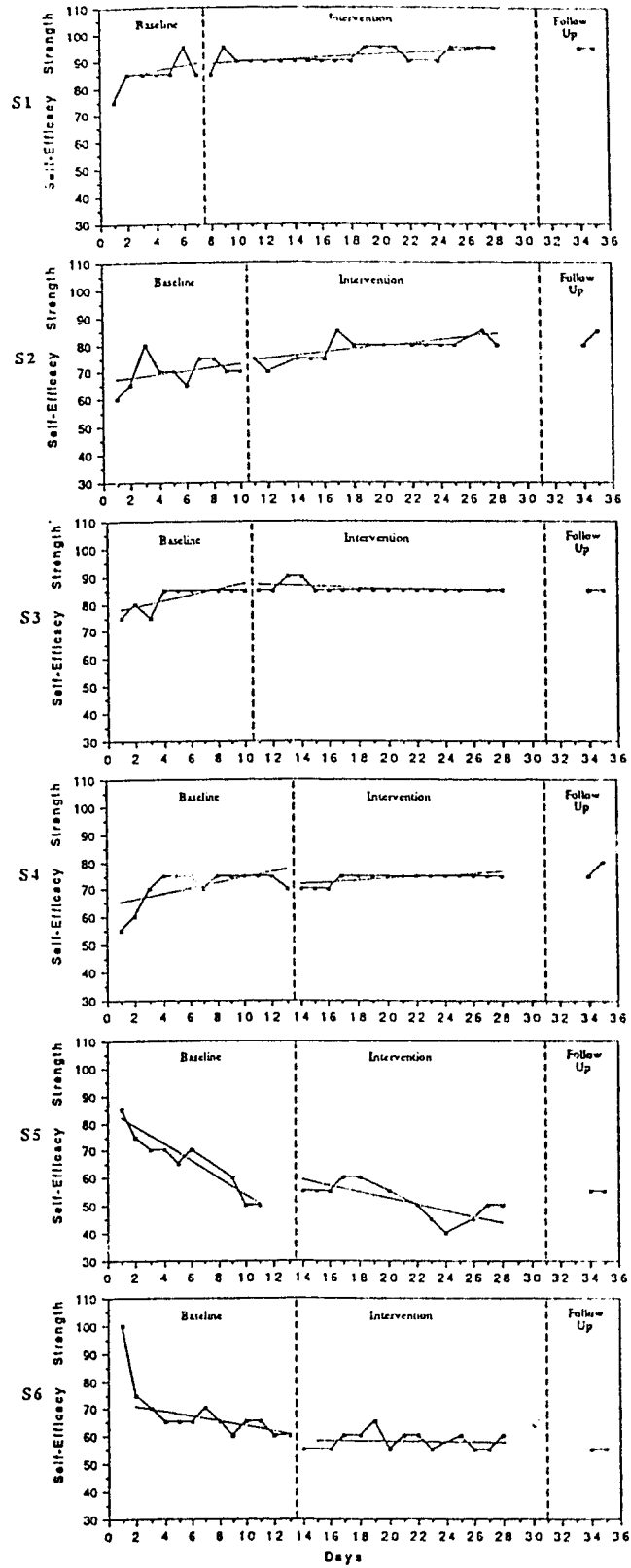
Self-Efficacy Strength Graphs for 0%, 25%, 50% and 100% levels



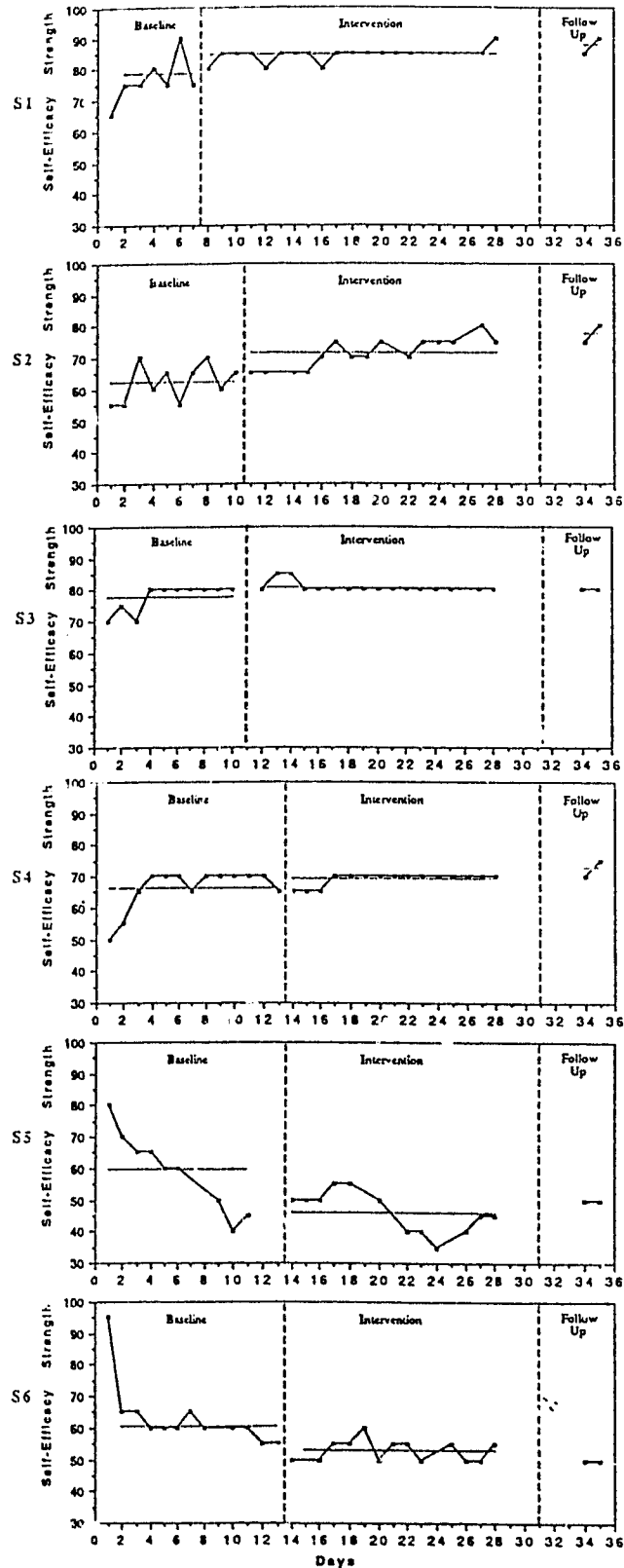
Self-Efficacy strength scores (0% level)



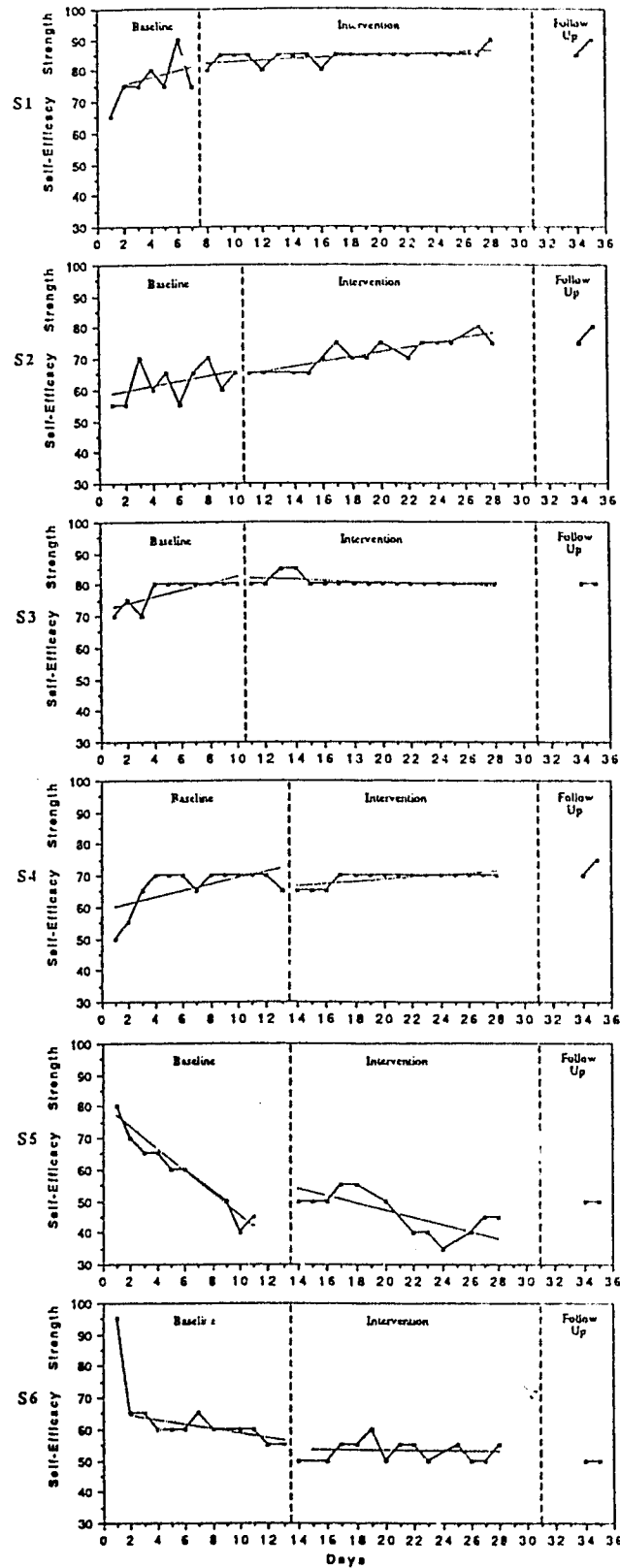
Self-Efficacy strength scores (25% level), plus means



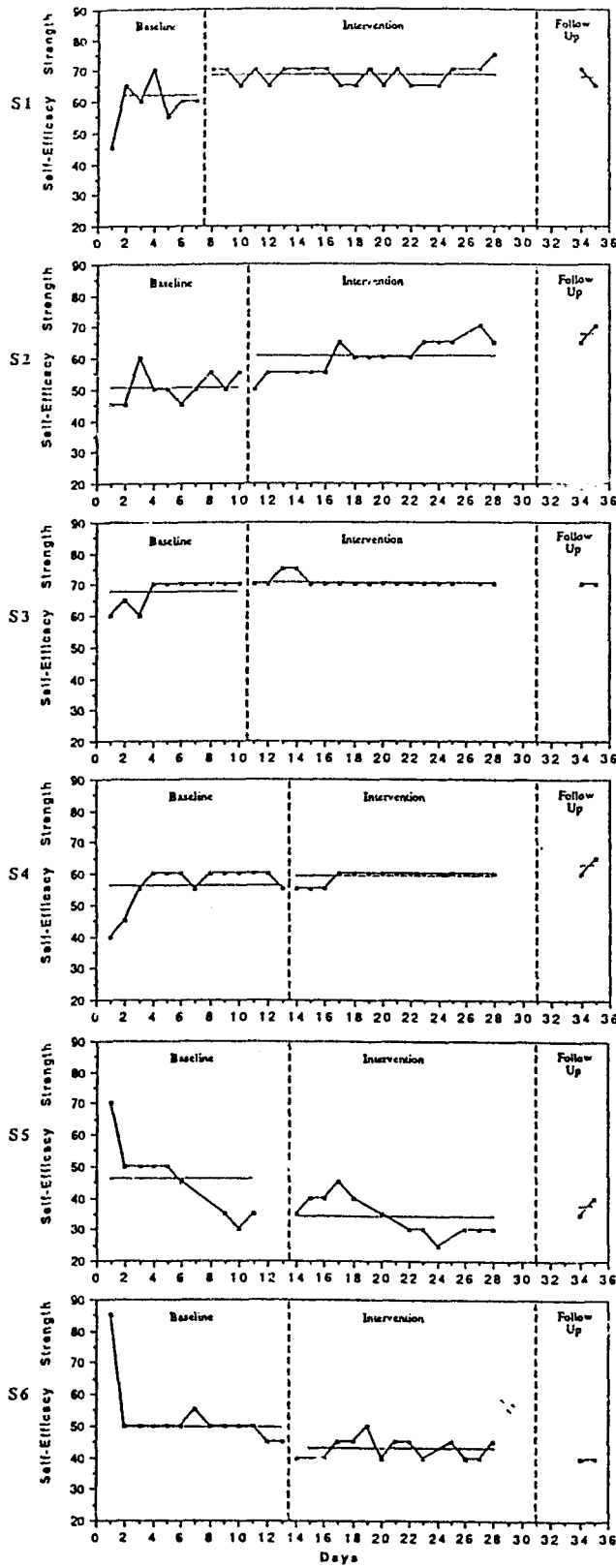
Self-Efficacy strength scores (25% level), plus trends



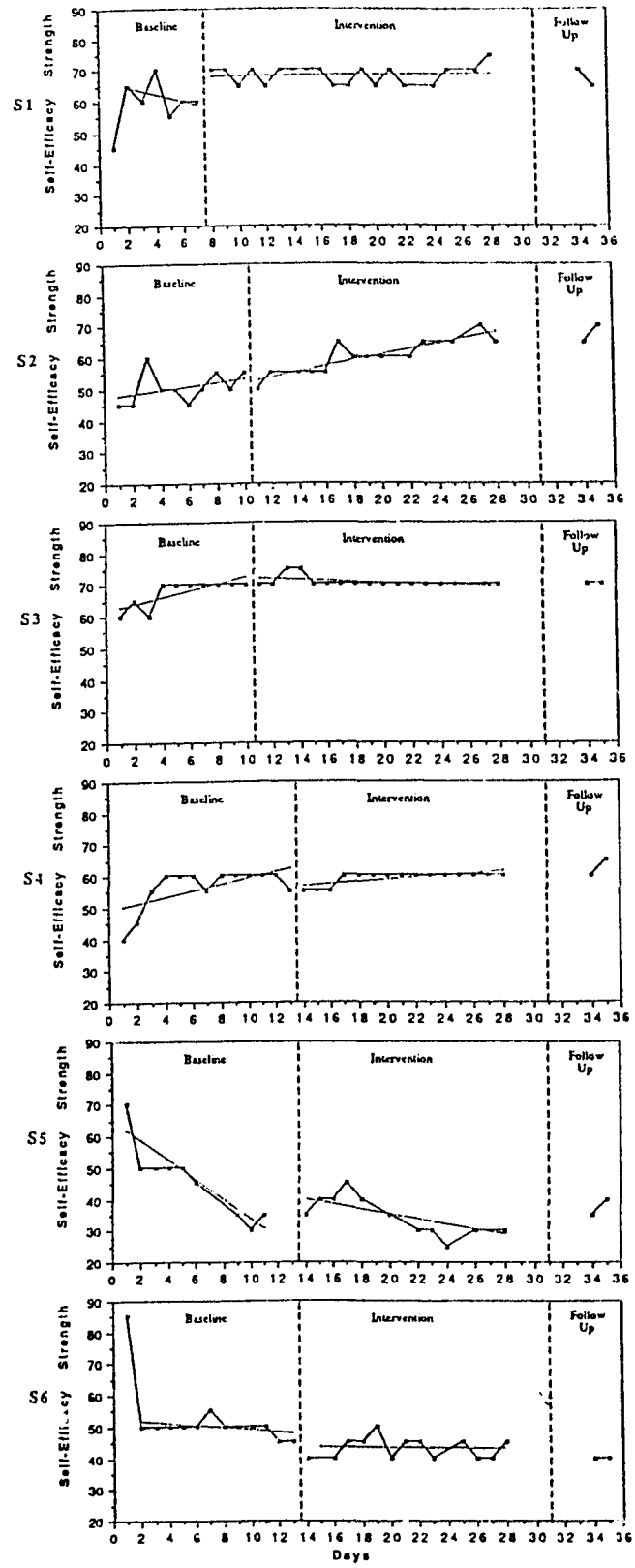
Self-Efficacy strength scores (50% level), plus means



Self-Efficacy strength scores (50% level), plus trends



Self-Efficacy strength scores (100% level), plus means



Self-Efficacy strength scores (100% level), plus trends