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Effects of Video and Cognitive Imagery on Throwing Performance of Baseball Pitchers: A Single Subject Design

Jamie Lynn Nelson

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THE EFFECTS OF VIDEO AND COGNITIVE IMAGERY ON THROWING
PERFORMANCE OF BASEBALL PITCHERS:
A SINGLE SUBJECT DESIGN

by

JAMIE LYNN NELSON

(Under the Direction of Daniel Czech)

ABSTRACT

The purpose of this study was to examine the effects of a three week imagery and video
imagery intervention program on throwing accuracy performance of individual baseball
pitchers. A secondary purpose of this study was to investigate if differences in accuracy
response existed in low verses high ability imagers. A sample of pitchers (n=30) were
asked to take the Movement Imagery Questionnaire- Revised and participants were
randomly selected from the highest and lowest twenty percent of the group. The
participants were obtained from high school and college level teams within the
southeastern Georgia region (n= 6). Following the first week of baseline measurements,
two high ability and two low ability imagers took part in a three week video imagery and
imagery intervention program. Two participants of each imagery ability, served as the
control group and were asked only try their best during throwing accuracy measurements.
Results showed that two participants demonstrated an increase in performance, while all
participants expressed a desire to continue to use imagery for its various effects.
Suggestions for future research and further insight are discussed.

INDEX WORDS: Perfect pitch, Imagery, Video Imagery, Throwing performance,
High ability imagers, Low ability imagers.
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A SINGLE SUBJECT DESIGN

by

JAMIE LYNN NELSON

B.S., California State University, Long Beach, 2005

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2007
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DEDICATION

First and foremost this work is dedicated to my family whom has not only made possible the opportunities that I have been given, but have shown me the value and significance of my experiences. “It has always seemed strange to me that in our endless discussions about education so little stress is laid on the pleasure of becoming an educated person, the enormous interest it adds to life. To be able to be caught up into the world of thought -- that is to be educated.” – Edith Hamilton

I am who I am, and will be because of the knowledge I have gained and paths I have traveled. It is because of there unending love and support on any given endeavor, that I have not only accomplished what I have today, but that I will continue to approach life as a continuous series of adventures, giving where and when I am able, and growing and learning from every step and encounter. “We have a hunger of the mind which asks for knowledge of all around us, and the more we gain, the more is our desire; the more we see, the more we are capable of seeing.” – Maria Mitchell

Further this work is dedicated to Bryan Wachsman who has brought me the serenity and joy that was essential during this endeavor in remaining balanced, lighthearted and reassured. You have made me feel at home in a new place and in my heart, showing me again how truly wonderful it feels to share myself with the world.
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I would like to acknowledge Dr. Daniel Czech. In seven years of college education, never have I been so blessed to have a mentor that has dedicated himself so genuinely and passionately, not only to his every undertaking, but to every individual as well. “Do not train children to learning by force and harshness, but direct them to it by what amuses their minds, so that you may be better able to discover with accuracy the peculiar bent of the genius of each.” – Plato

His investment, appreciation, and true belief in each and every student and their unique capabilities has not only made all the difference in my success here, but in all my years to follow. Thank you for setting higher standards when you knew they could be reached, for your genuine energy and hopes for our future, and for the example of how to teach without telling and by lighting a fire in each individual. “We cannot hold a torch to light another's path without brightening our own.” – Ben Sweetland

I would further like to acknowledge my outstanding committee whose ceaseless willingness to help and contribute made this work possible. Your perspective, opinions and knowledge have reformed my critical thinking skills and made my first experience with research what I hope to be the first of many.

Last, but most certainly not least, I want to acknowledge my peers in which I was able to go through this adventure with. I could not have picked a more supportive, fun and gifted family to be a part of throughout these years. Environment and friends make all the difference. Without each of your company, conversations, and presence, this time would not be as cherished as it is. I will miss each and every one of you, keep in touch.
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INTRODUCTION

As the effort to increase athletic performance grows, so does the field of applied sport psychology. Investigating the effectiveness and potential of psychological skills is becoming increasingly important (Shambrook & Bull, 1996). A psychological skill that is quite frequently used and has demonstrated effectiveness is visualization, or imagery (Kearns & Crossman, 1992; Shambrook & Bull, 1996).

Imagery is the ability to create or re-create a positive or negative experience in the mind using a variety of senses (Carboni, Burke, Joyner, Hardy, & Blom, 2002; Kenitzer & Briddell, 1991). Imagery can positively affect mechanical or execution flaws, simulate practice without the physical component, and create successful outcomes (Vealey & Walter, 1993). Stewart (1997) suggests that imagery practice should be a dynamic re-enactment of imagined or simulated events involving detail and multiple senses.

Kinesthetic imagery is understood to be a visualization or mental representation that involves various modalities, or all of the senses (Schiffman, 1995). It recreates the movement of the body, the feelings that are felt within it during the imagined movement, the sounds that may be heard and even the scent of the environment.

The psycho-neuromuscular feedback theory posits that during imagery sessions, although weaker in magnitude, muscular activity within the body is the same as if the skill is actually being practiced (purposed by Carpenter in 1894; cited in Hale, 1982). The improvement in motor performance is believed to come from the kinesthetic feedback that coincides with the imagery practice (Corbin, 1972).

Research on imagery as a psychological skill is vast and has shown over time can increase self confidence and efficacy (Munroe- Chandler & Hall, 2004, Beauchamp,
Bray, & Albinson, 2002), attentional focus (Calmel, 2004), and decrease stress levels.

Research has also shown imagery can affect motor tasks and performance directly
(Stroksahl & Ascough, 1998; Groslambert, Candau, Grappe, Dugue, & Rouillon, 2003).
Furthermore, imagery has been shown to affect sport specific tasks such as putting
accuracy, free-throw shooting and dart throwing accuracy.

Imagery has been shown to be very effective in regards to accuracy in sport.
Thomas and Fogarty (1997) found that imagery in combination with positive self-talk
training improved not only putting performance, but psychological factors as well.
Woolfork et al. (2005) found that positive imagery participants, in comparison to the
negative imagery training and control group participants, experienced significant
increases in putting performance. Moreover, imagery has been shown to positively
enhance free-throw shooting performance among collegiate basketball players. Kearns &
Crossman (1992); Shambrook & Bull (1996); Templin & Vernacchia (1993, 1995);
Stewart (1997); and Carboni, Burke, Joyner, Hardy & Blom, (2000) determined imagery
to be effective to some degree, in most individual cases on free-throw shooting
performance.

Much of the above cited research utilized a single subject design. This type of
design has been shown to be important in applied sport psychology to demonstrate the
improvements of individual cases that may be overlooked in a traditional group analysis
(Shambrook & Bull, 1996). More specifically, when used as a multiple baseline design,
conclusions may be drawn that the effects may be due to the specific intervention (Bryan,
1987, p. 286). This design allows for an individual analysis of the imagery implementation
and a way to tailor the intervention to the individual (Stewart, 1997).
Originating visualization theories have not always been applied to sport performance and began in the cognitive and spatial awareness research. Bess (1909) was among the first research noted and is credited for the measuring system developed for visualization. The Bess Scale addresses the differences in individual imagery ability. The basis of the literature is derived from cognitive theory of imagery and more closely tied to the understanding of the term kinesthetic imagery (Schiffman, 1995).

A pitcher may be asked to imagine the ball in his hand before a throw, to feel the laces and texture on his hand, maybe even brush the dirt off, as if he had just picked it up from the ground. It is discussed by Bess that the image should be as vivid and detail oriented as possible. The Bess Scale measures the vividness of the visualizations practiced on a seven degree scale of vague to vivid scores. However, Wilson & Barber (1981) found that individuals can vary greatly in their ability to visualize in a vivid manner. Moreover, Stoksahl and Ascough (1998) found that some athletes were very detailed in their imaging, while others were very vague, concluding that those less vivid images may not be as effective in enhancing performance. Therefore, athletes who are lower in imagery ability may not reap the full performance enhancement benefits of imagery training. These findings may give further reasoning to investigate the effects of video imagery. More specifically, individuals that lack the skill of vivid imaging may find that a video re-enactment of the task allows them to “see” the desired performance in their mind more clearly and to mentally prepare for the actual event or task demonstration.

Little research has been found that examines the effects of internal video imagery, a video shown from the internal perspective of an athlete, on performance. However,
some research has integrated video tape modeling with imagery training. Hall and Erffimmeyer (1983) investigated high school female basketball players who were assigned to a video modeling/imagery group and a relaxation/imagery group. Results can only be attributed to a combination of psychological skills, as they were compounded within the study, but it was concluded that the video modeling/imagery group demonstrated increased performance levels in foul shooting when compared to the relaxation/imagery group. Furthermore, little research has been found on video internal imagery and other sports, more specifically baseball and pitching accuracy.

While research on imagery is vast, this study seeks to investigate the effects of cognitive imagery and video imagery on throwing performance of baseball pitchers. A secondary purpose of this study is to examine the difference between imagery ability, low verses high, and throwing performance response after experiencing video and cognitive imagery interventions.
METHODS

Participants

Participants consisted of six baseball pitchers in the southeast region of Georgia. The participants were selected from high schools and colleges throughout the southeast region and were asked to sign a consent form before participation in the study. Participants under the age of 18 were asked to return a parental consent form before participation. Four males, current athletes at the collegiate level, and two current high school male athletes took part in this investigation. The mean age of the participants was 19.8, with ages ranging from 16 to 22 years. Only participants currently on pitching staffs of high school or college baseball teams were utilized. All participants had been baseball athletes for at least the previous two years, at either the high school level or college. The consent form returned prior to participation assured participants of confidentiality, briefed them of the purpose of the present study, and the risks and benefits of participation. Contact was made with each institution, informing participants, parents, and coaches that athlete participation was completely voluntary.

Apparatus

The Samsung Sports Camcorder SC-X205L/X210L was used to record the accuracy measurement sessions in order to ensure that accurate points were recorded for each pitch. At no time was the pitcher captured in these recordings. The Samsung Camcorder SC-X205L/X210L external helmet camera module, used to capture recordings of an accurate pitch from the internal perspective of the pitcher, were used in the video imagery interventions.
Instrumentation

Throwing performance was measured by an Easton © nine square Strike Zone Target. The Easton Strike Zone target was placed on the plate in the Georgia Southern University visitor’s bullpen to emulate a real life scenario. The target was assigned point values between one and ten to the varying sections of the target; ten assigned to the center box and lesser point values closer to the edges of the nine boxed strike zone. Point values between the ranges of the surrounding boxes values were assigned to the dividing lines themselves (See Appendix F). Each measurement session was video taped so that film may be reviewed to ensure that the correct points were assigned for each throw. Only the strike zone device and the end result of the pitch were captured on video tape during measurement sessions.

Prior to the study an imagery ability test was given to 30 baseball pitchers of the high school or collegiate level to determine high and low imagery ability participants and participant selection. The MIQ-R, Movement Imagery Questionnaire- Revised (see Appendix A), was used to measure imagery ability among the athletes. Hall and Martin (1997) developed the MIQ-R, a revision of the MIQ (Hall & Pongrac, 1983), to test and determine individual’s ability in visual (seeing) and kinesthetic (movement) imagery. Authors determined the MIQ- R to be a valid and reliable revision of the MIQ after research showed significant correlations on both visual and kinesthetic scales. Hall, Pongrac and Buckolz (1985) found a test- retest co-efficiency score of .83 on the MIQ, a .89 for the visual scale and .88 for the kinesthetic scale on internal consistencies (Atienza et al., 1994).
A Post Study Imagery Questionnaire was distributed to the participants at the completion of the investigation. This questionnaire attempted to get feedback from each participant on their experience with imagery, past and present, and further imagery use. Moreover, the questionnaire sought to inquire about the participant’s attitude towards imagery and further reflection on other effects that may have occurred with imagery practice aside from performance. The questionnaire consisted of the following inquiries: Did you at anytime use imagery outside of this study? How do you feel about the use of imagery in general? Do you feel it helped you and how so? Do you feel there was a difference between the two types of imagery and if so what were they? Will you continue imagery use?

Procedure

Baseball pitchers were distributed the MIQ-R test and scores were collected and recorded by number to protect confidentiality and allow for as much random selection of participants as possible. To complete the MIQ-R, a brief explanation was given of what the inventory covers, along with directions on how to complete the questionnaire. Participants scored each question using a Likert scale ranging from one to seven. Values were totaled for each individual and from these scores, three participants from each of the higher twenty percent and lower twenty percent of imagery ability were randomly selected and asked to participate in the study. Eliminating the middle scores attempted to ensure that the participants represent actual high and low imagery abilities of baseball pitchers within the sample. Participants signed a written consent form (see Appendix E) or were given a parental consent form to be signed by the responsible party and returned prior to the study (see Appendix E).
Participants were then informed that for the next four to five weeks, depending on whether or not a baseline was demonstrated, each was to meet with the observer five times in the first week(s) or baseline portion of the study, and four times for the following three week intervention portion of the study. Throwing performance was measured before interventions began five times a week until a stable baseline was demonstrated. A stable baseline was identified by an average score that has no more than a two point variance for at least three trials in a row. A baseline was demonstrated within the first week of the study and imagery interventions began the second week of the study, each intervention lasting six visits or a week and a half. Measurements were taken four times a week, post imagery session, during the imagery and video imagery intervention programs, until the studies completion. Throwing performance measurements were determined by the average of a series of ten pitches in a NCAA Division I University’s visitor’s bullpen, with the measurement apparatus placed in front of the bullpen home plate. During the baseline measurement portion of the study, the Samsung Sports Camcorder SC-X205L/X210L was used to capture and create video imagery segments. Participants were asked during the baseline measurement portion of the study to wear the external helmet camera module that was placed on the side of each individual pitcher’s head, at eye level, to capture the pitcher’s own internal perspective of an accurate pitch being thrown. The device fits comfortably on a head band that fits around the pitcher’s head. No sign of discomfort was demonstrated. These recordings were used to create the video imagery segments shown in the intervention. The pitcher was at no time captured in the recordings. The design of the study includes counter balancing to eliminate sequence effects. Participants one and four experienced the cognitive imagery intervention during
week one of the intervention portion of the study, followed by digital imagery sessions beginning in the middle of week two or at the individual’s seventh session. Participants two and five received video imagery sessions as the first intervention in week one of the intervention portion of the study and cognitive imagery in sessions seven through twelve. Participants three and six were measured four times a week, but received no intervention, serving as a control group. The video and cognitive imagery sessions were conducted on an individual basis during a scheduled time slot in the University’s Mental Edge Training Facility. During the video imagery interventions, participants were asked to watch the previously recorded ten point pitch while imagining the accompanying sensations from all other senses; hearing, smell, taste and feel, in as much detail as possible. During cognitive imagery interventions the participants were asked to imagine the ten point pitch in their mind as vividly as possible, using all of their senses. Each individual’s imagery session was conducted for a duration of approximately 10 minutes. At the study’s end, each participant completed the Post Study Imagery Questionnaire to gain insight on the player’s attitudes towards imagery and their reflections of individual responses to the imagery practice, performance or otherwise related. Further, the post study imagery questionnaire attempted to determine if players would adhere to imagery practice and possible reasons why adherence would be experienced. (See Appendix D).

Data Analysis

Data was graphically represented for each individual and reviewed for practical differences in throwing accuracy. Ocular statistics (Carboni, et al, 2000) were reviewed by a group of trained researchers to determine actual changes in throwing accuracy, and
control for researcher’s bias and expectancy. Qualitative results of the Post Study Imagery Questionnaire were collected and reported.
RESULTS

Data collected in this study was evaluated using mixed methodological procedures of ocular statistics (Carboni, et al, 200) as well as in a qualitative nature. Throwing performance scores and standard deviations are shown in Table 1. Throwing performance scores over the length of the study are demonstrated in Figures 1-6. Perfect Pitch Counts are shown in Table 2. Perfect pitch count scores over the length of the study are demonstrated in Figures 7-12. Imagery effectiveness was reported qualitatively with the exception of participants three and six who did not receive any intervention and served as the control group.

Participant One

Participant one (Cognitive Imagery First) demonstrated a 2.9 ($SD= 4.5, 3.6, 3.9$) throwing performance baseline within the first week of the study. All throwing performance scores remained above the baseline measurement, ranging from 3.2 ($SD= 3.9$) to 3.9 ($SD= 4.6$) (See Table 1). The exception to these numbers was session 8, where the participant had an accuracy score of 1.4 ($SD= 1.8$). This number dropped below the baseline, but not out of our margins of implied change set at .9 (See Figure 1). During the following video imagery interventions, accuracy scores remained above the baseline ranging between 3.5 ($SD= 3.7$) and 5.3 ($SD=3.7$). Throwing performance scores increased above our margins of implied change set at 4.9 for session 14 with a score of 5.3 ($SD= 3.7$). During the baseline portion of the study, participant one ranged between one and two perfect pitches (See Table 2). This continued throughout the study with the exception of the imagery intervention portion. During the imagery intervention portion, sessions 6 through 11, the perfect pitch count ranged from zero to three (See Figure 7).
Post Study Imagery Questionnaire

Participant one reported using imagery during a game, while participating in the study, but had not used imagery before the study. He stated, “I would like to continue using imagery and practice it more before games. I feel like it really helps when I start rushing.” Participant one further explained that using the breathing techniques in the relaxation portion of the imagery script helped him to slow down his momentum and refocus. The player expressed that he felt the video imagery was more helpful to see the desired outcome, but had a hard time imaging the accompanying sensations throughout the video imagery sessions.

Participant Two

Participant two (Video Imagery First) established a baseline at 1.0 ($SD = 1.9$) within the first week of the study. Throwing performance scores slowly increased during the first intervention, with scores ranging from 1.4 ($SD = 2.3$) to 4.1 ($SD = 5.1$) (See Table 1). All of the throwing performance scores fell above the baseline, as well as above the line of implied change in the case of session 11 (See Figure 2). During sessions 12 through 17, the imagery intervention, all scores remained above the implied line of change set at 3.0, ranging from 4.0 ($SD = 3.7$) to 5.1 ($SD = 4.1$). During the established baseline, sessions two through five, participant two ranged from zero to one in perfect pitches (See Table 2). During the video imagery intervention, perfect pitch count remained at zero until session 10, where the count increased to four perfect pitches and returned to one in session 11. For the final intervention, imagery, participant two scored between two and three perfect pitches throughout (See Figure 8).
Post Study Imagery Questionnaire

Participant two reported never having used imagery prior to the study, but is currently implementing it in games due to improved pitching performance since the study began. Participant two stated, “I haven’t walked anybody, it must be working. I started trying to see the ball go where I want it to before I throw the pitch and it really seems to help.” Moreover, the player expressed a desire to continue using imagery as it helped with his accuracy and his confidence.

Participant Three

Participant three (No Interventions) demonstrated a baseline of 3.8 ($SD= 3.6$) within the first week of the study. For sessions 6 through 11, throwing performance scores ranged from 1.0 ($SD= 1.9$) to 4.1 ($SD= 3.9$) (See Table 1). These scores all fell below the baseline with the exception of session 11 with a score of 4.1 ($SD= 3.9$). During session 10, the participant scored 1.0 ($SD= 1.9$), dropping below the line of implied change at 1.8 (See Figure 3). Throwing performance scores for sessions 12 through 17 ranged from 1.0 ($SD= 1.9$) to 2.7 ($SD= 4.3$). These scores fell below the baseline. During sessions 13 through 16, scores descended to the margin of implied change. During the baseline portion of the study, participant three ranged between two to three perfect pitches per session, however, for the remainder of the study, sessions six through seventeen, participant three ranged from zero to two on the perfect pitch count (See Figure 9).

Participant Four

Participant four (Cognitive Imagery First) established a baseline at 4.3 ($SD= 3.8$) within the first week of the study. During the first intervention, the throwing performance
scores dropped below the baseline, with the exception of session 11 with a score of 4.5 ($SD = 4.7$). These scores ranged between 1.8 ($SD = 2.4$) and 4.5 ($SD = 4.7$) (See Table 1). For sessions seven and eight, scores fell below the implied margin of change set at 2.3, with scores of 1.8 ($SD = 2.4$) and 2.1 ($SD = 2.0$). During sessions 12 through 17, participant four received video imagery. Throwing performance scores ranged from 3.3 ($SD = 2.4$) to 4.5 ($SD = 3.5$). The majority of these scores fell below the baseline, with the exception of sessions 16 and 17 with scores of 4.5 ($SD = 4.1, 3.5$) (See Figure 4). During the baseline portion of the study, participant four threw between zero and two perfect pitches. This range continued throughout the duration of the study, throwing zero to two perfect pitches per session, with the exception of session 11, scoring three perfect pitches (See Figure 10).

**Post Study Imagery Questionnaire**

Participant four reported having used imagery before the study, but expressed some difficulty imagining vividly. The athlete expressed a preference for a detailed imagery script to be read to him, finding it easier than it was to vividly see the selected image. Participant four stated, “I usually do imagery before my games that I know I’m going to be pitching in. It helps me get focused and I want to get better at it.” Further, he expressed a desire to continue imagery use, but made no note of a difference between the two interventions.

**Participant Five**

Participant five demonstrated (Video Imagery First) a baseline at .8 ($SD = 1.3$) during the first week of the study. Throwing performance scores for the first intervention ranged from 1.2 ($SD = 3.2$) to 4.8 ($SD = 4.6$). These throwing performance scores all fell
above the baseline (See Table 1). Sessions eight and nine, with scores of 3.3 ($SD= 4.7$) and 4.8 ($SD= 4.6$), increased above the margin of implied change, set at 2.8 (See Figure 5). During sessions 12 through 17, which was the imagery intervention portion of the study, throwing performance scores ranged between 2.5 ($SD= 4.0$) and 4.0 ($SD= 4.1$). All of these scores fell above the baseline, with sessions 14 through 17 exceeding the margin of implied change, scoring between 3.5 ($SD= 4.6$) and 4.0 ($SD= 4.1$). During the baseline portion of the study, participant five threw zero perfect pitches. During session nine of the video imagery portion of the study, participant five threw three perfect pitches, scoring one perfect pitch for the following session 10, and again three perfect pitches for session 11. During sessions 12 through 17, the perfect pitch count ranged from zero to two. This score dropped to zero once in session 12, but remained between one and two for sessions 13 through 17 (See Figure 11).

**Post Study Imagery Questionnaire**

Participant five reported never having used imagery before the study, but is considering to adhere to pre-game imagery sessions after the research has ended. Participant five expressed noticing not only a positive change in his throwing accuracy, but an increase in his confidence as well. The athlete stated, “when I stop between each pitch, take a breath and see where I want the ball to go, it helps me to refocus. Also, when I do throw a bad pitch, it doesn’t carry over as much. I don’t get caught in a bad momentum. I am more able to release the last pitch and trust the next one, because I’ve seen myself throw it where I want to put the ball (in my head) many more times before. I know I can do it.”

**Participant Six**
Participant six (No Intervention) demonstrated a baseline at 3.4 ($SD= 3.1$) during the first week of intervention. Throwing performance scores ranged from 1.0 to 4.4 in sessions 6 though 11 (See Table 1). With the exception of a 4.4 ($SD= 3.4$) throwing performance score in session nine, all scores fell below the baseline. During session 10, the player experienced a 1.0 ($SD= 1.9$) throwing performance score, which fell below the margin of implied change set at 1.4 (See Figure 6). Throwing performance scores for sessions 12 through 17 ranged between 1.0 ($SD=1.9$) and 2.4 ($SD= 3.6$). All of these scores fell below the baseline. Moreover, in session 14 the player scored a 1.0 ($SD= 1.9$), which fell below the margin of implied change. During the established baseline portion of the study, participant six threw zero perfect pitches. In sessions 6 through 11, participant six ranged between zero and two perfect pitches per session, scoring two perfect pitches in session nine. For the remainder of the study, sessions 12 through 17, participant six threw between zero and one perfect pitch per session (See Figure 12).
# TABLES AND FIGURES

## Table 1: Throwing Performance Scores

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* Standard Deviations in parenthesis.
Table 2: Perfect Pitch Count

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Figure 1

Participant 1 High Ability: Performance Scores (Imagery/Video Imagery)
Figure 2

Participant 2 High Ability: Performance Scores (Video Imagery/Imagery)
Figure 3

Participant 3 High Ability: Performance Scores (Control)
Figure 4

Participant 4 Low Ability: Performance Scores (Imagery/Video Imagery)

![Graph showing performance scores for Participant 4 with sessions ranging from 1 to 17, and mean ability scores for baseline, imagery, and video imagery.]
Figure 5

Participant 5 Low Ability: Performance Scores (Video Imagery/Imagery)
Figure 6

Participant 6 Low Ability: Performance Scores (Control)
Figure 7

Participant 1 High Ability: Perfect Pitch Count
Figure 8

Participant 2 High Ability: Perfect Pitch Count

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Sessions: 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1
Figure 9

Participant 3 High Ability: Perfect Pitch Count
Figure 10

Participant 4 Low Ability: Perfect Pitch Count

![Graph showing mean low ability perfect pitch count over sessions. The x-axis represents sessions from 1 to 17, and the y-axis represents mean low ability perfect pitches from 0 to 5. The graph is divided into Baseline, Imagery, and Video Imagery phases. The data shows a pattern of pitch count variation across sessions.]
Figure 11

Participant 5 Low Ability: Perfect Pitch Count

![Graph showing the mean low ability perfect pitch count over sessions. The x-axis represents sessions, and the y-axis represents the mean low ability perfect pitch count. The graph has three phases: Baseline, Video Imagery, and Imagery, with data points showing fluctuations in pitch count across sessions.]
Figure 12

Participant 6 Low Ability: Perfect Pitch Count
DISCUSSION

The purpose of the present study was to examine if imagery would have an effect upon throwing performance of individual baseball pitchers. Further, the present study sought to determine if different ability imagers, low and high, would respond differently to different imagery interventions, imagery and video imagery. Participants one, two and five all demonstrated an increase in score from their individually established baseline by session nine. These results parallel similar single subject imagery research on sport performance (Kearns & Crossman, 1992; Shambrook & Bull, 1996; Templin & Vernacchia, 1993, 1995; Stewart, 1997, Carboni, et al, 2000; Munroe-Chandler, Hall, Fishurne, Shannon, 2005). Further investigation of brief interventions has long been suggested as the question of how long and how often an intervention should be in order to be effective has yet to receive a concrete answer (Thelwell, Greenless, & Weston, 2006; Cumming, Hall, Shambrook, 2007). It has been suggested that positive effects occur from psychological skill practice only after extensive practice and application as they develop similarly to physical skills (Weinberg & Williams, 2001). Thelwell, Greenless, and Weston (2006) found an intervention combination of imagery, self-talk and relaxation to be effective when taught over a three day period, with imagery training lasting one day, and being measured once a week over a nine match period. Murphy (1990) suggests no longer than ten minute sessions in interventions, while 3 to 5 times a week is suggested by Weinberg and Gould (2007). Bull (1995) found positive results using a four week training period with eight training sessions. Researchers have examined treatment times and frequency by leaving it to the discretion of the participant and recording objective reports, lasting as briefly as one minute (Carboni, et al, 2000).
Cumming, Hall and Shambrook (2007) concluded that overall use of imagery could be increased with interventions as short as a workshop. The findings of the present study indicate that imagery interventions may be effective for specific tasks such as throwing performance, in as briefly as four ten minute sessions a week, for three weeks.

In the present study, no distinct differences were found between the two interventions with any of the participants. While greater throwing performance scores were recorded in the last six sessions of the study, this is believed to be a response to the time in which the participants had been engaged in imagery practice and not to the specific imagery intervention as all participants that received the interventions responded similarly. Gordon, Weinberg and Jackson (1994) found similar results with an investigation of two different types of imagery, internal and external. Researchers asked cricket bowlers (pitchers) to engage in a ten minute imagery session six times, over a three week period, before a throwing measurement of 12 pitches was taken. Future research examining effects of multiple interventions, should investigate appropriate amounts of time for each intervention to be effective.

Research has shown that imagery ability is a large determinant of how an individual will respond to imagery interventions in regards to performance (Hall, 1998). However, participants two and five experienced a greater positive change in throwing performance scores and perfect pitch counts in comparison to all other participants. Their success with the imagery interventions may not be contributed to greater imagery ability as they represented both the high and low ability imagers. While a lower ability imager may have more difficulty controlling and creating vivid images, all individuals regardless of imagery ability may benefit from imagery practice (Magill, 2007 p. 432). Each of
these participants played on the high school level and established a lower throwing performance baseline score than the other participants of the collegiate level. Isaac and Marks (1994) and Piaget and Inhelder, (1971) concur that imagery ability is developed by the age of seven. Moreover, Payne and Isaacs (1995) explain that the highest level of cognition and abstract thinking is developed at 11 to 12 years of age. The mean age of participants two and five is 17 years, placing them at the end of this developmental period. This perspective may explain the difference in response to intervention was not due to the participants’ ability to image, as they should be developmentally equal to the collegiate level participants. Competitive level differences have been found in imagery use research (Barr & Hall, 1992; Salmon, Hall, & Haslam, 1994; Vadocz et al., 1997). Factors such as years of experience, ability to effectively create and control images, differences in player motivational levels in sport and to perform imagery contribute to these differences.

Thelwell, Greenless, and Weston (2006) explain how differences in goal orientations may be responsible for a player’s level of investment in performing imagery. It was found that athletes with moderate to high levels of task and ego orientation will be more invested in imagery use, which in turn, increases the frequency of imagery practice (Cumming, Hall, Gammage, & Harwook, 2002; Harwood, Cumming, & Hall, 2003). Bull (1995) examined the effects of a four week mental training program on varsity athletes. He found that athletes with higher sport motivation were more likely to adhere to the program and that athletes who were in their earlier stages of their career were more likely to have higher motivation. It is possible that participants two and five experienced a higher level of motivation being in the earlier stages of their career, when compared to
participants one, three and four, who were experiencing their expected final season of their careers.

Fatigue and overtraining may be another rationale for low motivation. All of the participants were in season and experiencing a vigorous training schedule during the time of the investigation. All participants expressed feelings of fatigue and exhaustion on various days during the study, which may have affected performance and concentration. Burnout can be defined as a perceived imbalance between demands and response capability that may lead to players’ negative physical and emotional states (Creswell & Eklund, 2006). Also, Creswell and Eklund (2006) state that, “…inadequate rest and recovery periods would also contribute to their negative experiences, p. 232.” It is possible that participants may have found this study to be an extra task that consumed extra time normally used for recovery or relaxation. This may have contributed to lack of focus or motivation on days of uncharacteristic drops or any decrease in the trend of accuracy scores, the participant’s loss of interest in the study, or with holding effort and saving energy for other more highly prioritized tasks. This was supported by the performance of participants three and six whom actually decreased in performance overtime without intervention, and reflects the attitudes of participants one, three, four, and six.

Conducting the study during the season may have contributed to a lack of focus and concentration. Other possible distractions may have contributed to this as well. For example, during the video imagery intervention, select participants demonstrated a clear loss of focus when opening their eyes from the relaxation portion of the imagery to view the video. Another method of viewing for participants, such as a dark room where video
recordings could be prompted from outside, or using greater technology such as virtual reality head gear to view the recorded video, may be more successful in maintaining focus and/or a relaxed state. Furthermore, all imagery sessions were conducted in the Georgia Southern University Mental Edge Training Facility in order to ensure that each participant would undergo the same length of vivid imagery sessions. A vivid script is encouraged to help each player incorporate as many senses as possible (Thelwell, Greenless, & Weston, 2006). Moreover, when the vivid script was used, the participants were told to focus on seeing only the center box (See Appendix C). This may have contributed to the cause of the increased perfect pitch counts of participants two and five (See Figures 8 and 11).

In the present study throwing performance was defined as the pitcher’s ability to throw the ball as close to a specific spot deemed as the target. To measure throwing performance the mean score of the ten pitches thrown during each session was recorded and graphically represented. The number of perfect pitches, defined as pitches that hit the center target and scored ten points, was recorded and graphically represented as well. Actual performance enhancement may be defined by each individual differently. Some may consider greater consistency and more pitches thrown nearer to the target optimal. Others may deem an increase in pitches thrown at the actual target in combination with lower scoring pitches as performance enhancement. For the purpose of the present investigation, each sessions mean score and perfect pitch count was used to determine performance response. During the cognitive imagery interventions, participants were asked to envision throwing only to the center box, while in video imagery sessions participants were asked to watch the previously recorded pitches thrown threw the center
box, thus an increase in pitches to the center box was determined to indicate positive effects on throwing performance due to imagery interventions.

There are limitations that may have occurred during the data collection process. For example, noise could be heard during the sessions. It was not mentioned or noted that this was an identifiable distraction and an area with less noise and distractions would be more optimal for future studies. Lastly, imagery sessions and throwing performance measurements were often conducted at different times of the day for different participants. During several sessions the participants were unable to attend until the evening where there was less daylight during the throwing accuracy measurements. This inconsistency may have played a role in a participant’s success or lack of within the study if an individual’s performance, concentration or fatigue levels vary throughout different times of the day.

Post Study Imagery Questionnaire results revealed a description of the positive affects of imagery had on their performance and confidence. In addition, an increased appreciation for psychological skills training developed during the experience. These themes parallel past research (Kearns & Crossman, 1992; Shambrook & Bull, 1996; Templin & Vernacchia, 1993, 1995; Stewart, 1997, Carboni, et al, 2000; Thelwell, et al, 2006). Participants one, two and five expressed positive regards toward imagery sessions, their confidence in their task ability, and the stress and anxiety reduction effects when rushing a pitching sequence. This supports similar findings on the various possible benefits of imagery such as improved regulation of arousal (Hecker & Kaczor, 1988), increased motivation in athletes (Callow & Hardy, 2001), the increased ability to modify cognitions such as self-efficacy (Feltz & Ressinger, 1990) and self-confidence (Callow,
Hardy, & Hall, 2001). Past research demonstrates, “…that mental practice (imagery) can be used as a way to control anxiety levels and to prepare the specific strategies and movements required to perform the skill in the upcoming event.” (Magill, 2007 pg. 432).

It is suggested for future researchers to investigate alternate methods in which to administer video imagery so that focus may be maintained. Furthermore, it is suggested that future imagery researchers should examine at what length and frequency a multiple intervention study needs to be administered in order to see clear, definite results. Although established baselines did not vary more than one point, the present study selected a criterion of two points on a ten point scale to define a baseline and actual change. Future research may find using more strict criteria helpful so that more pronounced effects may be identified. While long time requirements and lost hours of practice were of concern to coaches and athletes when considering the implementation of a psychological skills program, the present findings imply that effects can be seen from an imagery program on a position specific task, in as quickly as three weeks or twelve, ten minute sessions. Moreover, these interventions may take place in season and in conjunction with a rigorous physical training program. Barriers that prevented athletes from continuing a psychological skills training program were identified by Bull (1991) to include lack of time, a disruptive home environment, and a need for an individualized package. With a brief script delivered and position specific intervention package as used in the present study, these issues should no longer be of concern. When discussing the implementation of psychological skills packages, Shambrook and Bull (1999) expressed time management, structuring and scheduling, and integrating psychological skills into existing training programs as issues that needed to be addressed. The present study’s
findings, past research in workshops (Cummings, Hall, & Shambrook, 2007), and future research can aide in eliminating these obstacles, as it has been demonstrated that intervention programs may be brief and integrated into intense physical training programs to reap positive results.
REFERENCES


APPENDIX A

RESEARCH QUESTIONS, DELIMITATIONS, LIMITATIONS, ASSUMPTIONS, AND DEFINITIONS
Research Questions

1. What are the effects of digital and cognitive imagery on the throwing accuracy scores of baseball pitchers?

2. How does digital and cognitive imagery affect low and high ability imagers differently?

Delimitations

1. This study will focus only on male baseball pitchers of 14 to 24 years of age.

2. The participants will all be chosen from the Southeastern Georgia region.

3. High and low ability imagers will only be selected from the convenient sample in which test were distributed.

4. Only quantitative results are available from the MIQ-R questionnaire.

Limitations

1. Convenience sampling will be used.

2. Generalizability may be questioned as the six participants chosen of the southeastern region of the United States may not be representative of the baseball pitcher population.

3. Participants may not fully understand and/or execute an imagery session.

4. Participants were not given a choice of skill and asked to work only with the throwing accuracy task.
5. The pitches used to measure throwing accuracy will be outdoors on multiple days. Weather factors such as wind can not be controlled and may vary between measurements.

6. The imagery sessions conducted will be relatively brief, between 10 to 15 minutes, and may not be enough time for the desired effects.

7. The practice of a single imagery implementation is two weeks which may not be enough time for maximal effects on throwing accuracy.

8. Participants may possess internal biases that may affect the results of the imagery implementations.

Assumptions

1. Each athlete will put forth their best effort to throw accurate pitches and focus on visualizing the instructed image.

2. All participants will be honest when answering the MIQ-R. While no research could be found to date on a norm for imagery ability scores on the MIQ-R, it must be assumed that participants selected are of high and low imagery abilities by the elimination of the midsection scorers.

3. Selected participants are of high and low abilities due to the elimination of the mid-section scorers, using only extreme scores of both the highest and lowest twenty percent.

4. It should be assumed that the control participants did not practice any imagery training on their own time during the nine weeks of study.
5. Participants will not be affected by changing outside experiences unrelated to the imagery interventions during the length of the study.

Definitions

1. Perfect pitch- When the ball hits directly in the center of the selected center box on the strike zone accuracy measurement device.

2. Throwing performance – The pitcher’s ability to throw the ball as close to a specific spot deemed as the target. This will be measured by taking the average number of points earned during the participants 10 pitch series recorded four times a week, post imagery session.

3. Imagery- Re-creating or creating an experience in the mind using all of the senses; also the mental image produced by memory or imagination in the brain.

4. Video imagery- Viewing a digital recording of the desired image to be created within the mind, while imagining all accompanying sensations.

5. High ability imagers- Participants who fell within the top twenty percent of MIQ-R scores collected from the original sample of participants.

6. Low ability imagers- Participants who fell within the bottom twenty percent of MIQ-R scored collected from the original sample of participants.
APPENDIX B

MOVEMENT IMAGERY QUESTIONNAIRE – REVISED
MOVEMENT IMAGERY QUESTIONNAIRE – REVISED (MIQ-R)

Craig R. Hall and Kathleen A. Martin, 1997

RATING SCALES

Visual Imagery Scale

7 6 5 4 3 2 1

Very easy Easy to Somewhat Neutral Somewhat Hard to Very easy To see see Easy to (Not easy Hard to to see see see not hard see)

Kinesthetic Imagery Scale

7 6 5 4 3 2 1

Very easy Easy to Somewhat Neutral Somewhat Hard to Very easy To Feel Feel Easy to Feel (Not easy Hard to Feel Feel not hard Feel)


MOVEMENT IMAGERY QUESTIONNAIRE REVISED TEST ITEMS

1. **STARTING POSITION:** Stand with your feet and legs together and your arms at your sides.

   **ACTION:** Raise your right knee as high as possible so that you are standing on your left leg with your right leg flexed (bent) at the knee. Now lower your right leg so that you are again standing on two feet. Perform these actions slowly.

   **MENTAL TASK:** Assume the starting position. Attempt to feel yourself making the movement just performed without actually doing it. Now rate the ease/difficulty with which you were able to do this mental task.

   | Rating |

2. **STARTING POSITION:** Stand with your feet slightly apart and your hands at your sides.

   **ACTION:** Bend down low and then jump straight up in the air as high as possible with both arms extended above the head. Land with your feet apart and lower your arms to your sides.

   **MENTAL TASK:** Assume the starting position. Attempt to see yourself making the movement just performed with as clear and vivid a visual image as possible. Now rate the ease/difficulty with which you were able to do this mental task.

   | Rating |

3. **STARTING POSITION:** Extend the arm of your non dominant hand straight out to your side so that it is parallel to the ground, palm down.

   **ACTION:** Move your arm forward until it is directly in front of your body (still parallel to the ground). Keep your arm extended during the movement and make the movement slowly.
MENTAL TASK: Assume the starting position. Attempt to feel yourself making the movement just performed without actually doing it. Now rate the ease/difficulty with which you were able to do this mental task.

Rating

4. STARTING POSITION: Stand with your feet slightly apart and your arms fully extended above your head.

ACTION: Slowly bend forward at the waist and try and touch your toes with your fingertips (or if possible, touch the floor with your fingertips or hands). Now return to the starting position, standing erect with your arms extended above your head.

MENTAL TASK: Assume the starting position. Attempt to see yourself making the movement just performed with as clear and vivid a visual image as possible. Now rate the ease/difficulty with which you were able to do this mental task.

Rating

5. STARTING POSITION: Stand with your feet slightly apart and your hands at your sides.

ACTION: Bend down low and then jump straight up into the air as high as possible with both arms extended above the head. Land with your feet apart and lower your hands to your sides.

MENTAL TASK: Assume the starting position. Attempt to feel yourself making the movement just performed without actually doing it. Now rate the ease/difficulty with which you were able to do this mental task.

Rating
6. **STARTING POSITION:** Stand with your feet and legs together and your arms at your sides.

**ACTION:** Raise your right knee as high as possible so that you are standing on two feet. Perform these actions slowly.

**MENTAL TASK:** Assume the starting position. Attempt to see yourself making the movement just performed with as clear and vivid a visual image as possible. Now rate the ease/difficulty with which you were able to do this mental task.

Rating

---

7. **STARTING POSITION:** Stand with your feet slightly apart and your arms fully extended above your head.

**ACTION:** Slowly bend forward at the waist and try and touch your toes with your fingertips (or if possible, touch the floor with your fingertips or hands). Now return to the starting position, standing erect with your arms extended above your head.

**MENTAL TASK:** Assume the starting position. Attempt to feel yourself making the movement just performed without actually doing it. Now rate the ease/difficulty with which you were able to do this mental task.

Rating

---

8. **STARTING POSITION:** Extend the arm of your non dominant hand straight out to your side so that it is parallel to the ground, palm down.

**ACTION:** Move your arm forward until it is directly in front of your body (still parallel to the ground). Keep your arm extended during the movement and make the movement slowly.

**MENTAL TASK:** Assume the starting position. Attempt to see yourself making the movement just performed with as clear and vivid a visual image as possible. Now rate the ease/difficulty with which you were able to do this mental task.

Rating
APPENDIX C

PERFECT PITCH IMAGERY SCRIPT
Perfect Pitch Script

Take a deep breath in, and exhale any thoughts or worries of the day. Continue breathing deeply, allowing any thoughts to slip out of your head. Letting go of anything that you have to accomplish today, knowing that all you have to do for the next ten minutes is just be here. Take another breathe in, scanning your body for any tension or tightness, tired or sore muscles, ….. breathe it out. On each exhale you sink a little deeper into the chair, feeling heavier with each breath out. Take a couple more breathes, breathing in relaxation and releasing all else.

See your self standing on the mound. …Your feet have found a comfortable and balanced stance… Feel the rubber under your foot… You hear all the sounds around you,… feel the breeze or the sun on your face. Maybe the guys are getting ready for practice. You look at your target and see the exact spot you want to put the ball. You feel your hand inside the glove, …..and the other that is gripped on the ball. You take in a deep breathe and release it, …clearing you mind, ….letting go of any doubt, and trusting that the ball will go straight through the center box of the target. ….Confident, you begin you pitch and feel your weight shift to your back leg,…the slight movement in your arms and the energy in your upper body. ….Your other leg lifts from the ground, your knee drawing up toward your chest. In one smooth motion, with power and ease, your arm drops down and back beginning its rotation. You drive your front leg forward, pushing off with your back …. The ball of your foot finds the ground as your hips rotate toward the target…your arm follows through naturally across your body. You release the ball, feeling it leave your hand with momentum and power, your back leg comes forward as you see the ball fly through the center of the target…..

You return to the mound. Hearing the ground crunch beneath your feet as you walk. Take a deep breath again. Reset. Knowing you are a great pitcher and that you can put the ball where ever you choose. Confident and trusting your pitch you will begin again on my cue. You will see your self in real time delivering this same perfect pitch, feel your body put the ball through the center of the target again. Begin on your next exhale.
APPENDIX D
CONSENT FORM AND PARENTAL CONSENT FORM
CONSENT TO PARTICIPATE IN A RESEARCH PROJECT FORM

I understand that the questionnaire I am about to complete is a part of a research project entitled, “The Effects of Digital and Cognitive Imagery on Throwing Accuracy of Baseball Pitchers: A Single Subjects Design,” conducted by Jamie Nelson.

This study is designed to examine the effects of cognitive imagery and digital imagery on throwing accuracy of baseball pitchers. A secondary purpose of this study is to examine the difference between imagery ability, low verses high, and accuracy response after experiencing difference imagery interventions, digital verses cognitive. The study will consist of evaluating the your throwing accuracy and imagery ability using the MIQ-R survey. You will be required to throw ten pitches, five times a week for the first one to two weeks. After this is conducted, you will experience four weeks of intervention where you will be asked to throw a series of ten pitches, three times a week after a ten to fifteen minute imagery session. Benefits attained from participating in this study will be the gaining of imagery skills for performance enhancement and use outside of athletics. This study will also provide much needed research in the imagery area in the field of applied sport psychology. Baseline measurements will last from one to two weeks, followed by the intervention portion of the study that will last four weeks. The study will last a total period of five to seven weeks depending on the baseline portion results.

It is important to note that all tests, recordings and results will be confidential and be kept in a locked cabinet in the Georgia Southern University Mental Edge Training Facility, where only the researcher and advisor will be given access. All video recordings
will be erased after a period of one year. Your name will not appear on any publications, nor will any of the results be given to coach or other people at your school. Risks involved in participation are minimal. Imagery sessions and pitches thrown present no more risk than daily activities or daily physical practice. By signing below, I am agreeing to allow Jamie Nelson to use the information I provide in presentation and publication. I understand that any relationship between myself and the information I contribute to this study will be kept confidential. Further, I understand that I may end participation in this study at any time without penalty or prejudice to myself, course grade, employment status or any other personal matter. If I have any questions or concerns about my participation in this study, I may contact Jamie Nelson at 562-477-2803 or Dr. Daniel Czech at 912-681-5267. If I have any questions or concerns about my rights as a research participant, I may contact Georgia Southern University Office of Research Services and Sponsored Programs at 912-486-7758. You must be 18 years of age or older to consent to participate in this research study. If you consent to participate in this research study and to the terms above, please sign your name and indicate the date below.

You will be given a copy of this consent form to keep for your records.

Print Participants Name ______________________________

Participants Signature _______________________________
CONSENT TO PARTICIPATE IN A RESEARCH PROJECT FORM

I understand that the questionnaire my child is about to complete is a part of a research project entitled, “The Effects of Digital and Cognitive Imagery on Throwing Accuracy of Baseball Pitchers: A Single Subjects Design,” conducted by Jamie Nelson.

This study is designed to examine the effects of cognitive imagery and digital imagery on throwing accuracy of baseball pitchers. A secondary purpose of this study is to examine the difference between imagery ability, low verses high, and accuracy response after experiencing difference imagery interventions, digital verses cognitive. The study will consist of evaluating the your throwing accuracy and imagery ability using the MIQ-R survey. Your child will be required to throw ten pitches, five times a week for the first one to two weeks. After this is conducted, he will experience four weeks of intervention where he will be asked to throw a series of ten pitches, three times a week after a ten to fifteen minute imagery session. Benefits attained from participating in this study will be the gaining of imagery skills for performance enhancement and use outside of athletics. This study will also provide much needed research in the imagery area in the field of applied sport psychology. Baseline measurements will last from one to two weeks, followed by the intervention portion of the study that will last four weeks. The study will last a total period of five to seven weeks depending on the baseline portion results.

It is important to note that all tests, recordings and results will be confidential and be kept in a locked cabinet in the Georgia Southern University Mental Edge Training Facility, where only the researcher and advisor will be given access. All video recordings
will be erased after a period of one year. Your child’s name will not appear on any publications, nor will any of the results be given to the coach or other people at your school. Risks involved in participation are minimal. Imagery sessions and pitches thrown present no more risk than daily activities or daily physical practice. By signing below, I am agreeing to allow Jamie Nelson to use the information my child provides in presentation and publication. I understand that any relationship between my child and the information he contributes to this study will be kept confidential. Further, I understand that my child may end participation in this study at any time without penalty or prejudice to himself, course grade, employment status or any other personal matter. If I have any questions or concerns about my child’s participation in this study, I may contact Jamie Nelson at 562-477-2803 or advisor Dr. Daniel Czech at 912-681-5267. If I have any questions or concerns about my child’s rights as a research participant, I may contact Georgia Southern University Office of Research Services and Sponsored Programs at 912-486-7758. If you consent to participate in this research study and to the terms above, please sign your name and indicate the date below.

You will be given a copy of this consent form to keep for your records.

Print Participants Name____________________________
Participants Signature____________________________
APPENDIX E

POST IMAGERY STUDY QUESTIONNAIRE
**Post Study Imagery Survey**

Did you at anytime use imagery outside of this study?

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

How do you feel about the use of imagery in general? Do you feel it helped you and how so?

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

Do you feel there was a difference between the two types of imagery and if so what were they?

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

Will you continue imagery use?

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________
APPENDIX F

POINT ASSIGNMENT DIAGRAM
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Point Assigned Target

Strike Zone
APPENDIX G

EXTENDED REVIEW OF LITERATURE
Extended Review of Literature

Past research has shown that imagery used in sport may demonstrate significant results in multiple aspects that contribute to sport performance such as increases in self confidence and efficacy (Munroe- Chandler & Hall, 2004, Beauchamp, M., Bray, S., & Albinson, J., 2002), attentional focus (Calmel, C. 2004), and decreased stress levels, while also affecting motor tasks and performance directly (Stroksahl & Ascough, 1998, Groslandebert, A., et.al. 2003).

Imagery Theory

Imagery, described as the visualization or mental representation that involves various modalities, or all of the senses, has undergone a tremendous amount of research and in turn, its’ effects have been explained by numerous theory. Carpenter (1894) introduced the relationship between imagery use and the Neuromuscular Feedback Theory. As cited in Hale (1982), it is discussed that during imagery practice a localized muscular activity occurs that is virtually identical to the pattern of muscular activity that would occur during the physical practice of the imagined activity, only in lesser magnitude. From this muscular activity, a kinesthetic feedback is returned (Corbin, 1972) in which may be the active component in actual performance enhancement or in any occurring change.

A separate and somewhat contradictory theory that has been used to explain imagery results is the Symbolic Learning Theory (Sackett, 1934). This theory explains that a task is composed of “symbolic elements” that an individual may become familiar with after first being introduced to them. It is this exposure to the task that imagery practice provides for the individual and that may be the key component to its success.
Tasks that are more cognitive in nature are believed to be composed of more “symbolic elements”, thus it is believed that these cognitive tasks should show the most improvement post imagery practice. Feltz & Landers (1983) and Feltsz, Landers, & Becker (1988) found similar results in that over a wide range of tasks Meta-analyses indicated that after imagery implementation these cognitive tasks improved mostly in comparison to strength and motor tasks.

Earlier research done by Bess (1909) understood imagery to be linked with cognitive and spatial awareness activities of the brain. Primarily the difference in individuals’ imagery ability was noted and later a scale was developed, the Bess Scale, in which one could as objectively as possible, measure an individuals’ ability to visualize. These differences in ability were apparent in further research and lead to a greater understanding of the term kinesthetic imagery, the ability to visualize with vividness and using all of the senses (Schiffman, 1995).

General Findings in Sport

In past research Bandera suggests that mental imagery may be used as a method to increase self confidence and efficacy. His prior research on collective efficacy, defined as “the shared belief of the team’s capabilities to succeed in a given task,” (Munroe-Chandler & Hall, 2004), imply that effort, activity selection, and persistence in times of difficulty, are effected and created by problems within the group. From these studies, authors developed the research question of how motivational imagery may affect collective efficacy.

The purpose of the study was to determine how imagery may be implemented to increase a youth soccer team’s collective efficacy. Participants, 14 youth female soccer
players, were divided into three groups, forwards, midfielders, and goal defenders, received imagery interventions for 13 weeks through out a 15 week season. Interventions were given prior to practice, once a week from an identical script that was later found to be used daily and was encouraged to be more individualized by the athlete as they became more familiar with the imagery method. Interventions would begin at week 4 for the forward group, week 7 for the mid fielder group and week 10 for the goal defender group. Dependent variables were collective efficacy, measured by the confidence questionnaire and imagery use, tested by the imagery assessment questionnaire given prior to interventions to determine if the interventions were used as instructed. Quantitative data was collected for the measure of collective efficacy, while qualitative data was collected within imagery assessment.

Results showed that the forwards and the midfielders groups showed an immediate increase by 6 and 7% in collective efficacy in training after imagery implementation, the goal defenders however showed no change. Within competition collective efficacy was increased immediately by 4 % for the forwards group and 6% for the mid fielders, again no change in the goal defender group. The results for the goal defending group were suggested to attribute to the late implementation of the program in a season in which they had already been successful and efficacy levels were already high due to prior wins without imagery use. However, when asked about the implementation program, all athletes felt that the program had helped and remained positive about its affects and prospects.

The effects of imagery on the selective attention of national softball players was investigated by Calmels (2004). Measured through Nideffer’s (1976) Test of Attentional
and Interpersonal Style (TAIS), scores for batting specific selective attentions were recorded for each of the four participants of a multiple baseline study. Three participants underwent 28 sessions of a scripted imagery program from an audio tape for ten minutes a day. Results found that the three participants that had taken part in the imagery interventions were more able to eliminate unnecessary external stimuli and narrow their focus to specific warranted stimuli.

Stemming from Bandera’s (1986, 1997) theory of imagery use, authors hypothesized that imagery, mastery and general, would be positively correlated with self efficacy, and thus be predictive of sport performance (Beauchamp, M., Bray, S., & Albinson, J., 2002), further it was predicted that this relationship would be effected by imagery use. Among collegiate golfer participants, results showed that imagery significantly influenced golf performance and self efficacy, imagery use determined the relationship between golf performance and self efficacy.

In another study, self efficacy and perceived stress levels were measured before during and after a 5.1 m climb of a designated route by volunteer, female, novice climbers. Randomly assigned to one of two groups, control and imagery intervention, participants of the intervention group began a scripted imagery program, resulting in the increased self efficacy of the climbers in comparison to the control group and a decreased level of anxiety during and after the climb.

During an imagery intervention in the competitive season with an elite rugby player, a study (Evans, Cardiff, Jones, et. al., 2004) investigated the effects of an intervention over a 14 week period in a cognitive specific performance environment. Using the Sport Imagery Questionnaire and qualitative data, it was interpreted that the
player experienced an increase in motivation levels, ability to generate confidence in his playing before games, control over his anxiety, as well as greater detail and vividness in his imagery practice. Further research suggestions emphasized the importance of individualizing interventions to meet different needs of athletes.

Imagery has shown significant results when implemented with various other psychological skills such as self talk, goal setting, positive thinking, arousal regulation, and concentration routines. The following study investigated the results of such a mental training program on two elite junior athletes. Assessment of the program was determined by the Competitive State Anxiety Inventory -2 (CSAI-2), various aspects of tennis performance, and statistical data of two specific individuals. At the study’s end, participants of the mental training program when compared to the control group experienced a significant increase in self confidence and tennis performance, and a significant decrease in somatic and cogitative anxiety levels. Further, results of the two specific cases followed imply that the mental training program can eliminate targeted performance trouble areas.

In the following study researchers demonstrated how imagery training in combination with classical training methods (Groslambert, A., et.al. 2003) can positively affect athletic performance or components of it, further, these affects were shown after intense activity, a more real life application. Past research findings show that imagery training may positively affect postural control and shooting performance. This study sought to take previous research further and find out how biathlon athletes would respond with imagery interventions and classical shooting training, the difference being that biathlon athletes must perform the shooting task after intense exercise, affecting muscle
fatigue, stability and heart rate. The independent variables looked at between the 16 biathlon athlete participants were imagery training and classical shooting training with the control group of just classical shooting training. The dependent variables were stability, measured by the tremometer test developed for the rifle, shooting performance, measured by the number of missed shots in a trial of five, giving the study quantitative data. These test were taken before an exercise bout of roller skiing at a heart rate intensity of 90% that would allow the athletes to simulate their physical environments when competing, the test were then administered again after. Results gave significant differences between the end measurements and the first two measurements on stability and although not significant (p= .006), the tendency was the same in the shooting performance measurement.

**Imagery ability and use**

Imagery ability is believed to mediate imagery use (Bandera, 1986, 1997), and perceived imagery ability may influence sport performance as well (Stroksahl & Ascough, female participants from multiple sports were investigated to determine if this correlation exists between confidence in imagery ability and imagery use, and if efficacy in imagery ability determined the relationship between imagery ability and imagery use. Results found that imagery was used more often when athletes were more confident in their imagery ability, further, the relationship between cognitive imagery use and imagery ability was mediated by efficacy of imagery ability ( Short, S., Tenute, A., & Feltz, D., 2005).

How imagery use positively affects performance was discussed early and further demonstrated in a study of recreational, provincial, and national athletes. Using the
Deliberate Imagery Practice Questionnaire, developed specific for the present study, athletes perceived level of importance of imagery was measured in relation to concentration, relevancy and enjoyment. Results revealed that the higher the skill level of the athlete, the greater their perceived importance of imagery practice was and the greater importance they placed on its practice to positively enhance their performance.

Calmels, France, Holmes, et. al. (2004) sought to investigate the effects of a structured imagery intervention on self-reported vividness of movement imagery in four national softball players. These participants spent ten minutes, four to five times per week practicing an audio taped imagery intervention program that consisted of twenty eight sessions. Imagery vividness measures were acquired using the Vividness of Movement Imagery Questionnaire throughout the multiple-baseline design. Among all of the participants a significant increase of up to 26.7% were demonstrated from baseline scores to post imagery vividness training score, with the exception of participant three who began here baseline vividness rating at a higher level, thus leaving less room for improvement. These findings indicate that visualization ability and vividness may be improved with practice and training. Images that were of rare scenarios and or uncommon images were reported to be more difficult to image. One participant stated that the external perspective was far more challenging than the internal perspective when seeking clarity and vividness. In turn, familiar situations or images were less challenging to imagine clearly as feelings and other somatic feelings and sensory feedback have already been experienced and paired with the envisioned scenario, thus making the image more vivid. Imagery that was practice immediately post game was stated to be much more effective and beneficial.
Athletes must be able, not only to learn, but practice and apply imagery skills in the real setting in which they perform. In order for this to be possible the design of the study must be as near to real life as possible, in setting and in actual detail of visualization. One study specifically (Groslambert, A., et.al., 2003) demonstrated how imagery training in combination with classical training methods, as used in physical practice, can positively affect athletic performance or components of it, further these affects were shown after intense activity. The authors did a tremendous job of controlling for extraneous variables and simulating the performance environment as accurately as possible.

A study including 172 colligate basketball players investigated the relationship between imagery ability and high and low physical performance, as a possible factor for competitive separation or athletic distinction between high and low performers. The Sport Imagery Questionnaire, Movement Imagery Questionnaire- Revised, and the Basketball Background Questionnaire were all used to measure and collect data. Overall, the findings concluded that through kinesthetic imagery and motivational specific imagery basketball performance was best enhanced. It was stated that Elite players were have the ability to feel the what is going on around and within themselves and to increase their internal drive for success before and during games, thus giving them greater consistency.

Type of Imagery

Throughout imagery research and practice, there have been few conclusions drawn to determine which, if any, perspective of imagery is most successful in performance enhancement. In a study done by Glisky & Williams (1997), the internal and external perspectives of imagery practice were examined with two tasks, cognitive/ visual
and motor/kinesthetic. After the distribution and completion of the Imagery Assessment Questionnaire (IAQ, derived from Vigus & Williams 1985) 21 internal and 21 external imagers were selected to participate and randomly assigned to groups while 7 of each were assigned to a control. When examining the image clarity, results show a main effect of (M= 7.92) for the internal imagers, when compared to the external imagers main effect of (M=6.86). It was found that there was a significant interaction between task and perspective, indicating that external imagers rated their imagery clarity lower on one task than another, while the internal perspective imagers felt consistent on image clarity throughout the tasks.

**Single Subject Design**

A multiple baseline, single subjects design was applied (Calmels, Berthoumieux, & d’Arripe- Longueville, 2004; Carboni, et. al., 2002; Mamassis, G., & Doganis, 2004) to various imagery investigations, thus demonstrating that this is an effective means by which to demonstrate the significant effects of implemented imagery programs. With a multiple base line single subject design, results may be directly implied as the effect of the manipulated variable or in the present study, of the implemented program.

Calmels, France, Holmes, et. al. (2004) successfully used a multiple baseline, staggered single subject’s design to demonstrate the differences of internal and external perspective imagery among different tasks, and as discussed before, finding a statistically significant difference, after peer review, between baselines to post treatment results.

Suggestions were made by the authors (Carboni, et. al. 2002) for further research in the area of brief imagery sessions with a time table of eight weeks or more or
conducting sessions 5 to 7 days per week. Investigating weather brief sessions of imagery had an effect on free throw shooting performance and concentration style of intercollegiate basketball players, six participants were selected, by recommendations of their coaches’, between the ages of 18 to 23. Four females and two males participated in the study for six weeks, for participant’s current players and two former basketball players. The independent variable was the brief sessions of visualization, while dependent variables were concentration, free throw efficacy and free throw performance. The Basketball Concentration Survey was used to measure effective and ineffective use of attention. A free throw efficacy questionnaire was administered to measure athletes own perception of their free throw ability, post imagery sessions a Imagery rating Scale was administered to collect objective data on the imagery sessions themselves. The athletes reported qualitatively to the imagery sessions themselves, each athlete reporting similarly that they found that the imagery did help in some way and several participants said that they would continue the use of imagery skills. The quantitative free throw data was compared to post study percentage and the percentages of the previous year’s free throw scores. Large increases in free throw efficacy scores were found in participants numbers 2, 3, and 4, while participants 3, 5, and 6 demonstrated increases in the free throw shooting scores, however overall no significant changes were made in the concentration scores. Suggestions for further research and possible explanations for the results discussed the small number of participants, the short duration of imagery implementation.

Imagery sessions of 10 to 15 minutes in length (Munroe-Chandler & Hall, 2004, Camel, 2004), demonstrate that brief imagery sessions may be effective, however,
reference was made to prior research by Vealey and Walters whom stated it was important that imagery programs be used throughout an entire season to be effective, thus leading to further questioning of the affects of shorter implementation time.
Additional References


### Application for Research Approval

<table>
<thead>
<tr>
<th>Name of Principal Investigator: Jamie L. Nelson</th>
<th>Email: <a href="mailto:Jamie_l_nelson@georgiasouthern.edu">Jamie_l_nelson@georgiasouthern.edu</a></th>
</tr>
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<tbody>
<tr>
<td>Phone: 562-477-2803</td>
<td>Address: 314 Clairborne Ave. Statesboro, GA 30458</td>
</tr>
<tr>
<td>Department: Health and Kinesiology</td>
<td>Project Start Date: 11/1/06</td>
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<tr>
<td></td>
<td>Project End Date: 12/07/06</td>
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<td>If student project please complete advisor’s information below:</td>
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<tr>
<td>Advisor’s Name: Dr. Daniel Czech</td>
<td>Advisor’s email: <a href="mailto:drczech@georgiasouthern.edu">drczech@georgiasouthern.edu</a></td>
</tr>
<tr>
<td>Advisor’s phone: 912-681-5267</td>
<td>P.O. Box:</td>
</tr>
<tr>
<td>Department: Health and Kinesiology</td>
<td>All applicants please complete all fields below:</td>
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### Project Information:

- **Title:** The Effects of Digital and Cognitive Imagery on Throwing Accuracy of Baseball Pitchers: A Single Subject Design
- **Project Duration (in months):** 1.25 to 1.5 months
- **Number of Participants:** 6
Brief (less than 50 words) Project Summary:
This study aims to determine effects from a single subject design of brief digital and cognitive imagery sessions on throwing accuracy of baseball pitchers, and if a relationship exists between imagery ability level and interventions. Stroksahl and Ascough (1998) found visualization enhances performance and has greater effects when practiced in greater detail and vividness. The MIQ-R, Movement Imagery Questionnaire- Revised (Hall & Martin, 1997), measuring vividness, will be used to determine imagery affects on participants of varying abilities. Three baseball pitchers of each ability level will be assigned to digital imagery, cognitive imagery, and control groups. Sessions will be conducted for approximately 10 to 15 minutes. The average of the ten pitches thrown at a strike zone device will be used to measure throwing accuracy pre and post interventions, three times a week for four weeks of intervention. Interventions will begin after individual baselines have been demonstrated, approximately 1 to 2 weeks. It is hypothesized that throwing accuracy will improve with imagery implementation in comparison to the control group and that lower ability athletes will respond better to digital imagery than cognitive.

Please respond to the following as briefly as possible, but keep in mind that your responses will affect the actions of the Board. Clearly label your responses in sections that correspond to the specific information requested. You may insert your responses in each section on this page, leaving a space between the question and your answers. Narrative should not exceed 4 pages.

The application should be submitted electronically or 2 duplicate copies sent to the Office of Research Services and Sponsored Programs, at P. O. Box 8005, Statesboro, GA 30460, and should contain, in this order: a signed cover page, the informed consent checklist page, the project proposal narrative, and the informed consent that you will use in your project. Additional information, such as copies of survey instruments, advertisements, or any instruments used to interact with participants should be attached at the end of the proposal clearly designated as an Appendix.
Personnel. Individuals participating in the research beyond myself, Jamie Nelson, and the advisor, Dr. Daniel Czech, will be Dr. B. Joyner, and Dr. T. Lachowetz as the thesis committee. These individuals will assist in advising, serve as a peer review board for data analysis and all other thesis committee functions including overseeing and ensuring sound research.

Purpose.

Research Questions

3. What are the effects of digital and real life imagery on high school and college baseball pitchers?

4. How do the two imagery implementations, digital and cognitive, affect low and high ability imagers throwing accuracy differently?

Hypothesis

1. Both imagery intervention groups will have significantly higher throwing accuracy scores than the control group.

2. Lower imagery ability individuals’ will demonstrate significantly higher accuracy scores when digital imagery is introduced, than lower ability individuals who experienced cognitive imagery as the first implementation.

As the effort to increase athletic performance grows, so does the field of applied sport psychology. Investigating the effectiveness and potential of psychological skills is becoming increasingly important (Shambrook & Bull 1996). A psychological skill that is quite frequently used and has demonstrated effectiveness (Kearns & Crossman, 1992; Shambrook & Bull 1996) is visualization, or imagery.
Imagery is the ability to create or re-create a positive or negative experience in the mind (Carboni, 2000). Mechanical or execution flaws, simulated practice without the physical component, and the creation of a successful outcome have all been approached through imagery (Vealey & Walter, 1993). Imagery practice should be a dynamic re-enactment of imagined or simulated events involving detail and multiple senses. Kinesthetic imagery (Schiffman, 1995) is understood to be a visualization or mental representation that involves various modalities, or all of the senses. It recreates the movement of the body, the feelings that are felt within it during that movement, the sounds that may be heard and even the smells.

It is suggested by the neuromuscular feedback theory that during imagery sessions, although weaker in magnitude, muscular activity within the body is the same as when the skill is actually being practiced (purposed by Carpenter in 1894; cited in Hale, 1982). The improvement in motor performance is believed to come from the kinesthetic feedback that coincides with the imagery practice (Corbin, 1972).

Research on imagery as a psychological skill is vast and has shown over time that visualization can increases self confidence and efficacy (Munroe- Chandler & Hall, 2004, Beauchamp, M., Bray, S., & Albinson, J., 2002), attentional focus (Calmel, C. 2004), and decreased stress levels. Research has also shown imagery can affect motor tasks and performance directly (Stroksahl & Ascough, 1998, Groslambert, A., et.al. 2003). Furthermore, imagery has been shown to affect the following sport specific tasks such as putting accuracy, free-throw shooting and dart throwing accuracy.

Imagery has been shown to be very effective in regards to accuracy in sport. Thomas & Fogarty (1997) found that imagery in combination with positive self talk
training improved golf performance and psychological factors, more specifically putting. Individuals implementing only positive imagery training for a simple motor task, putting accuracy, found that in comparison to the negative imagery training and control groups, putting performance was significantly increased, while a decline in performance was demonstrated by the negative imagery group (Roberts, Woolfolk, Marks, et.al., 2005). Imagery has been shown to positively enhance free-throw shooting performance among collegiate basketball players. Kearns & Crossman (1992), Shambrook & Bull (1996), Templin & Vernacchia (1993, 1995), Stewart (1997), and Carboni (2000) determined imagery to be effective to some degree, in most cases. Much of this research utilized a single subject design that has shown to be important in applied sport psychology to demonstrate the improvements of individual cases that may be overlooked in a traditional group analysis (Shambrook & Bull, 1996). More specifically when used in as a multiple baseline design, conclusions may be drawn that the effects may be due to the specific intervention (Bryan, 1987, p. 286). This design allows for an individual analysis of the imagery implementation and a way to tailor the intervention to the individual.

Originating visualization theories have not always been applied to sport performance and began in the cognitive and spatial awareness research. Bess (1909) was among the first research noted and is credited for the measuring system developed for visualization. The Bess scale addresses the differences in individuals imagery ability. The basis of the literature is derived from cognitive theory of imagery and more closely tied to the understanding of the term kinesthetic imagery (Schiffman, 1995).

A pitcher may be asked to imagine the ball in his hand before a throw, to feel the laces and texture on his hand, maybe even brush the dirt off, as if he had just picked it up
from the ground. It is discussed by Bess that the image should be as vivid and detail oriented as possible. The Bess scale measures the vividness of the visualizations practiced on a seven degree scale of vague to vivid scores. However, Wilson & Barber (1981) found that individuals can vary greatly in their ability to vividly visualize. Moreover, Stokahl & Ascough (1998) found that some athletes could be very detailed in their imaging, while others were very vague, concluding that those less vivid images may not be as effective in enhancing performance. Therefore, athletes who are lower in imagery ability may not to reap the full performance enhancement benefits of imagery training. These findings may give further reasoning to investigate the effects of digital imagery. More specifically, individuals that lack the skill of vivid imaging may find that a digital re-enactment of the task allows them to “see” the desired performance in their mind more clearly and to mentally prepare for the actual event or task demonstration.

Little research has been found that examines the effects of internal digital imagery, a video shown from the internal perspective of an athlete. However, some research has integrated video tape modeling with imagery training. In a Hall & Erffimmeyer (1983) study, experienced high school female basket ball players were assigned to a video modeling/imagery group and a relaxation/imagery group. Results can only be attributed to a combination of psychological skills as they were compounded within the study, but it was concluded that the video modeling/imagery group demonstrated increased performance levels in foul shooting when compared to the relaxation/imagery group.

**Describe your subjects.** Participants in this study will be six baseball pitchers in
the southeast region of Georgia. The participants will be selected from high schools and colleges throughout the southeast region and will be asked to sign a consent form before participation in this study. The participants will consist of men who ranged in age from 14 years to 24 years. Only participants that are currently on pitching staffs of high school or college baseball teams will be utilized. The consent form will assure them of confidentiality, the purpose of the present study, and the risks and benefits of participation. Contact will be made with each institution and they will be informed that their participation is completely voluntary and have completed an informed consent form prior to participation.

**Methodology (Procedures).** Baseball pitchers will be distributed the MIQ-R test and scores will be collected and recorded by number to protect confidentiality and allow for as much random selection of participants as possible. From these scores, three participants from each of the higher twenty percent and lower twenty percent of imagery ability will be randomly selected and asked to participate in the study. Eliminating the middle scores will attempt to ensure that the participants represent actual high and low imagery abilities of baseball pitchers.

Throwing accuracy will be measured before interventions begin, five times a week, until a stable baseline is demonstrated. If a stable base line is not demonstrated after two weeks the participant will be asked to withdraw from the study and a new participant of the same ability category will be asked to participate. A stable baseline will be identified by an average score that has no more than a two point variance for at least three trials in a row. After a baseline is demonstrated imagery interventions will begin, each intervention lasting two weeks. Measurements will be taken three times a week, post
imagery session, during the imagery intervention program, until the program's completion. Accuracy measurements will be determined by the average of a series of ten pitches in a real-life setting, with the accuracy measurement apparatus placed in front of the home plate. Accuracy measurements will be taken on the Georgia Southern University Baseball field and will be scheduled at times when the field is not occupied or in use. Video recordings of the throwing accuracy trials will be taken to ensure that points where accurately assigned for each throw. These recordings will capture the measurement device and end result of the pitch, the participant will at no time be captured in these recordings. During the baseline measurement portion of the study, the Samsung Sports Camcorder SC-X205L/X210L will be used in conjunction with its external helmet camera module, to capture recordings of an accurate pitch from the internal perspective of the pitcher. The recordings will be used to create digital imagery videos. Digital imagery videos will be recorded from the external helmet camera module that will be placed on the side of each individual pitcher's head, at eye level, to capture the pitcher's own perspective of the pitch being thrown. The device fits comfortably on a head band that will be worn on the pitcher's head. No sign of discomfort is anticipated. If by chance, the pitcher becomes uncomfortable, the head band will be taken off and refit to make it more comfortable. The pitcher will at no time be captured in the recordings. Each individual's recorded pitch from the helmet camera module will be used in their individual digital imagery intervention. Counter balancing will be done to eliminate sequence effects. For participants one and four, cognitive imagery will be implemented at week 1 of interventions, followed by digital imagery sessions beginning in week 3 of interventions. Participants 2 and 5 will receive digital imagery sessions as the first
intervention in weeks 1 and 2 and cognitive imagery in weeks 3 and 4 of interventions. Participants 3 and 6 are measured three times a week but will receive no intervention, serving as control. The digital imagery sessions will be conducted on an individual basis during a scheduled time slot in the Georgia Southern University Mental Edge Training Facility, located in the Hanner building gymnasium. During the digital imagery interventions participants will be asked to watch the previously recorded accurate pitch while imagining the accompanying sensations from all other senses; hearing, smell, taste and touch, in as much detail as possible. Cognitive imagery sessions will be held on the field of practice on an individual basis as well, to replicate a real life setting. During cognitive imagery interventions the participants will be asked to imagine the accurate pitch in their mind as vividly as possible, using all of their senses. Each individual’s imagery session will be for duration of approximately 10 to 15 minutes.

Video recordings of accuracy measurement sessions and digital imagery material will be kept in a locked cabinet within the Georgia Southern University Metal Edge Training Facility. Access to these recordings will be given only to the researcher and advisor. All recordings will be erased after a period of one year.

**Risks.** Risks involved in participation are minimal. Pitchers will be asked to participate in imagery sessions in which an accurate pitch thrown in real life will be imagined in detail. During the digital imagery interventions pitchers will be asked to watch the video recording of their accurate pitch previously recorded with the Samsung Sports Camcorder. The imagery interventions present not more risk than daily activities. The Samsung Sports Camcorder is powered by a battery pack (1200mAh) at its main unit and
presents minimal risk of shock or other injury due to excess voltage. Pitches thrown
during accuracy measurements present no more risk than daily physical practice.

**Research involving minors.** If minors should be selected to participate, parents will be informed
as participants. They will be educated on the purpose, procedures, benefits and minimal risks,
rights as a research participant, and confidentiality procedures of the study. They will be given a
parental consent form in which they have the option to sign or decline their child’s
participation.

**Cover page checklist.** Research may involve the participation of minors, in which case the
consent of their parents will be sought and procedures discussed above will be followed.
APPENDIX I

BIORGRAPHY
I began my college education in Aug. 2000 at Colorado State University. It was here that I took my first sport psychology class and found myself drawn to the field. I found myself passionate about the idea that we can actually change our lives, our realities, by how we think. From this day forth I sought further education in the field of sport psychology, determined to make this my life career. In 2002 I transferred to California State University, Long Beach, where I took on the sports psychology major as well as athletic training. During my hours in the training room I was able to experience first hand how imperative it is that athletes remain mentally tough. I was able to see how many of them had not been shown not only the power of the mind, but how to develop it in order to perform at your best. Further, how these principles may be used to enhance the healing process. I graduated in 2005 with a Bachelors of Science in Kinesiology with an emphasis in Sport Psychology. I continued my education at Georgia Southern University where I have been given many applied opportunities in multiple sports including individual and group settings. I will be graduating in May 2007 with a Masters of Science in Kinesiology.