THE EFFECTS OF MENTAL IMAGERY TRAINING ON A BASEBALL THROWING TASK

THESIS

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By

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This study was designed to determine if long term training of mental imagery skills is more beneficial to an athlete than immediate imagery rehearsal practiced only prior to an event. Subjects were thirty male high school baseball athletes who were randomly assigned to one of three treatment conditions: (1) long term imagery training and practice; (2) immediate imagery practice only; and (3) control. An accuracy relay-throwing test was performed with pre-test, mid-test, and post-test performance trials. Results of the study revealed no statistically significant differences over the three test periods for any of the treatment conditions. Thus, long term imagery combined with immediate imagery practice, immediate imagery practice and control groups performed equally well on the baseball throwing task.
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CHAPTER I

INTRODUCTION

The mind-set of the athlete has become a growing area of importance and concern in athletics. One reason for this growing popularity is the need to gain an "edge" on the competition. Athletes are always trying to find ways to perform at their highest level. Coaches as well as athletes are now realizing that to reach one's fullest potential, one must train the mind as well as the body. One type of training that has recently become popular in the area of mental training, is mental practice, or as it is widely referred to today, mental imagery.

Mental practice has been defined as "symbolic rehearsal of a physical activity in the absence of any gross muscular movements" (Richardson, 1967, p.95). Mental practice is a topic that has been studied for nearly one hundred years. Carpenter, in 1894, studied and developed the first theory of imagery (Hale, 1982). This theory was known as the ideo-motor principle. It was also reported by Wiggins (1984) that research in the area of mental practice was studied in 1897-1898 by William Anderson, a noted physical educator. In the past century, more than one hundred studies have been conducted in the field of mental practice. This past research, along with much anecdotal evidence, has made imagery a popular topic.
Although there is a great amount of research and anecdotal evidence in this area, there are still conflicting reports concerning the effectiveness of imagery rehearsal. The literature has supported the belief that imagery can enhance one’s performance. For example, Feltz and Landers (1983) published a meta-analysis which reviewed sixty studies dealing with the effects of mental practice. Feltz and Landers concluded, with an average effect size of .48, that mental practice can enhance one’s performance. There are however, a number of studies (Corbin, 1972; Epstein, 1980) that have not found enhanced performance after employing imagery training techniques. Additionally, 30 of the 60 studies in the Feltz and Landers (1983) research failed to show statistical significance on mental practice effects. Thus, results concerning the effectiveness of imagery on athletic performance are equivocal.

The theoretical foundation of imagery dates back to 1894. Carpenter (1894) first began research in the field of imagery and developed the "ideo-motor principle" (Hale, 1982). Carpenter believed that any idea that controlled the mind would be expressed in the muscles (Hale, 1982). This was the premise of the ideo-motor principle. The most popular name associated with this principle, is the "psycho-neuromuscular theory" (Richardson, 1967a). The psycho-neuromuscular theory proposes that "minute innervations" identical to actual movements but weaker are present in the
involved muscles during imagery (Hecker & Kaczor, 1988). These innervations are believed to secure a memory trace for movement (Zecker, 1982).

The symbolic-learning theory explains the process of imagery by breaking down a physical task into symbolic parts of a whole skill. This theory is substantiated by numerous research studies (Feltz & Landers, 1983; Ryan, Blakeslee & Furst, 1986; Ryan & Simons, 1981; Zecker, 1982; Zeigler, 1987), and is supported by the fact that many athletic skills have been analyzed and described in text books designed to teach the reader how to perform a specific task (Ryan & Simons, 1981).

Another theory is Lang's (1979) bio-informational theory. This theory works on the pretense that the images in the brain are developed around propositions associated with relationships, descriptions and set responses (Hale, 1982). The propositions are categorized into the two classifications of stimulus and response propositions. A stimulus proposition is a description stimulus. An example of this type of proposition is to describe one's baseball glove as, "the brown leather glove." A response proposition is a description of a physiological response. An example of a response proposition is describing "the nervous fluttering in one's stomach as one approaches home plate." The bases of these propositions provide for a physiological and a psychological response so that a complete and realistic image can be developed.
Mahoney and Avener (1977) categorized imagery into the two components of internal imagery and external imagery, thus expanding the direction of interest in this area of study.

This distinction refers to the perspective of the imagery. In external imagery, a person views himself from the perspective of an external observer (much like in home movies). Internal imagery, on the other hand, requires an approximation of the real-life phenomenology such that the person actually imagines being inside his/her body and experiencing those sensations which might be expected in the actual situation (Mahoney & Avener, 1977, p.137).

When studied separately, neither of the two components of imagery, internal and external, has shown a significant increase in performance over the other. Internal imagery, however, is thought to be slightly more beneficial than external imagery documented by Mahoney and Avener's (1977) correlational study.

One major area that has been neglected in the imagery research is that of long-term imagery training of subjects. Notable exceptions are the investigations of Rodgers, Hall, & Buckolz (1991) and Zhang, Ma, Orlick, & Zitzelsberger (1992) that have investigated long-term training of imagery on performance. The Rodgers, et al., (1991) study provided
a 16 week training program in which the subjects had two 15 minute individual imagery training sessions per week for 12 of the 16 weeks. The study revealed a significant increase in imagery ability, but had no significant changes in the new performance measures. Zhang, et al., (1992) trained subjects in imagery for four of six weeks of imagery/relaxation training. Results in the Zhang, et al., (1992) research indicated that the children who used imagery accomplished significantly greater improvements in accuracy and technical quality of their shots than children in comparison groups. Even with these limited investigations, most studies solely investigated the short-term effect of imagery on motor skill acquisition. That is, the imagery training received by participants has ranged from a few minutes such as the Epstein (1980) study to several hours such as the Mumford & Hall (1985) research (Rodgers, Hall & Buckolz, 1991). Testing the effects of long-term imagery training (practice over a period of time) to those of short-term imagery training (practiced only immediately before the test) is lacking in the imagery research. Perhaps the lack of empirical testing of long-term training in past research accounts for the many inconsistencies in the area of imagery research.
PURPOSE OF THE STUDY

The purpose of the present study was to determine if long term training in mental imagery skills is more beneficial to an athlete than immediate imagery rehearsal practiced only prior to an event.

HYPOTHESIS

Long term practice of imagery skills will lead to a more effective baseball throw for distance and accuracy than immediate imagery rehearsal used only prior to performance.

LIMITATIONS OF THE STUDY

A limiting factor of this study was the control of imagery being practiced by subjects in the immediate imagery practice group and the control group.

DELIMITATIONS OF THE STUDY

This study was delimited to male baseball players. The ages of these subjects varied between fifteen and eighteen years of age. All subjects were participants on their respective high school varsity and junior varsity teams.
DEFINITION OF TERMS

The following terms were employed in this study:

1. Mental practice - "... the symbolic rehearsal of a physical activity in the absence of any gross muscular movements" (Richardson, 1967a, p.95).

2. External imagery - "... a person views himself from the perspective of an external observer (much like in home movies)" (Mahoney and Avener, 1977, p.137).

3. Internal imagery - "... requires an approximation of the real-life phenomenology such that the person actually imagines being inside his/her body and experiencing those sensations which might be expected in the actual situation" (Mahoney and Avener, 1977, p.137).

4. Immediate imagery - imagery practiced only prior to the post-test.

5. Long-term imagery - imagery practiced prior to each team practice session for a four week time period.

6. Relay Throw - a throw that is designated for a specific person that may be caught and thrown by another teammate to aid in making the original distance shorter for the thrower.
7. Cut-off man - the player that catches the relay throw and throws it to the intended destination.

8. Crow-hop - a movement that a baseball player usually performs before throwing a baseball to give him extra power on the throw. In basic movement terms, this is a gallop (step-slide) followed by a step and throw.
CHAPTER II

REVIEW OF LITERATURE

Mental practice or mental imagery is a psychological skill used extensively in sport psychology and athletics. Mental practice has been defined as "the symbolic rehearsal of a physical activity in the absence of any gross muscular movements" (Richardson, 1967, p.95) and it is a psychological technique used to enhance physical performance.

Mental imagery has had many names and theories associated with it. The topic of imagery has been investigated under a variety of other names: e.g., symbolic rehearsal (Sackett, 1934), imaginary practice (Perry, 1939), implicit practice (Morrisett, 1956), mental rehearsal (Whiteley, 1962), and conceptualizing practice (Egstrom, 1964).

Research in the field of mental imagery appeared as early as the last century. Wiggins (1984) mentioned a series of six research studies in the area of mental practice performed by physical educator William Anderson during the academic year of 1897-1898. Imagery has been effective in a variety of ways. Imagery has been proven to reduce Warm-Up Decrement (WUD) (Anshel & Wrisberg, 1988), control emotions (Murphy, Woolfolk, & Budney, 1988) and eliminate fear, loss of confidence, and negative self-appraisals in athletes (Rushall, 1988).
Imagery in Athletics

It was first suggested that there was a relationship between mental imagery and athletic performance by Twining (1949), and Vandell, Davis, & Clugston, (1943) (Burhans, Richman and Bergey, 1988). Since the 1940's, imagery has attracted a number of research studies (well over 100) attempting to discover it's actual effects on performance. Although the amount of research on imagery is abundant, absolute answers are not. The results of the research, as well as the factors influencing the results, are still inconclusive.

There are a number of studies (Andre & Means, 1986; Clark, 1960; Corbin, 1967; Gould, Weinberg, & Jackson, 1980; Hird, Landers, Thomas, & Horan, 1991; Mahoney & Avener, 1977; Richardson, 1967; Ryan & Simons, 1981; Zecker, 1982; Zeigler, 1987) that have indicated that imagery has a positive effect on performance. Richardson (1967a,b.), and Weinberg (1982) conducted reviews of the mental practice literature and concluded that mental practice was generally effective in enhancing performance. Further, Feltz and Landers (1983) conducted a meta-analysis of the mental practice literature, in which they looked at 60 studies, and reported that mentally rehearsing a motor skill influences performance somewhat better than no practice at all.

In contrast, Corbin (1972) reviewed the imagery literature and interpreted the research to be inconclusive.
Ryan, Blakeslee, & Furst (1986), and Epstein (1980), conducted studies in the imagery field and the results indicated that imagery had no positive effect on the subjects. Thus, as Zecker (1982) suggested, mental practice can prove to be a beneficial technique, although showing why it is beneficial is more difficult to discover.

Some of our best evidence for imagery’s effectiveness is anecdotal. On a number of occasions world class and professional athletes have announced their use of imagery in preparation for performance. "High performance athletes in various regions of the world who have made extensive use of mental-imagery training have found it effective in improving the quality and/or consistency of their performances" (Zhang, Ma, Orlick, & Zitzelsberger, 1992, p.230). Athletes such as high-jumper "Dick Fosbury, innovator of the Fosbury-Flop, never attempted a jump until he visualized himself successfully clearing the bar" (Burhans, Richman, & Bergey, 1988, p.26). Dwight Stones (Olympic high-jumper), Jean-Claude Killy (Olympic skier), and Jack Nicklaus (professional golfer) are just a few elite athletes who have advocated the use of imagery in their performances. A consideration of the effectiveness of imagery on elite athletes is their motivational level. An imagery program for an athlete at this performance level may be taken more seriously and practiced with greater enthusiasm due to the athlete’s intense nature and drive for perfection.
Inconsistencies of Imagery Research

One reason the imagery research is so ambiguous is the fact that investigations have relied on counting statistically significant and nonsignificant results from selected mental-practice studies rather than giving attention to individual use of imagery (Hird, Landers, Thomas, & Horan, 1991). It is difficult for this type of review to clearly show imagery’s true effectiveness. Sample size in research, is a major factor in determining statistical significance. Therefore, a study that had demonstrated consistent mental practice effects but had a small sample size may not have produced statistically significant results (Hird, et al., 1991). Suinn (1984) pointed out that an additional problem with the mental practice literature is the definition of mental practice itself. Mental practice has been defined so broadly that it includes merely thinking through a motor activity (Murphy, 1990).

A third reason for the inconsistent results is the lack of imagery training. Much of the research that has been conducted, has given little or no training to the subjects involved in the study. Imagery training has ranged from minutes (e.g., Epstein, 1980) to hours (e.g., Mumford & Hall, 1985) (Rodgers, Hall, & Buckolz, 1991). Mental practice may be more effective in producing performance enhancement if subjects are first trained in it’s use (Hird,
Landers, Thomas, & Horan, 1991). An explanation of imagery along with some suggestions for it's use, lead some experimenters to believe this was sufficient training to be tested on.

Imagery Training in Past Research

Rodgers, Hall and Buckolz (1991), suggested that their study in the field of mental imagery "represents the most extensive application of imagery training in an experimental field setting to date" (p.123). An extensive sixteen week study was conducted. The subjects met for two fifteen minute sessions per week, for twelve weeks of a sixteen week period.

Zhang, et al., (1992), conducted an imagery study that encompassed three 30 minute introductory sessions of imagery in the first week, two weeks of relaxation training, and three more weeks of imagery training. Imagery was practiced three times per week for approximately 6 minutes per session during the final three weeks. The latter two studies seem to be the exception in imagery training rather than the rule. Many researchers (Epstein, 1980; Feltz & Reissinger, 1990; Hird, Landers, Thomas, & Horan, 1991; Isaac, 1992; Lee & Hewitt, 1987; Ryan, Blakeslee & Furst, 1986; Ryan & Simons, 1981; Zecker, 1982; Zeigler, 1987) gave a brief introductory explanation of imagery, or used an audiotape to advise the subjects on imagery. Once informed, the subjects were then asked to perform this task (imagery) effectively,
with little to no practice. According to Goss, Hall, Buckolz, and Fishburne, (1986) everyone seems to have the ability to generate and use images, but not to the same degree. Subjects must be given a chance to learn and practice imagery before they can be tested on it. Rodgers, Hall and Buckolz (1991) demonstrated that "mental skills such as imagery can improve with practice" (p.123). Athletes need to practice physical skills to become proficient at them, thus psychological skills need to be practiced to be learned.

Motivation in Imagery

Motivation is another area that needs to be considered as a possible detriment to research performance. For example, Isaac (1992) reported that few studies cited in these reviews were conducted in actual field contexts using subjects who learned actual sport skills, under the same conditions and time periods in which sports activities are typically taught. Many of the imagery studies performed have taken place in university settings using university students as subjects. Much of the motivation of the subject is extrinsic; coming from some form of class credit issued to those who participate. Intrinsic motivation, coming from within a subject, is generally more effective due to the personal relevance to the individual. Many studies on imagery have used apparatus such as peg boards and pursuit rotors (Hird, Landers, Thomas, & Horan 1991), joysticks and
telegraph keys (Watters, & Bourgon, 1988), stabilometers (Ryan & Simons, 1981), and movement patterns (Goss, Hall & Buckolz, 1986) to test the effects of imagery on performance. It is difficult to motivate someone to perform well on skills that have no influence on learning and have no personal use to an individual once he/she leaves the laboratory.

**Internal and External Imagery**

Mahoney and Avener (1977), categorized imagery into the two components of internal and external imagery. The two types of imagery can be explained in terms of perspectives. External imagery is viewed by an individual from a third person perspective. In other words, the individual would see themselves performing as though they were watching the performance on television. Internal imagery is viewed from a first person perspective. In this type of imagery one would see the event being played as though one was actually performing it. Mahoney and Avener (1977) reported that while "all the finalists said they used imagery extensively..., the better athletes reported a higher frequency of 'internal' rather than 'external' images" (p.137). It should be noted that the research conducted by Mahoney and Avener, was strictly correlational in nature.

Based on Mahoney and Avener’s (1977) research, internal imagery is thought to be the most effective method of mental rehearsal. Prevalent in internal imagery is what is known
as kinesthetic feedback. The kinesthetic feedback that is received during internal imagery, stimulates the muscles in a similar way that actually performing the movement would. Evidence proving internal imagery is more effective than external imagery in producing muscular activity was provided by Hale (1982), and Harris and Robinson (1986). These studies demonstrated greater muscular activity during internal imagery as opposed to external imagery. Epstein (1980), on the other hand, had no significant differences in performance from internal and external imagery groups. Although Epstein’s (1980) study did not support Mahoney and Avener, it was observed that when trying to test the two imagery perspectives, it was difficult to describe subjects as strictly internal or external imagers because individual’s images varied considerably both within and between images. Hale (1982) and Harris and Robinson (1986) reported similar findings in their studies.

**Vividness and Controllability in Imagery**

Vividness and controllability of an image are factors that have been tested to see if there has been any significant effects on physical performance. Start and Richardson (1964) concluded that individuals scoring higher on vividness and controllability tests did not demonstrate greater performances than those individuals scoring lower on the same tests (Ryan & Simons, 1981). In accordance with Start and Richardson (1964), Weinberg, Seabourne, & Jackson
(1987) also concluded that there were no significant between-group differences found for any of the imagery measures with subjects generally reporting clear, vivid, controllable images.

In contrast, Corbin (1972), suggested that "imagery seems most effective in modifying behavior when it is vivid and under control" (Kendall, Hrycaiko, Martin, & Kendall, 1990, p.159). Supporting this belief are Ryan & Simons (1982) who concluded that the subjects in their study who reported "strong visual images showed more improvement than those with weak visual images, and those reporting strong kinesthetic images were better than those with weak kinesthetic images" (Goss, Hall, Buckolz, & Fishburne, 1986, p.469-470).

Associated with vividness and controllability of an image is the ability to utilize as many senses as possible. When practicing imagery, Arnold (1946) noted that combining visual and kinesthetic imagery was more effective than visual imagery alone. Similarly, Cautela and Kearney (1986) and Cautela and Samdperil (1989) believed that the greater the number of senses involved in imagery, the more the imagery would parallel real life situations.

Theories Explaining Mental Imagery

Many different theories have attempted to explain the processes of mental imagery. The most popular theories are the psychoneuromuscular theory, the symbolic learning theory, and the bio-informational theory.
In 1894, Carpenter, a pioneer in the field of imagery, believed that any idea that controlled the mind would be expressed in the muscles (Hale 1982). This theory was known as the "ideo-motor principle." Richardson (1967) later renamed this principle and labeled it the psychoneuromuscular theory (Hale 1982). Since Richardson, this explanation has also been referred to as the "muscle memory theory (Vealey, 1987), the feedback theory (Corbin, 1972), the muscle potential hypothesis (Mackay, 1981), and the mirror hypothesis (Feltz & Landers, 1983)" (Hecker & Kaczor, 1988, p. 364).

The psychoneuromuscular theory postulates that during imagery of a physical skill, "minute innervations" that are identical to the actual muscle movement, but weaker, take place in the involved muscles of that skill (Hecker & Kaczor, 1988). "This minute innervation is felt to consolidate the memory trace for the movement, resulting in a transfer to the physical practice situation" (Zecker, 1982, p.54). It is believed that during imagery practice, the imager receives visual and kinesthetic feedback that may be used to correct skill performance (Richardson, 1967).

Richardson (1967) reminds us that studies by Jacobson (1932) and Shaw (1940) have shown that the process of imagining a movement is associated with the presence of action currents in the muscle groups used in making the actual movement. More recently Hale (1986) and Harris and
Robinson (1986) supported this idea of muscular activity during imagery of a skill. Rather than a theory of explanation, the psycho-neuromuscular theory is now best looked upon as a strong component of an effective imagery program (Hecker & Kaczor, 1988).

The Symbolic-learning theory, originally explained by Sackett (1934), Morrisett (1956), and more recently by Feltz and Landers (1983), suggests that mental rehearsal provides the imager with a chance to rehearse the order of a physical skill as symbolic parts of a whole. According to this theory, "mental practice facilitates motor performance only to the extent that cognitive factors are inherent in the activity" (Feltz & Landers, 1983, p.45).

Symbolic learning has had a considerable amount of research (Feltz & Landers, 1983; Ryan, Blakeslee, & Furst, 1986; Ryan & Simons, 1981; Zecker, 1982; Zeigler, 1987) supporting it’s effectiveness. Researchers used skills that were primarily cognitive in nature (such as a maze) compared to skills that were primarily motor in nature (such as a stabilometer). For example, Ryan and Simons (1981) found that on a motor-cognitive continuum, the task near the cognitive end of the continuum was enhanced, whereas the task near the motor end of the continuum showed little or no improvement. These findings were compatible to those of Sackett (1934), and Morrisett (1956) (Ryan and Simons, 1981).
Ryan and Simons (1981) previously noted that very few motor skills failed to include cognitive elements. Almost all "perceptual motor skills" necessitate some degree of cognition. Sport skills such as a golf shot or a free throw in basketball can be broken down using cognitive descriptions, as shown by the detailed analysis found in most sport texts. Isaac (1992) demonstrated that imagery was an effective tool for improving complex motor skills such as trampolining.

The Bio-informational theory, also known as the information-processing model of imagery was developed by Lang (1977), and begins with the assumption that an image is a functionally organized, finite set of propositions stored by the brain.

In this model, the image descriptions include two fundamental parts; stimulus propositions and response propositions. According to Hale (1982), stimulus propositions are descriptors about stimuli (e.g., a black 25 lb. dumbbell), whereas response propositions are assertions about behavior (verbal responses, overt motor acts, and physiological organ responses, e.g., "tensing a muscle"). The images are also believed to include response instructions for the imager producing a pattern for physical responses. Lang's theory assumes that adjusting the desired behaviors either overtly or covertly will lead to a modification of the other (Murphy, 1990).
Experience and Skill Level in Imagery

The effects of experience and skill level have appeared quite often in the imagery literature. A number of authorities and researchers in the field (Feltz & Landers, 1983; Harris & Robinson, 1986; Hecker & Kaczor, 1988; Noel, 1980; Richardson, 1967; Weinberg, 1982; Zecker, 1982) have stated that subjects with higher skill level achieve greater results in imagery rehearsal than subjects with lower skill level.

Experienced athletes have already learned the motor sequence associated with successful performances. This information would, according to theory, be stored as a network of propositions in long term memory. Imagery rehearsal would involve processing of the memory network. The novice has no prototype for skillful performance in memory (Hecker & Kaczor, 1988, p.366).

Zecker (1982) theorized that if mental practice is introduced after minimal (or no) experience with the task, mental practice could very well prove detrimental, for the learner would not yet know the proper sequence of movements. If this theory is correct, an unskilled athlete practicing imagery could possibly strengthen incorrect techniques.
In some cases lower ability, less experienced athletes, have shown a decrement in performance from pre- to post-test with the use of imagery. Epstein (1980), Noel (1980), and Zecker (1982), indicated that people with less experience and expertise at "their" skill showed a decrease in performance. Epstein (1980) believed that the lesser skill of females made them more susceptible to being distracted instead of focused by the use of mental rehearsal.

Zeigler, (1987) on the other hand, demonstrated that not only did the experienced players not increase significantly on performance, but the less experienced players improved more significantly from pre- to post-test than all other groups. Results of this study, however, were in favor of experienced athletes in respect to long-term retention from imagery. It should be noted that in Zeigler's (1987) study, all of the subjects in the experiment had some previous experience.

Weinberg (1982) summed up the experience literature by stating that "It appears that mental practice can facilitate performance in both the early or latter stages of learning although subjects need to have some minimal amount of physical practice before mental practice can be effective, especially in a complex skill" (p.199).

Imagery research is in need of parameters for which experience can be categorized. Researchers have used the term experience on a number of occasions. What is lacking
in many of these occasions is a specific definition of what constitutes experience, little experience, and no experience. The lack of specific operational definitions can pose problems in the research. While some researchers may have labeled a group of subjects who have tried a skill for a short period of time as non-experienced, a different researcher may have labeled that same group as having little experience. Labeling specific categories of experience may lead to a reduction of inconsistencies in this area of research.

**Imagery with Physical Practice**

It has been proposed by some researchers (Corbin, 1967; Hecker & Kaczor, 1988; Isaac, 1992; Rogers, Hall, & Buckolz, 1991; Singer, 1972; Weinberg, 1982) that imagery may be most effective when it is combined with, and not used in place of physical practice. Researchers (Hird, Landers, Thomas, & Horan, 1991; and Feltz, Landers, & Becker, 1988) however, have indicated that mental practice combined with physical practice was not as effective as physical practice alone (from Hird, et al., 1991). Further, Weinberg, Hankes, and Jackson (1991) found that "none of the mental/physical practice groups performed significantly better than the physical practice group which had no mental practice" (p.10).
Time In Imagery

Time in imagery has been investigated in two ways; how long and when to practice. According to Feltz and Landers (1983), the practice sessions that showed the greatest amount of mental practice effects, were under one minute, or between fifteen to twenty minutes. According to Twining (1949), mental practice sessions should not exceed five minutes if concentration is to be maintained, while Weinberg, Hankes, and Jackson (1991) found "that there were no significant performance differences between the 1, 5, and 10 minute mental preparation periods" (p.10). These results concur with those of Caudill and Weinberg (1983), and Weinberg, Gould, and Jackson (1981). Thus, it does not appear that the length of the mental preparation period is a critical variable in determining it's effectiveness on subsequent performance.

On a scale of practice trials, Feltz and Landers (1983) also mention that trials under six, or between thirty-six and forty-six, produced the largest effect sizes. In this same report, Feltz and Landers (1983) noted that "motor and strength tasks generally required many more trials/minutes (than cognitive tasks) to achieve large effect sizes" (p.42).

The best time to practice imagery has not yet been determined. The Weinberg et al., (1991) results demonstrated that whether mental practice came before or
after physical practice had no significant impact on performance of the basketball shooting task.

Age In Imagery

The age of the subjects in imagery research has generally recognized the adult population. Research is now beginning to broaden the ages for which imagery is studied. Wrisberg and Anshel (1989) studied forty boys ranging from 10.2 - 12.4 years of age. The study revealed that young athletes are able to learn and employ mental training techniques to enhance their performance not unlike elite athletes. Zhang, et al., (1992) concluded "that children who used mental imagery experienced significantly greater improvement in the accuracy and technical quality of their shots than the children in comparison groups" (p.230).

According to Zhang, et al., (1992) the use of mental imagery, and mental training in general, may be particularly promising for children because it offers an opportunity to learn mental skills at an early age.

Summary

The review of the literature indicated a void in research on the important factor of imagery effectiveness due to imagery training and practice. The lack of training in imagery research has raised the question: Will long term training of imagery be more beneficial to improving a skill than the immediate practice of imagery only?.
Rodgers, Hall & Buckolz, (1991) performed an extensive imagery training program in their study proving at that time that "there still does not appear to be a very large or direct impact of the training on performance" (p.123). Zhang et al., (1992), documented that subjects in the imagery training group demonstrated significantly greater improvements in performance than those subjects not receiving imagery training. Clearly, more research in this area is necessary.

Based on this review and the existing need for imagery training research, it was hypothesized that long-term practice of imagery combined with immediate imagery practice would enhance an athlete's performance significantly greater than practicing immediate imagery only, or not practicing imagery at all. Thus, this study attempted to determine if imagery is a skill that needs to be practiced to become effective.
CHAPTER III

METHOD

Purpose of Study

The purpose of this study was to determine if long-term practice and training of mental imagery skills is more beneficial to an athlete than immediate imagery rehearsal practiced only prior to an event.

Subjects

The subjects were thirty males ranging in age from fifteen to eighteen (mean age = 16.6 yrs. old). The average height and weight of the subjects was 68.9 inches and 161.5 pounds. All subjects were members of a varsity and junior varsity high school baseball team. The subjects received no compensation for participation. Participation was strictly voluntary. Each subject was given a consent form that was signed and returned to the experimenter. Any athlete who was under the age of eighteen years had a parent's or guardian's approval and signature.

Design

Subjects were matched by baseball skill and randomly assigned to one of the following three conditions: (1) long-term imagery training and practice (subjects were trained in imagery for two weeks before practicing for five minutes prior to each baseball practice session for a period of four weeks) with immediate imagery practice (imagery was
practiced during testing) -- Group A; (2) immediate imagery practice only (imagery was practiced only prior to and during the testing of the skill at the final post-test) -- Group B; and (3) control -- Group C.

The total experimental time was six weeks in duration. The first two weeks of the study were devoted to introductions and imagery training for Group A. The first two weeks for Groups B and C consisted of introductions followed by experimental procedures. Four weeks of this study consisted of imagery practice for Group A and a continuation of the experimental procedures for Groups B and C. Group B was introduced to imagery prior to the post-test on the final day of week six. The post-test was administered on the final day of the study. Following the post-test, questionnaires were completed by all subjects.

This study utilized a 3 x 3 factorial design (treatment conditions x trials). Scores were analyzed by conducting an analysis of variance (ANOVA) with repeated measures on the final factor. Alpha was established at .05.

Performance measure. The throwing test required each subject to throw a baseball ten times at a large target (117" in diameter) hung against the home plate backstop 110 feet away. The center of the bull’s-eye was set at a height of 60" (five feet). The center bull’s-eye was the approximate size (9") and color (brown) of an infielder’s glove. The nine concentric circles surrounding the bull’s-
eye were each six inches in width. Point values ranging from ten (bull’s-eye) to one (circle furthest away from bull’s-eye) were awarded for each strike of the target made by a player. If a subject missed the target, a zero was awarded for the throw. Total points ranged from 0 (no hits of the target) to 100 (10 consecutive bull’s-eyes). The 110 foot distance was an estimated average relay throw for a high school athlete. This estimate was based on the suggestion of the experienced head baseball coach.

**Performance task.** The ball used in this experiment was a regulation New Jersey high school baseball. The assistant handed each ball to the subjects before every throw. Points scored were assigned visually by the experimenter. Chalk was used to ensure an imprint on the target at the spot of impact. Once the subjects had a grip on the baseball, the ball was dipped in chalk powder on the side of the baseball furthest away from the subject’s fingers. The ball was chalked by the subject before each throw. To prevent the chalk from hindering a subject’s throw, the baseball’s were wiped off with a cloth at the completion of each throw.

The subjects began with their throwing hand, still holding the ball, in their glove. The subjects then performed a crow-hop (see definition of terms), to simulate game play, before throwing the ball. To aid in the realism of a cut-off man, before each throw, the experimenter stood in front of the target with a glove in the exact spot of the
bull’s-eye. The experimenter’s glove was resting gently against the target’s bull’s-eye. Once the ball was released, the experimenter quickly moved aside to get the reading of the ball’s impact on the target and to record the score. The target was wiped clean after each throw. A thirty-second interval was used between throws. The throwing task was performed as a pre-test, at the end of week three, and on the final day of week six.

Procedure

As the subjects entered the team room, they were welcomed by the experimenter. All subjects were handed an informed consent form. This form contained a brief description of the experiment as well as information concerning the rights of the subject. The subjects that were eighteen years of age or older signed the form at that time. Subjects under the age of eighteen had a parent or guardian sign and return the form before testing began.

Pre-test. A pre-test of the throwing skill was given. The pre-test scores were collected, recorded and evaluated as a baseline for comparison at the conclusion of the study. The pre-test scores also were used as a technique to match players by skill (accuracy in throwing). Players were matched by ability prior to random assignment to treatment conditions to protect against the unlikely event that all highly skilled players were randomly assigned to one condition. The point values (ranging from 0-10) for each of
the subject's ten throws were totaled and used to match the players by score. Once matched, each of the subjects were randomly assigned to treatment conditions. The investigator met with each group separately. Subjects were asked to not speak of their role in the experiment until the study had been completed.

Group A - Long Term Imagery with Immediate Practice. The imagery training was two weeks in duration (six meetings). On day one of imagery training, subjects were introduced to the area of mental imagery. The introduction was followed by an explanation of imagery which included the benefits of imagery, as well as tips on imagery usage. The experimenter explained that imagery is a form of mental practice that is to be used in conjunction with physical practice. Internal and external imagery protocols were explained (see definition). Following the introduction and explanation, a discussion period was made available to the subjects to answer any questions they had at that time.

Scenes related to baseball were described for each subject to visualize. This imagery practice "test" was performed to give the subjects a chance to try imagery as well as test their imagery ability. The subjects were instructed to imagine the scene as clearly as possible. The scenes for the imagery ability test contained both internal and external cues. Some scenes were directed toward internal imagery ("smell" and "feel"), while other scenes
were directed toward external ("see") imagery. These scenes were chosen to help the subject discover which imagery perspective (internal/external), if any, was preferred. In addition to testing imagery ability, this imagery practice gave the subjects insight and knowledge about their own imagery experience.

The subjects were asked to close their eyes and imagine themselves standing on the baseball field. The subjects were then asked to "see" the clear blue sky, the green grass, the brown dirt, themselves standing on a baseball field, and a teammate throwing a baseball toward them. The subjects were asked to "smell" the fresh air, the freshly cut grass, and their oiled glove. Lastly, the subjects were asked to "feel" the grass under their spikes, the dirt under their spikes, the soft wind as it came up the hill through the trees, and the tension in their muscles as they prepared to catch a thrown ball.

The subjects were then asked to answer a questionnaire (Appendix B) to rate their imagery experience. The subjects rated their image clarity on a scale of 1-5. One represented difficulties and little imagery experienced. Five represented good, clear imaging with no difficulties. If a subject was able to imagine the scenes with little difficulty, and "visualized" a clear scene, that subject rated the experience a four or five. If a subject had trouble "visualizing" the scenes and could not focus on the
appropriate cues, the subject rated the experience a one or two. The imagery vividness test was performed on days one, three and six of training. The questionnaires were used to determine if training was helpful in imagery acquisition. Closing comments were made to complete day one of training.

Day two began with a review of day one. The first imagery practice in which the subjects participated was one of a positive, non-threatening scene (ie., a favorite place or a favorite experience). This first imagery scene was chosen by each subject individually. The next scene involved imagery practice using details related to the baseball team room. If a subject was having difficulty visualizing the team room, he was instructed to open his eyes to reinforce or confirm his image. The subjects were then handed a baseball. Subjects were instructed to hold the baseball in one hand and their glove in the other. Subjects were instructed to notice as many details about each object as they could. Details that were suggested were the size, the weight, the color and any other distinguishable characteristics of the ball and glove. Subjects were then instructed to place the objects on the floor in front of them. Once the objects were on the floor, the subjects were asked to visualize the ball and glove as best they could. A discussion period followed the imagery practices.
Day three of the imagery training began with subjects visualizing the team room. The experimenter had the subjects start in the team room so the images could be reinforced. This reinforcement was performed in an attempt to build confidence in the subjects' ability to image. The subjects then imaged themselves standing up and walking out of the team room, walking down the hallway in the direction of the gymnasium, "looking" into the weight room before descending the stairs, and walking into the gym. Subjects were further instructed to visualize picking up a baseball from the ball bag and throwing it to a partner. If a subject's concentration was lost, or, if the subject had difficulty following the scene, he was instructed to continue visualizing from the point where he lost focus. If it was too difficult for a subject to continue from where he lost focus, he was instructed to begin visualizing back in the team room. The imagery practice "test" was given at the conclusion of the training on day three. The vividness questionnaire was completed following the practice.

On day four of the imagery training, subjects were taken to the baseball field. Subjects were instructed to notice all the details of the field, including how the grass felt under their spikes, how the dirt felt under their spikes, how the air smelled, how the grass smelled, how the grass looked, how the sky looked, and how the dirt looked. Subjects were instructed to sit on the ground in a comfort-
able position while visualizing all the details they had just noticed. Then, subjects were instructed to stand and physically throw a baseball three times to a partner in the group. Subsequently, subjects were instructed to sit back down and visualize throwing and catching the baseball until the experimenter said time. A discussion period was held at the end of the session.

Day five of the training involved rehearsal of a guided imagery scene that was developed by Epstein (1980). Changes in Epstein’s script were made to make it applicable for this particular study. The subjects were instructed to follow the scene as closely as possible, stressing a successful outcome. Each subject had the option to imagine the guided imagery internally or externally.

The script read as follows:

I want you to imagine yourself as you walk onto the field with your glove on your hand. Now imagine yourself walking off of the field. Once again, imagine yourself walking back onto the field. Try to make this image as clear as possible. Imagine yourself picking up a baseball with your glove hand. Now imagine yourself as you look up to the cut-off man to make your throw. Imagine yourself turning your body into position as you take your crow-hop. As you crow-hop, imagine your glove hand moving across the front of your body, as your throwing hand enters your mitt to grab
the ball. Imagine the stitches on the ball. Imagine your body weight shifting from your back foot to your front foot as your arm begins it’s throwing motion. Imagine your body rotating as your arm whips forward and you release the ball with a snap of your wrist. Imagine your follow through as you look at your target to "see" a successful throw to your cut-off man. (10 second pause.) Let’s do that again. Imagine yourself picking up another baseball. Now go through the motions of throwing the ball to your cut-off man, just as we did earlier. Take your time and do it now. (10 second pause.) For the next few minutes I want you to simply practice throwing the baseball to your cut-off man. Try to observe every detail relevant to throwing a baseball. If you have any trouble imagining this, just pause, relax and continue to practice it. Like any other skill, it will come more easily with practice. Begin throwing the baseball to your cut-off man until I tell you to stop. (approximately 3 min. pause.)

A discussion period was held at the end of the session.

On day six of the imagery training, subjects followed the guided imagery scene. Following the guided imagery practice, the subjects participated in the imagery practice "test." At the completion of the imagery practice, the vividness questionnaire was administered.
If at any time a subject had difficulty with the imagery experience, the experimenter met with him to determine the nature of the specific problem. The experimenter gave suggestions to the subjects to assist them in improving their imagery ability.

Due to the possibility that an imagery experience will never be the same for any two people (Murphy, 1990), the experimenter met with each subject in Group A individually, to explore the subject’s interpretation of his own image. The subjects in Groups B and C also met with the experimenter individually to eliminate any treatment bias, although they were asked to respond to questions on how they felt on that specific day.

Imagery practice began for Group A on the first day of baseball practice following the imagery training. The subjects in Group A met for five minutes at the beginning of each practice to rehearse their imagery scene. The start of practice was chosen for this group because the experimenter believed that the subjects would be "fresh" and motivated, making it easier to develop clear, vivid, and controllable images.

At the completion of each imagery practice, there was a brief discussion period, wherein the subjects could discuss the images they visualized, whether they had a problem with the image, or sharing of ideas.
For testing procedures, the subjects were instructed to practice the same imagery scene they had been practicing for the previous four weeks. At the time of testing, the subjects practiced the imagined skill until they had successfully completed one perfect throw at the target. If a perfect throw could not be imagined, the subjects were instructed to imagine hitting the target as best they could.

**Group B - Immediate Imagery Practice Only.** The immediate imagery group met for the first time as a group during week one of the study. In this meeting, the subjects were informed of their role in this study. Specifically, subjects were told that the coaching staff was looking at the effects of attitude or emotion on physical performance. The experimental condition for this group began during week one (while the subjects of group A went through imagery training) and continued through week six. The experimenter met with this group at the beginning of practice to discuss how subjects mentally felt that day, and if they believed their attitude would effect their performance. Prior to the final post-test, the subjects in Group B were given the same introduction and explanation about imagery that Group A had received. The subjects practiced the imagery at the time of the introduction, and prior to each throw of the post-test. Group B was given the same post-test instructions that Group A received for imagery practice.
Group C - Control. To control for placebo effects, control subjects met with the experimenter for five minutes at the beginning of each practice session. The subjects in this group followed the same procedure as Group B, with the exception of the introduction to imagery. During the post-test the subjects in Group C were asked questions, by the assistant, related to baseball situations that required verbal responses. This form of distraction was used in an attempt to prevent the subjects from performing mental imagery during the post-test.

Post-experimental questionnaires. At the conclusion of the post-test, each subject was asked to complete a post-experimental, 1-11 Likert scale, questionnaire (Appendix C). The questionnaire was used to ascertain if subjects other than those in Group A participated in imagery practice during the study. The questionnaires also tapped information related to a subject’s experience level and relaxation level during testing. The latter information was used only to better understand the subjects performance. A second post-experimental questionnaire (Appendix D) was completed by the subjects of group A. This questionnaire was helpful in checking the commitment of the subjects toward imagery during the experiment. Once all of the information was collected, the subjects were informed of all experimental details. Subjects interested in more
information on the topic of imagery were provided with appropriate information.

Statistical Analyses

Performance scores were analyzed by a $3 \times 3$ (treatment conditions x tests) analysis of variance (ANOVA) with repeated measures on the final factor. Significance was established at the .005 (.05/11) level. A one-factor ANOVA was conducted to analyze questionnaire data.
RESULTS AND DISCUSSION

Results

The purpose of this study was to determine if long-term practice and training of mental imagery skills of a baseball performance is more beneficial to an athlete than immediate imagery rehearsal practiced only prior to an event. Scores were analyzed using a 3 x 3 ANOVA with an alpha level set at .05.

The subjects were 30 male high school athletes. Age, height, and weight were recorded for each subject. Table 1 displays these demographic data.

Table 1
Mean and Standard Deviations For Demographic Variables of High School Baseball Players

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Range</th>
<th>MEAN</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>AGE</td>
<td>30</td>
<td>15-18 years</td>
<td>16.60</td>
<td>.93</td>
</tr>
<tr>
<td>HEIGHT</td>
<td>30</td>
<td>64-74 inches</td>
<td>68.90</td>
<td>2.23</td>
</tr>
<tr>
<td>WEIGHT</td>
<td>30</td>
<td>138-194 pounds</td>
<td>161.57</td>
<td>14.22</td>
</tr>
</tbody>
</table>

Scores obtained from the baseball throwing task (for accuracy and distance) over three different test periods (pre-test, week 3, post-test) were not statistically significant for any of the three treatment conditions.
These data are presented in the following table:

Table 2

Baseball Performance Data

<table>
<thead>
<tr>
<th>GROUPS</th>
<th>N</th>
<th>MEAN</th>
<th>SD</th>
<th>MEAN</th>
<th>SD</th>
<th>MEAN</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>10</td>
<td>34.2</td>
<td>13.82</td>
<td>35.9</td>
<td>13.35</td>
<td>34.8</td>
<td>16.17</td>
</tr>
<tr>
<td>B</td>
<td>10</td>
<td>34.6</td>
<td>12.83</td>
<td>28.2</td>
<td>12.08</td>
<td>27.6</td>
<td>8.87</td>
</tr>
<tr>
<td>C</td>
<td>10</td>
<td>35.3</td>
<td>12.49</td>
<td>42.0</td>
<td>12.61</td>
<td>35.3</td>
<td>9.42</td>
</tr>
<tr>
<td>TOTAL</td>
<td>30</td>
<td>34.7</td>
<td>12.61</td>
<td>35.4</td>
<td>13.53</td>
<td>32.6</td>
<td>12.08</td>
</tr>
</tbody>
</table>

Thus, long term imagery combined with immediate imagery practice, immediate imagery practice only, and control groups performed at the same level.

A post-experimental questionnaire related to use of imagery beyond the experimental protocol was administered to all groups at the completion of the final performance post-test. Analysis of these data revealed significant group differences for two of the ten responses. Specifically, question 1, "How much mental imagery did you use during this experiment?," and question 3, "How much mental imagery did you use during the post-test?," resulted in group differences and are reflected in Table 3.
Table 3

Imagery Usage Questionnaire

<table>
<thead>
<tr>
<th></th>
<th>Post-experimental Questionnaire Item 1</th>
<th>Post-experimental Questionnaire Item 3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MEAN</td>
<td>SD</td>
</tr>
<tr>
<td>A</td>
<td>8.6</td>
<td>1.4298</td>
</tr>
<tr>
<td>B</td>
<td>6.3</td>
<td>1.6364</td>
</tr>
<tr>
<td>C</td>
<td>6.4</td>
<td>1.4298</td>
</tr>
<tr>
<td>TOTAL</td>
<td>7.1</td>
<td>1.8071</td>
</tr>
</tbody>
</table>

With regard to the use of imagery prior to actual baseball performance, the ANOVA for item 1 demonstrated that although Groups B and C did participate in the use of imagery, (Group C -- without imagery instruction) during the experiment, Group A used significantly more imagery ($F(2,30)=7.493, p = .003$) throughout this experiment than did Groups B and C. On item 3, the subjects in Groups A and B used significantly more imagery ($F(2,30)=7.768, p = .002$) during the performance post-test than the subjects of Group C. Group C was the only group in the experiment that was not formally introduced to imagery during the experiment.

The Imagery Commitment Questionnaire was administered only to subjects in Group A who had engaged in long term imagery training and immediate imagery practice before performance. The questionnaire (Table 4) tapped into a number of variables related to imagery skills, commitment to the treatment condition and ability to grasp imagery scenes.
Table 4

**Imagery Commitment Questionnaire (Group A -- only)**

<table>
<thead>
<tr>
<th>QUESTION</th>
<th>WEEK</th>
<th>MEAN</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>8.3</td>
<td>.95</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>3.9</td>
<td>1.79</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>6.6</td>
<td>2.72</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>7.8</td>
<td>1.99</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>8.9</td>
<td>1.10</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>9.7</td>
<td>1.25</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>6.1</td>
<td>1.45</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>4.1</td>
<td>2.33</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>8.8</td>
<td>1.14</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>8.6</td>
<td>1.51</td>
<td></td>
</tr>
</tbody>
</table>

Scores reported for items 1 and 2 indicated that subjects were committed to and could follow the specific imagery scenes. Items 3 through 6 focused on subjects ability to follow the guided imagery scenes from week one through week four.

The results would seem to indicate that the subjects were able to follow the imagery scene to a greater degree as the repetition of practice increased. From week one, to week four, the subjects' mean scores increased from 6.6 to 9.7.

Item 9 referred to subjects' commitment to learning and practicing imagery techniques, while item 10 referred to subjects' total commitment to practice the guided imagery scene. Mean scores of 8.8 and 8.6, respectively, suggest a high commitment on the part of subjects in Group A. The Imagery Vividness Questionnaire (Table 5) demonstrated the potential of the subjects to increase their visual and
kinesthetic imagery abilities. Although some scores decreased from Test 1 to Test 2, all scores increased from Test 1 to Test 3. This may be an indication that imagery is a skill that can be improved with practice.

Table 5

Imagery Vividness Questionnaire (Group A -- only)

<table>
<thead>
<tr>
<th>QUESTION</th>
<th>TEST 1</th>
<th>TEST 2</th>
<th>TEST 3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MEAN</td>
<td>SD</td>
<td>MEAN</td>
</tr>
<tr>
<td>1</td>
<td>3.8</td>
<td>.92</td>
<td>4.4</td>
</tr>
<tr>
<td>2</td>
<td>4.2</td>
<td>.42</td>
<td>4.4</td>
</tr>
<tr>
<td>3</td>
<td>4.1</td>
<td>.88</td>
<td>4.5</td>
</tr>
<tr>
<td>4</td>
<td>3.7</td>
<td>1.06</td>
<td>4.4</td>
</tr>
<tr>
<td>5</td>
<td>3.9</td>
<td>.99</td>
<td>4.4</td>
</tr>
<tr>
<td>6</td>
<td>3.6</td>
<td>1.26</td>
<td>4.2</td>
</tr>
<tr>
<td>7</td>
<td>3.4</td>
<td>1.07</td>
<td>3.6</td>
</tr>
<tr>
<td>8</td>
<td>2.6</td>
<td>1.17</td>
<td>2.9</td>
</tr>
<tr>
<td>9</td>
<td>3.9</td>
<td>1.66</td>
<td>4.2</td>
</tr>
<tr>
<td>10</td>
<td>4.2</td>
<td>1.40</td>
<td>4.2</td>
</tr>
<tr>
<td>11</td>
<td>4.2</td>
<td>1.32</td>
<td>3.7</td>
</tr>
<tr>
<td>12</td>
<td>3.4</td>
<td>1.35</td>
<td>3.2</td>
</tr>
</tbody>
</table>

Discussion

There may be a number of reasons for the non-statistically significant results achieved in this study. First, although there has been a sparsity of research conducted to determine the effectiveness of imagery on performance for subjects who have been exposed to imagery training, it is possible that such training and/or practice of imagery skills (Corbin, 1972; Epstein, 1980; Ryan, Blakeslee, & Furst, 1986) does not enhance one’s ability to effectively use imagery or is even needed to develop and become actively involved in imagery rehearsal. Intuitively,
imagery training would seem to help develop the imagery skills necessary for improved performance, however, imagery may not be as complicated as sport psychologist's (Vealey, 1988; Weinberg, 1982) make it out to be. For example, Vealey (1988) has suggested that athletes might focus on the imagery methods and lose sight of the skills they are designed to facilitate. Many athletes who use imagery prior to a performance use it instinctively. These athletes who use imagery, and endorse it's effectiveness, may have a natural proficiency for this skill and may have learned it unconsciously without the need of training.

Further, from the acquisition literature, it is known that for efficient transference of a physical skill to occur, similar task stimuli are required. Thus, "learning different or incompatible responses to identical stimuli usually results in initial negative transfer" (Sage, 1984, p.330). The learning and transference of a psychological skill, such as imagery, may parallel the learning acquisition of a physical skill and be task specific rather than general (e.g., imaging the team room). The training program, in which Group A took part, stressed increasing the subjects general imagery ability. If psychological skills do parallel physical skills, the first week of the imagery training program would have been unrelated to the task tested. In other words, the first week of imagery training may have helped develop the general imagery ability of the
participating subjects, while doing nothing to develop the imagery ability of the athletes who would perform the throwing task. It may be necessary when training an individual in mental imagery skills to be task specific from the onset. If an athlete needs assistance in hitting, the imagery program should begin and concentrate solely on hitting.

It is interesting to note that while the majority of a baseball team will have to throw the baseball a distance of approximately 110 feet at some point in a game, each member of the team does not have to throw to a cut-off man. Therefore, from a retrospective analysis, the throwing skill tested, and the imagery in which subjects engaged may not have been applicable for the majority of the team. The imagery rehearsal and the accuracy throwing task was specifically set up for an outfield relay throw. Outfielders, unlike infielders, pitchers, and catchers, are in the habit of throwing the baseball to a cut-off man. Seven of the ten subjects in Group A were not outfielders. Similarly, the two starting catchers on this high school team had two of the lowest performance scores recorded. These low scores are not an indication of poor throwing arms. Both of these catchers have very good throwing arms, but catchers are in the habit of throwing the ball down to the base when a runner is stealing. If a catcher throws the ball high, the runner is safe. It is possible that a
catcher may instinctively, when under the pressure of someone yelling "go," throw the ball down toward the base (or the lower portion of the target), where it must be in a game situation. Thus, it seems that greater attention should have been given to past playing experience by player position before assignment to treatment conditions.

An assumption could be made that the reduction in throwing performance was, in part, caused by physical rather than psychological factors. For example, the teams played 25 regular season games in two months. In the latter part of the season, state and county playoff games were interspersed with regular season games. In the final three weeks of the season, the team had only two or three days off per week. This type of schedule can be very demanding on a player when the high school has only 15 players on each team. The final post-test was performed on the final Friday (one of the day's off) of the second to last week of the season. Although a manipulation check on physical fatigue was not in the post-experimental questionnaire, many of the players remarked that their arm had been bothering them prior to the post-test.
CHAPTER V

SUMMARY, RESULTS, CONCLUSIONS, AND RECOMMENDATIONS

Summary

This study was designed to determine if long term training of mental imagery skills is more beneficial to an athlete than immediate imagery rehearsal practiced only prior to an event. It was hypothesized that long term practice of imagery skills would lead to a more effective baseball throw for distance and accuracy than immediate imagery rehearsal used only prior to performance. The subjects were 30 male high school athletes whose age ranged from 15 to 18 years. All subjects played on the varsity or junior varsity high school baseball team.

Each subject was pre-tested, matched by playing ability, and then randomly assigned to one of three conditions: (1) long term imagery training and practice -- Group A; (2) immediate imagery practice only -- Group B; and (3) control -- Group C. The total experimental time was six weeks in duration. For Group A, the first two weeks of the study were devoted to introductions and imagery training skills that would lead to clear, vivid, and controllable images. Subsequently, subjects imaged a successful throw of the ball to a target. The first two weeks for Groups B and C consisted of introductions followed by experimental
procedures. Four weeks of this study consisted of imagery practice for Group A and a continuation of the experimental procedures for Groups B and C. Group B was introduced to imagery prior to the post-test on the final day of week six. The post-test was administered on the final day of the study. Following the post-test, questionnaires related to use of imagery skills were completed by all subjects.

The performance task was an accuracy throwing test, in which each subject threw a baseball ten times at a large target (117" in diameter) that was hung 110 feet away. Point values ranging from 10 (bull’s-eye) to 1 (circle furthest away from bull’s-eye) were awarded for each strike of the target made by a player. If a subject missed the target, a zero was awarded for the throw. Total points ranged from 0 (no hits of the target) to 100 (10 consecutive bull’s-eyes). This throwing accuracy task was performed as a pre-test, a mid-test, and a post-test.

The study utilized a 3 x 3 factorial design (treatment conditions x trials). Scores were analyzed by conducting an analysis of variance (ANOVA) with repeated measures on the final factor. Alpha was established at .05. A one-factor ANOVA was conducted to analyze questionnaire data.

Results

The results of the study revealed that no statistically significant differences over the three test periods existed for any of the treatment conditions. Thus, long term imagery combined with immediate imagery practice, immediate
imagery practice and control groups performed equally well on the throwing task.

Data from post-experimental questionnaires yielded the following results:

1. Subjects in all treatment groups used imagery prior to the baseball throwing performance, although the imagery training group (Group A) used more imagery than Groups B and C;

2. Subjects in Groups A and B employed imagery techniques to a greater extent during performance on the post-test than the control group (Group C);

3. Subjects in long term imagery training and practice were committed to the imagery protocol, could develop specific imagery scenes, and increased their visual and kinesthetic imagery abilities.

Conclusions

The following conclusion is derived from the present study:

The beneficial effects on physical performance of long term imagery training combined with immediate imagery practice is similar to the traditionally employed tactic of imagery rehearsal immediately prior to a performance.

Recommendations

Based on the results of the present study, the following recommendations are made for future investigations:
1. Replicate the study, but increase the sample size for treatment conditions;
2. Conduct a similar study with long term imagery training techniques that are task-specific and player position-specific.
APPENDIX A

INFORMED CONSENT
INFORMED CONSENT

The present investigation will examine the effects of mental preparation on performance. Each subject will be asked to throw a baseball ten times at a target 110 feet away. This task will be performed once at the beginning of the study (pre-test), once in the middle of the study and once at the end of the study (post-test) six weeks later. During the six week experimental period, each group will meet with the experimenter for approximately five minutes each practice to rehearse their mental preparation strategy. An honest and complete effort is asked of each subject to aid in the accuracy of the test results. All scores will be combined and reviewed as group data. All names and scores will be kept confidential. A subject may withdraw from the experiment at any time during the study without prejudice. At the conclusion of the post-test, the completion of a questionnaire will be required as the final step. Truthful and honest responses will be expected of you on the questionnaires. No harmful effects, mentally, physically or emotionally will result from this study. As the experimenter, I will be available to answer any questions subjects or guardians may have.
INFORMED CONSENT

Name of Subject:__________________________________________

I have heard (or read) and understand the procedures involved with this experiment. I further understand that the risk involved is minimal and that I may relinquish my involvement at any time without prejudice or penalty. In understanding this I give my consent to participate in this investigation conducted by James D. Freeman.

_________________________  Signed:__________________________
Date                              Subject

_________________________  Signed:_________________________
Date                              Person Responsible

_________________________  Signed:_________________________
Date                              Witness

If the subject is a minor under the age of eighteen (18) years of age, the person responsible is the mother, father, or legal guardian.
APPENDIX B

VIVIDNESS TESTING QUESTIONNAIRE
VIVIDNESS TESTING QUESTIONNAIRE

1 = difficulty imaging scene / 5 = clear defined images

1. How well can you see the clear blue sky?
   1 2 3 4 5

2. How well can you see the green grass?
   1 2 3 4 5

3. How well can you see the brown dirt?
   1 2 3 4 5

4. How well can you see yourself standing on the baseball field?
   1 2 3 4 5

5. How well can you see your teammate throwing a baseball toward you?
   1 2 3 4 5

6. How well can you smell the fresh air?
   1 2 3 4 5

7. How well can you smell the freshly cut grass?
   1 2 3 4 5

8. How well can you smell your oiled glove?
   1 2 3 4 5

9. How well can you feel the grass under your spikes?
   1 2 3 4 5

10. How well can you feel the dirt under your spikes?
    1 2 3 4 5

11. How well can you feel the soft wind as it blows over the hill?
    1 2 3 4 5

12. How well can you feel the tension in your muscles as you prepare to catch a thrown baseball?
    1 2 3 4 5
APPENDIX C

IMAGERY USAGE QUESTIONNAIRE
POST EXPERIMENTAL QUESTIONNAIRE

1 = Low / 11 = High

1. How much mental imagery did you use during this experiment?
   1 2 3 4 5 6 7 8 9 10 11

2. How much mental imagery did you use during the pre-test?
   1 2 3 4 5 6 7 8 9 10 11

3. How much mental imagery did you use during the post-test?
   1 2 3 4 5 6 7 8 9 10 11

4. How much internal imagery did you practice?
   1 2 3 4 5 6 7 8 9 10 11

5. How much external imagery did you practice?
   1 2 3 4 5 6 7 8 9 10 11

6. How much baseball experience have you had?
   1 2 3 4 5 6 7 8 9 10 11

7. How much high school varsity experience have you had? (years)
   1 2 3 4

8. How relaxed were you during the experiment?
   1 2 3 4 5 6 7 8 9 10 11

9. How relaxed were you during the pre-test?
   1 2 3 4 5 6 7 8 9 10 11

10. How relaxed were you during the post-test?
    1 2 3 4 5 6 7 8 9 10 11
APPENDIX D

IMAGERY COMMITMENT QUESTIONNAIRE
POST EXPERIMENTAL QUESTIONNAIRE
1 = Low / 11 = High

1. How often did you imagine the appropriate scene during imagery training?
1 2 3 4 5 6 7 8 9 10 11

2. How much did your image differ from the appropriate scene during imagery training?
1 2 3 4 5 6 7 8 9 10 11

3. How much did you follow the guided imagery scene during week one of the imagery practice?
1 2 3 4 5 6 7 8 9 10 11

4. How much did you follow the guided imagery scene during week two of the imagery practice?
1 2 3 4 5 6 7 8 9 10 11

5. How much did you follow the guided imagery scene during week three of the imagery practice?
1 2 3 4 5 6 7 8 9 10 11

6. How much did you follow the guided imagery scene during week four of the imagery practice?
1 2 3 4 5 6 7 8 9 10 11

7. How often did you practice imagery outside of the scheduled imagery practice?
1 2 3 4 5 6 7 8 9 10 11

8. How often did you practice the guided imagery scene outside of the scheduled imagery practice?
1 2 3 4 5 6 7 8 9 10 11

9. How committed were you in learning how to practice imagery?
1 2 3 4 5 6 7 8 9 10 11

10. How committed were you to practicing the guided imagery scene?
1 2 3 4 5 6 7 8 9 10 11
APPENDIX E

ACTUAL PERFORMANCE SCORES
Table 6
Baseball Performance Data

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APPENDIX F

ACTUAL POST-EXPERIMENTAL QUESTIONNAIRE SCORES
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