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Effects of preshot routine time and movements on free throw shooting performance

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EFFECTS OF PRESHOT ROUTINE TIME AND MOVEMENTS ON FREE THROW SHOOTING PERFORMANCE

An Abstract of a Thesis

Submitted

In Partial Fulfillment

of the Requirements for the Degree

Master of Arts

Mickey Gay Mack

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The purpose of this study was to examine the effects that length of preshot routine and use of a set sequence of movements have on free throw shooting in basketball. Seventeen members comprising the University of Northern Iowa intercollegiate men's basketball team attempted 20 free throws in each of four different conditions: (1) normal routine, (2) normal routine with lengthened time, (3) altered routine with normal time, and (4) altered routine with lengthened time. For the altered time condition, subjects used a minimum of 200% of their normal time. For the altered routine condition, subjects used a routine provided by the researcher. Free throw performance was measured using an objective 5-point scoring system. MANOVA revealed significant effects for routine ($F = 5.9548$, $p < .05$). Neither time ($F = 0.2164$, $p > .05$) nor routine by time reached significance ($F = 0.8987$, $p > .05$). Results indicated that the movements in the routine had a significant effect on performance while length of time did not have a significant effect on performance. It was concluded, therefore, that coaches and athletes need to establish and repeatedly use a comfortable movement pattern with less concern regarding the precise timing in performing that routine.

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has been approved as meeting the thesis requirement for the Degree of Master of Arts

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CHAPTER I

INTRODUCTION

Sport in today's society is a big business with an intense following. In the United States alone corporations spend an estimated 6.2 billion dollars annually on sports marketing expenditures. Over 142 million spectators attended collegiate and professional games in football, basketball, and baseball in 1989 (LeUnes & Nation, 1989). Instant recognition and countless dollars are at risk in hundreds of contests each year. Even under these stressful conditions, many athletes are capable of performing at high levels of proficiency with great consistency.

Numerous times throughout the season an athlete will step to the line in a nationally televised basketball game and calmly sink two free throws enabling his team to win. A golfer will drop a 12 foot putt that wins the tournament. In an attempt to maximize performance many athletes have developed preperformance routines. In pressure situations inexperienced athletes tend to abandon or change their competition routines. Experienced athletes do just the opposite.

A preperformance (precompetition, preevent, or preshot) routine is a predictable pattern consistently carried out before an athletic performance that usually involves cue thoughts, actions, and/or images (Gayton, Cielinski, Francis-Keniston, & Hearns, 1989). A preperformance routine is used by athletes in an attempt to control their environment (Martens, 1987) and to synchronize their affective, perceptual, and motor systems (Southard, Miracle, & Landwer, 1989). The preperformance routine is used as a count-down to competition/execution, to trigger concentration, and/or to allow the incorporation of other psychological skills (Martens, 1987). Thus attention is focused on appropriate cues instead of on negative self-talk, doubts, or high arousal reactions.

The use of a preperformance routine is prevalent in many sports. A bowler who always wipes both hands, first the left and then the right, on a towel before picking the ball up from the left side is using a preperformance routine. The baseball batter who applies pine tar on his bat two times, knocks the dirt off his spikes, and then enters the batter's box without stepping on the lines is performing a preperformance routine. A basketball player who touches both wrist bands and dribbles three times before shooting a free throw is also using a preperformance (preshot) routine to control her environment.

As experience levels increase the predominance of preperformance routines and superstitions increase (Neil, Anderson, & Sheppard, 1981). Greene (1990) states that experienced golfers "develop a strategy that starts with a preshot routine that sets a good tempo, relaxes and focuses them, and makes the shot automatic" (p. 87). Martens (1987) suggests that these preperformance routines have emerged from superstitious explanations of what may have caused an excellent performance in a previous experience.

Whatever the origin, the use of preshot routines has been determined to have a positive effect on performance in golf (Boutcher & Crews, 1987; Crews & Boutcher, 1986a, 1986b) and in basketball (Gayton et al., 1989; Lobmeyer & Wasserman, 1986). One of these studies (Crews & Boutcher, 1986b) was a behavioral analysis comparing length of preshot routine time to players' ratings and scores in golf. A similar behavioral analysis (Walker, Nideffer, & Boomer, 1977) examined the relationship between concentration times prior to a dive and the actual dive score received in competition. Both of these studies reported that length of preshot routine time had an effect on quality of performance.

Other studies have been experimental in nature. Lobmeyer and Wasserman (1986) had subjects shoot free throws with and without the use of a preshot routine. The use of a preshot routine resulted in better performance. Gayton et al. (1989) also had subjects shoot free throws with and without a preshot routine but in a competitive situation. Again the condition using the preshot routine resulted in better performance. The competitive situation, however, led to a greater difference between conditions than reported by Lobmeyer and Wasserman. In a third experimental study (Southard et al., 1989) subjects shot free throws using similar conditions of with and without a routine. Results indicated no significant difference between conditions.

It is apparent that the use of a preshot routine is beneficial to performance. However, gaps in the research literature still exist. The current research literature has not examined the effect that altering the athlete's existing preshot routine might have on performance. Researchers have not established whether it is the length of the routine, the sequential nature of the movements of the routine, or the timing of the movements prior to shooting that are important to the performer. The effect of lengthening the routine time while using the same movement routine has not been studied. Additionally the effect of allowing the performer to maintain his or her normal length of routine but altering the routine movements has not been researched. This study was designed to examine the effects that length of preshot routine and the use of set preshot routine actions have on free throw shooting performance.

Statement of the Problem

The purpose of this study was to examine the effects that length of preshot routine and the use of set preshot routine movements have on free throw shooting performance.

Significance of Study

Preshot routines are used by most athletes in sports such as golf, tennis, and basketball. Many coaches believe that these routines or superstitious beliefs are ineffective and discourage such beliefs in athletes. Current research however has determined the use of a preshot routine to be beneficial under certain circumstances and with some restrictions. One restriction is that the individual's routine should not interfere with the preparations of other athletes on the team.

Preperformance routines or rituals are generally a predictable pattern involving cue thoughts, actions, and/or images consistently carried out before the performance of an athletic contest or skill (Gayton et al., 1989). Sport psychologists have recently begun studying this practice. Crews and Boutcher (1986a, 1986b; Boutcher & Crews 1987) have shown that the use of a preshot routine is beneficial to golf performance while other researchers (Gayton et al., 1989; Lobmeyer & Wasserman, 1986) found a preshot routine to be beneficial to free throw shooting in basketball.

These studies have compared the performance of basketball free throw shooting between the use of a preshot routine and no preshot routine. This has been done in both a non-competitive situation (Lobmeyer & Wasserman, 1986) and a competitive situation (Gayton et al., 1989). In the competitive situation, restricting the use of a routine led to a greater performance decrement between conditions than the non-competitive study. The effect of stress on free throw shooting performance is important to coaches and athletes. If competitive stress does lead to a decrease in performance, athletes need to be taught a method of coping with this stress. One such method of coping is the use of a

preshot routine. Players can be taught why a routine is effective and what constitutes a good routine.

The question remains, however, as to whether the effectiveness of using a preshot routine is due to the use of a prescribed length of time as selected by the performer or to the repeated use of a specific set of actions. Therefore this study was significant because it examined the effects of length of routine on performance while controlling the use of preshot routine movements. Conversely the routine movement pattern was studied while the length of routine was altered.

Results of this study may indicate that length of time is critical to performance. If time is found to be critical, coaches and athletes may need to focus on, and practice, using the same length of time whenever the preshot routine is used. If a set pattern of movements is found to be the critical factor, coaches and athletes may need to develop a pattern and then consistently use it as a preshot routine. Additionally the results of this study might be used to further the current theoretical explanations of why preperformance routines appear to be beneficial to performance. Thus a study to determine the effects of time and movement patterns on free throw shooting performance is significant.

Limitations

This study was limited by:

1. A small sample size which limits the generalizability of the study.

2. The possibility that the subjects did not comply with the researchers request to give utmost effort when shooting free throws.

3. The accuracy of reported preshot routine times due to the use of a hand-held stopwatch.

Assumptions

This study was conducted upon the following assumptions:

1. Subjects gave a maximal effort while being tested.
2. The stopwatches were reliable and valid.
3. The measuring of time for the preshot routine was consistent.

Hypotheses

It was hypothesized that altering the length of preshot routine and altering the movements of the preshot routine would have a negative effect on free throw shooting performance. Specifically, altering the routine movements would cause more of a decrement in performance than lengthening the routine time.

Definition of Terms

For consistency of interpretation, the following terms are defined:

Anxiety: The higher arousal states that produce feelings of discomfort or excessive concern and worry (Weinberg, 1989).

Arousal: The intensity underlying behavior; it is the physiological activation that instigates or activates behavior (Bird & Cripe, 1986).

Preperformance Routine: A set pattern of cue thoughts, actions, and/or images consistently carried out before the performance of an athletic event or skill (Gayton et al., 1989).

Preshot Routine Time: The length of time between the subject touching the basketball, to the instant the fingers break contact with the ball at shot release.

Stress: A complex psychobiological process that consists of three major elements: stressors, perceptions of danger, and emotional reactions. The stress process is

generally initiated by situations that are perceived as dangerous, potentially harmful, or frustrating (Spielberger, 1989).

CHAPTER II

REVIEW OF LITERATURE

This study was designed to examine the effects that length of preshot routine and preshot routine pattern sequences have on free throw shooting performance. It was predicted that altering either the length of the routine or the movements of the routine would negatively effect free throw shooting performance. It was specifically predicted that altering the actions of the preshot routine would have a greater negative effect on performance than altering the length of time allowed for the routine. For the purpose of this review, sport and the competitive process, and preshot routines will be discussed. Accordingly, the literature review has been organized into the following sections: (a) Sport and the Competitive Process, (b) Preperformance or Preshot Routines, (c) Basketball Performance Rating System, and (d) Summary.

Sport and the Competitive Process

The behavior of people involved in physical activity, particularly sport, has long been of interest (Martens, 1975). However, today's Western civilization has an even more intense interest in sport. Martens goes on to state that "competition is a social process that is so pervasive in Western civilization that none can escape it" (p. 66). A similar view is taken by Sage (1974). Sage suggests that sport is so embedded in our activities that to ignore it is to overlook one of the most significant aspects of contemporary American society. Sage states that sport has now extended into education, politics, economics, and even international diplomacy.

Although sport is of great interest today, it is not a recent phenomenon. Sport has existed for thousands of years. Palmer and Howell (1973) contend that archaeological evidence seems to indicate participation in boxing and wrestling events during the

Sumerian civilization of 3000 to 1500 B.C. During the same time period people of the Egyptian civilization enjoyed kicking games, crawling games, and ball games. The Olympic Games have a similar long history. The 1st Olympiad was held in Olympus in 776 B.C. and the modern Olympic Games were founded in 1896 (McIntosh, 1963).

Though sport has a long history, a unified definition of sport has not been universally accepted. Weiss (1969) uses a philosophical interpretation to see as the basic feature of sport man's drive for excellence and his effort to protect himself. Nixon (1984) defines sport as an institutionalized competitive activity involving opponents and stressing physical exertion. Perhaps one of the first comprehensive classification of games and sport was by Roger Caillois (1961) in the book Man, Play, and Games. He classified games into four main categories, one of which is agon. Caillois described agon as a group of games that seem to be competitive. The point of the game then is for each player to have his/her superiority recognized. McIntosh (1963) divided agon into four types of competition based on the participant's motive. The first two types of competition involve striving for superiority versus an opponent while the other two types of competition involve challenges of environment or expression. Competition involving proving one's self better than the opponent is a simple definition of sport accepted by many people today.

Blanchard and Cheska (1985) define sport as a game-like activity having rules, a competitive element, and requiring some form of physical exertion. The sport sociologist, Harry Edwards (1973), similarly defined sport as activities stressing physical exertion through competition. Since one of the common elements of these definitions is the inclusion of competition, further discussion of competition is

necessary. This term, competition, is what Martens (1975) refers to as the competitive process.

Martens described the competitive process as a "four-category frame of reference with the individual as the focal organism" (p. 68). His process of competition involves four stages of events. Each stage is affected by the other stages and also by external factors. All of the stages and their relationships are influenced by the individual and their attitudes, capabilities, and temperament.

Martens four stages are: the objective competitive situation, the subjective competitive situation, the response, and the consequences of the response. The initial stage with which a person is confronted is the objective competitive situation. This simply refers to the factors in the physical or social environment that are arbitrarily defined as constituting a competitive situation. An objective competitive situation is seen as a situation "in which the comparison of an individual's performance is made with some standard" (Martens, 1971, p. 71). A standard can be another individual's performance, an idealized performance level, or one's own past performance. This must be done however, in the presence of one or more persons who are aware of the comparison criteria and can evaluate the comparison process (Martens, 1975).

The second stage of the competition process is called the subjective competitive process and refers to how the person interprets, believes, and evaluates the objective competitive situation. Regardless of whether the person sought out the situation or circumstance caused the situation, an evaluation of the situation must occur. This evaluation will be influenced by numerous factors including motives, abilities, comparisons, and perceived capabilities (Martens, 1975).

Martens (1975) third stage in the competitive process is response. When the person approaches the objective competitive situation a response occurs at three levels. The person responds physiologically, psychologically, and behaviorally. Once again multiple factors may determine the response. The factors may be internal, such as motivational level, or external including time, facilities, and the opponent's behavior.

The final stage is the consequences arising from the comparison of the person's response to a standard (Martens, 1975). This can be either positive or negative. The true significance to the person is determined by how the person perceives the outcomes of the comparison. In other words, a person may win the contest against a poor opponent but still perceive this as a negative consequence due to the performance comparison.

This competitive process can produce considerable stress in a person. Stress is, according to Butt (1987), the "psychological villain of the sports world" (p. 202). Butt goes on to state that psychological stress occurs in sport when the athlete must struggle to maintain a competitive position. This competitive stress is more explicitly defined as a perceived difference between the expectation of the objective competitive situation and the response capability of the person, when failure to meet the demand has important consequences for the person (Martens, 1975).

Competitive stress in sports is a well-researched area (Easterbrook, 1959; Fenz & Epstein, 1967; Jones & Hardy, 1988; McAuley, 1985; Martens & Landers, 1970). Research findings have indicated that a frequent consequence of competitive stress in sports is anxiety (Sanderson, 1989). According to Slusher (1967) sport even encourages man to live with anxiety. Anxiety contributes to the basic satisfactions inherent in sport. Each time man takes the field in competition, he not only lives with anxiety, he welcomes it (Slusher, 1967).

Anxiety and arousal have been of great interest to researchers for many years. Specifically, the effects of arousal and anxiety on motor performance have been widely studied by sport psychologists. Arousal is the physiological activation that instigates behavior, the intensity underlying behavior (Bird & Cripe, 1986). Arousal is a neutral term that varies along a continuum ranging from deep sleep to intense excitement. Anxiety refers to higher arousal states that produce feelings of discomfort and worry (Weinberg, 1989). Anxiety can therefore be thought of as negative arousal.

One method that athletes use to control negative arousal levels is through the use of preperformance or preshot routines. A preperformance routine is used by athletes in an attempt to regulate their environment (Martens, 1987) and to synchronize their affective, perceptual, and motor systems (Southard et al., 1989). The preperformance routine is used as a count-down to competition, to trigger concentration, and/or to allow the integration of other psychological skills (Martens, 1987). Thus attention is focused on related appropriate cues instead of negative self-talk, doubts, or negative arousal levels.

Preperformance or Preshot Routines

A preperformance or preshot routine is defined as a predictable pattern involving cue thoughts, actions, and/or images consistently carried out before the performance of an athletic event or skill (Gayton et al., 1989). For years the use of a preshot routine has been prevalent in sports like tennis, basketball, and golf. Recently sport psychologists have begun to study this practice.

Routines or rituals have their origin in superstitions that have developed over the years about what might have caused an excellent performance (Martens, 1987).

Superstitions usually develop accidentally. An athlete might unkowingly wear one red sock and one green sock for competition. If the athlete then performs well, the ritual may be implemented into a routine. As athletes reach higher levels of competition and become more involved in a sport, there is a greater prevalence of superstition and ritual (Neil et al., 1981). This ritualistic pattern is used by experienced athletes to set a tempo, relax and focus attention, and to make the performance automatic (Greene, 1990).

Current research has focused on the possible benefits of using a preperformance or preshot routine. In a number of studies the use of a preshot routine has been determined to have a positive effect on performance. In basketball free throw shooting (Gayton et al., 1989; Lobmeyer & Wasserman, 1986) and in golf (Boutcher & Crews, 1987; Crews & Boutcher, 1986a) subjects performed at higher levels using preshot routines as compared to not using a routine.

In a non-competitive situation, Lobmeyer and Wasserman (1986) tested university females (n = 15), university males (n = 12), high school females (n = 6), and high school males (n = 10) shooting free throws. All four groups shot 20 free throws using their normal preshot routine and 20 free throws in a without preshot routine condition. When comparing the performance results, all groups shot better using their preshot routine prior to shooting.

Gayton et al. (1989) tested 25 male high school basketball players in a competitive situation shooting 20 free throws using their regular preshot routine and 20 free throws without using a preshot routine. Subjects were divided into groups of five based on free throw shooting ability. While 1 subject was shooting, the other 4 stood around

the lane. Their performance was recorded on a large easel placed to the side of the free throw line. A significantly larger number of baskets were made in the preshot routine condition. The competitive situation showed a greater difference between conditions than that reported by Lobmeyer and Wasserman in a non-competitive situation.

A third experimental study found no significant differences between ritual and non-ritual conditions for free throw success (Southard et al., 1989). Ten female varsity basketball players of a university team served as subjects in a non-competitive setting. Their mean age was 20. Subjects were not restricted by time in the non-ritual condition, but were instructed to shoot the ball without using any unnecessary movements. Results indicated that there were no significant differences in free throw success between the two conditions.

The results of the Southard et al. (1989) study would seem to contradict the other findings. It was noted, however, that subjects were allowed to, and did, maintain the average length of their ritualistic behaviors just prior to the shot. Subjects decreased the overall number of movements performed but still maintained the average duration of the movements in the latter part of their routine. The mean total time for the subject's normal routine was 4.94s and was decreased to 2.46s for the non-routine condition (Southard et al., 1989). Thus using the latter movements of their normal routine may have served as a preshot routine. The low number of free throws shot in each condition (10) may have also contributed to a lack of differences between conditions.

In an attempt to determine how many free throw shots should be used to obtain valid data, Weinberg, Chan, and Jackson (1983) conducted a pilot study. In one condition subjects shot 20 and in the second condition subjects shot 50 free throws. The results of

the two conditions revealed a significant correlation (r = .90). Thus 20 free throw attempts were used by Weinberg et al. (1983) to test free throw shooting performance. It was further noted in this study (Weinberg et al., 1983) that the American Alliance for Health, Physical Education, and Recreation (AAHPER) Skill Test Manual (Brace, 1966) also uses 20 free throws for testing.

Studies on the use of preshot routines in golf have yielded similar results (Crews & Boutcher, 1986a). Thirty undergraduate college students enrolled in beginning golf classes served as subjects. The 17 male and 13 female golfers were assigned to two groups, experimental and control. Subjective and objective measures of performance were recorded before training sessions began. For 8 weeks, the experimental groups (8 men and 7 women) practiced using a specific preshot routine prior to their full golf swing.

After the practice session ended, the golfers were posttested using the same measures of performance. Of the four groups [male routine (n = 8); male control (n = 9); female routine (n = 7); female control (n = 6)], only the males who were taught and practiced a preshot routine had significantly better scores. It was noted in the discussion that the trained males had superior skill before and after training. Therefore it was suggested that perhaps golfers might need to attain a certain level of skill before the preshot routine would positively affect performance (Crews & Boutcher, 1986a). If the golf swings were not well-learned, using a preshot routine may focus attention away from the swing where it is needed and on to the routine, thus serving as a distraction.

A second study by Boutcher and Crews (1987) used similar types of groups and conditions. Twelve collegiate golfers were randomly assigned to one of four groups:

female routine, female control, male routine, or male control. All 12 subjects practiced putting for 6 weeks. The two routine groups were taught to use specific cues and actions as a preputt routine while the control groups used their own putting protocols. Posttesting results indicated that the female routine group (n = 3) displayed significantly improved putting performance. The male routine (n = 3), male control (n = 3), and female control (n = 3) groups did not show any improvement. Both routine groups significantly decreased their variability of time on putting and increased their length of putting times. Discussions centered on the apparent differences in golfing abilities. According to the results, using a preshot routine to improve consistency may prove more beneficial to lesser skilled putters.

The length of preperformance routines has also been examined. A study of 3 male varsity divers on a university team examined the relationship between concentration time and diving performance (Walker et al., 1977). The actual concentration times used by the divers in 11 meets throughout the season were divided into three groups; fast, medium, and slow. Next the times were compared with the scores received in competition. It was found that the diver's best performance scores occurred when using the middle concentration times. The next best performances occurred at the faster concentration times, while the poorest performances occurred when the diver took longer than average times.

Another behavioral analysis involved the observation of 12 players on the Ladies Professional Golf Association (LPGA) tour (Crews & Boutcher, 1986b). The lengths of preshot routines were recorded for both the full swing and the putting stroke. The 12

players were then divided into groups based on their 1983 rankings. Significant differences between the groups were found. It was found that over the 12 observed holes, the more successful players had longer preshot routine times for both shots and had superior scores.

Previous research has focused on the possible benefits of using a preshot routine prior to the performance of a skill. These studies have examined different sports and have used various research methods. Most of the studies have, however reached similar conclusions. In the vast majority of studies, it was concluded that the use of a preshot routine was beneficial to performance.

Since the majority of studies (Boutcher & Crews, 1987; Crews & Boutcher,1986a, 1986b; Gayton et al., 1989; Lobmeyer & Wasserman, 1986) have concluded that the use of a preshot or preperformance routine is beneficial to performance, it seems logical and necessary to examine the possible explanations of why this occurs. Three possible explanations of why preperformance routines do appear to benefit performance can be proposed. First, preperformance routines may provide an optimal psychological set (Nacson & Schmidt, 1971). Secondly, preperformance routines may have become a part of the generalized motor program according to the schema theory (Cohn, 1990). And thirdly, preperformance routines may have become part of a skill which has reached the autonomous phase of motor learning (Cohn, 1990).

As stated previously, preperformance routines are used by athletes to provide focus (Greene, 1990), in an attempt to control the competitive environment (Martens, 1987), and to synchronize the athlete's affective, perceptual, and motor systems (Southard et al., 1989). The preperformance routine is also used to control arousal

levels (Greene, 1990), to trigger concentration, and to allow the integration of other psychological skills (Martens, 1987). Thus attention is focused on appropriate cues instead of negative self-talk or doubt. All of these techniques serve to provide the athlete with an optimal psychological set prior to performing the skill.

A second feasible explanation involves the schema theory of motor skill learning. Schema theory (Schmidt, 1975) postulates that a generalized motor program exists for similar movements of a given class. When numerous such movements have been performed, a set of rules or schema is developed concerning the relationship between the different elements. Once learned the generalized motor program has certain invariant features (Schmidt, 1976). Schmidt cites an example involving handwriting. If a subject writes a sentence on a chalkboard 10 times larger than on a piece of paper, the character of the writing is the same in both cases (Merton, 1972). Even though the musculature used for the large and small writing was different, the results were the same. Perhaps by the process of sequencing smaller programmed units together (Keele, 1987), the preperformance routine has become an invariant feature of the generalized motor program involving free throw shooting, according to the schema theory.

Another possible explanation involving schema theory has been proposed (Cohn, 1990). Schema theory holds that a generalized motor program is stored in memory and may be retrieved and executed (Schmidt, 1976). Preprogrammed commands with unique parameters are stored in memory. The part of memory involved in producing and controlling movement is what Schmidt calls recall schema. The purpose of the preperformance routine then, according to the schema theory, would be to help the performer select the proper motor program based on past experience (recall schema)

and to set up the correct parameters needed to perform the desired movement outcome (Cohn, 1990).

A final explanation is that the preperformance routine has reached the autonomous stage of motor learning (Fitts & Posner, 1967). In the autonomous stage, the skill can be performed with very little attention required. The skill has become primarily automatic. Once this stage is achieved, attending to the highly skilled movement can actually be harmful to performance. This phenomenon is known as the Bliss-Boder hypothesis (Boder, 1935) and may provide a basis for the rationale of establishing a preperformance routine.

Basketball Performance Rating System

Wallace and Hagler (1979) developed an objective rating system to evaluate basketball shooting performance in their study. A 5-point scale was used to measure how close the ball came to entering the basket without contacting the rim (swishing), which was considered a perfect attempt. The farther the ball was from being a perfect attempt, the fewer points received. Points were objectively given for the initial position of the ball on the rim of the basket. A ball completely missing the rim or a ball hitting the backboard first, regardless of the outcome, was given a score of 1 since it was as far from swishing through the net as possible.

Wallace and Hagler (1979) used their rating system to test 24 male college students. The subjects were randomly assigned to two groups ($n = 12$) and each subject shot 25 free throws in two different conditions. The two conditions were knowledge of results only or a combination of knowledge of results and knowledge of performance. ANOVA revealed significant differences between the two conditions.

Summary

It is evident that the competitive process elicits an emotional response in humans. This emotional response is usually in the form of increased anxiety. Preshot routines have been developed by players in an attempt to control anxiety responses. Initial research has focused on the possible benefits of using a preshot routine prior to the performance of a motor skill. While these studies have examined different sports and used various research methods, most of the studies have reached similar conclusions. The majority of the studies have concluded that the use of a preshot routine was beneficial to performance.

What makes the use of a preshot routine beneficial to performance, however, has not been researched. Certain research results have indicated that the lengths of preshot routines are important (Crews & Boutcher, 1986b; Walker et al., 1977). Southard et al. (1989) concluded that perhaps the timing components of the routine were a major factor related to free throw shooting success. It is not currently known whether it is the length of the routine, the timing of the movements leading up to the shot, or the use of a sequenced set of preshot movements that is the critical factor. Therefore further research on the effects of altering existing preshot routines should be advantageous to players and coaches who advocate the use of a preshot routine.

CHAPTER III

METHODS

This study was designed to examine the effects of using a set sequence of movements/actions in a preshot routine and the length of the preshot routine on free throw shooting performance. It was hypothesized that free throw shooting performance would be negatively effected by altering either the length or the actions of the preshot routine. In addition, it was hypothesized that changing the movements/actions of the routine would result in a greater decrement than lengthening the time allowed for the routine.

Experimental Design

The design of this study was a 2 x 2 factorial with repeated measures on both factors. The first factor is length of routine (unaltered and altered) and the second factor is movements within the routine (unaltered and altered). Therefore the independent variables are the routine movements and the length of time allowed to perform the preshot routine. The dependent variable is the subject's free throw shooting performance as measured with an objective 5-point performance scale (Wallace & Hagler, 1979).

Subjects

The 17 members comprising the University of Northern Iowa (U.N.I.) intercollegiate men's basketball team served as volunteer subjects for this study. Of these subjects, 14 were on a full scholarship at the Division I-AA school while 3 of the subjects were walk -on members of the team. Members of the U.N.I. men's basketball team were selected because the use of a preshot routine is taught and encouraged by the coaching staff. Also at this age and level of competition the preshot routine has usually become a set pattern

which is consistently carried out before the performance of each free throw. The athletes in this study were tested for free throw shooting performance after the conclusion of their season. The mean age for subjects was 21.0 while the mode was 22. The range in age was from 18 to 23. Five of the subjects were classified as freshman; 1 was a sophomore; 7 were juniors; and 4 of the subjects were seniors.

A within-group design was utilized with all subjects participating in four conditions: (a) unaltered normal routine, (b) unaltered normal routine using a longer period of time, (c) altered routine with normal time, and (d) altered routine using a longer period of time. Subjects were randomly assigned an order in which to shoot the four conditions. In this way the conditions were counterbalanced to reduce possible order effects.

Research Apparatus

A hand-held Accusplit (Model 705X Magnum) stopwatch was used to record the length of preshot routine. Six identical Accusplit (Model 705X Magnum) stopwatches were used for the testing sessions. Prior to the testing sessions, the stopwatches were synchronized. Preshot routine times were recorded as the length of time elapsed between the subject first touching the ball and the ball leaving the fingers at shot release.

A regulation basketball and a hoop 18 inches (45 cm) in diameter and 10 feet (3.03 m) high were used. The basketballs were the same basketballs used by the team during practices. The baskets were located in an indoor gymnasium which was part of the physical education complex. The four baskets used were separated from the other basketball courts by a wall.

Free throw shooting performance was measured using an objective rating system (Wallace & Hagler, 1979). The rating system was a measure of how close the ball came to swishing through the basket (i.e., a perfect attempt). The farther the shot was from being a swish, the lower the objective rating. One point was given for an air ball that didn't touch the rim. A ball hitting the backboard first, regardless of the outcome, was given a score of 1, since it was as far from swishing as an air ball. Two points were given for a ball hitting the front, back, or side of the rim and then falling away from the rim. Three points were given for a ball hitting on the top of the rim which could fall in or out of the basket. Four points were given to a ball hitting the inside of the rim which would most often fall through the basket. Five points were given for a swish in which the ball goes through the basket without touching the rim. This rating system has been used previously to obtain significant results (Wallace & Hagler, 1979).

Experimental Procedures

The head coach was asked if he would be willing to allow his team to participate in the study. The coach agreed to participate and it was determined that the study would take place approximately 3 weeks after the season was completed.

Prior to the first testing session, a baseline length of preshot routine was established. This was established by timing 10 free throws for each subject and then calculating the mean time. Four of the subjects' baseline times were taken from shots timed during actual intercollegiate games. Six subjects had their baseline times established from a combination of shots timed during games and from shots timed during practices (see Table 1). The final 7 subjects' 10 baseline trials were timed during

basketball practice sessions (this was done because some members of the team did not shoot 10 free throws during games in which the researcher was present).

A preshot routine was operationally defined as the length of time between the subject touching the basketball, to the instant the fingers break contact with the ball at shot release. After every free throw attempt, the subject was required to leave the free throw circle and then reenter. This was done in order to keep the subjects from getting in a rhythm and also to keep the preshot routine situations as identical as possible.

Table 1

Number of Shots Timed During Games and Practices

Subject	Games	Practice
1	5	5
2	4	6
3	4	6
4	4	6
5	2	8
6	2	8

Six U.N.I. graduate students were trained as research assistants in the week prior to the first testing session. The research assistants were all trained at the same time in how to correctly administer each test. Identical instructions were given to be read to the subjects prior to each condition. The assistants practiced reading the instructions and then practiced doing each test. In this way a degree of consistency was developed and the research assistants were able to become familiar with using the stopwatches and the scoring system.

All 17 members of the university men's basketball team volunteered to be in the study. Each subject signed an informed consent form (Appendix A) and was read the general session instructions (Appendix B). Over a 10-day period, the subjects were brought in to shoot under the four different conditions. Four subjects at a time were taken to a gymnasium that had four separate baskets. A subject and a research assistant was then assigned to each basket for that session.

In order to maximize motivation, the experimenters awarded first and second place commemorative plaques to the top two shooters (Gould, Petlichkoff, Simons, & Vevera, 1987). The top two shooters were determined by calculating their total score from the four conditions.

There were two testing sessions for each athlete in which they were asked to attempt 20 free throws under two different preshot routine conditions (40 total shots in each session). Because of scheduling conflicts, 2 subjects had to shoot all 80 shots in a single session with a short rest between conditions, and 3 subjects had to shoot in three different sessions (20, 40, and 20). Each subject was encouraged to shoot the free throws exactly as he would in a game situation.

For the first session the athlete shot 20 free throws using one of the four preshot routine conditions (assigned randomly, see Appendix C). Performance scores were recorded for each shot. Subjects then shot 20 more free throws in a different condition. Again performance scores were recorded. A few days (ranging from 2 to 9) following the first session, subjects returned to the gymnasium in order to complete the final session. The 5 subjects who did not attend the following session were contacted by telephone and reminded of the next testing session time. In the second session (again depending on the random assignment) subjects shot 20 free throws in each of the final two conditions.

In the unaltered normal routine condition, subjects were instructed to shoot 20 free throws exactly as they would in a real game situation. Specific mention of the use of a preshot routine was not made but subjects were told to use their normal free throw shooting style. Subjects were told that their performance results would be recorded (Appendix D) and were allowed five practice shots to warm up.

For the altered length of time condition, normal routine movements were used but subjects were required to lengthen the amount of time taken for the routine by a minimum of 200% of their baseline time. Subjects were given specific instructions to maintain the proportionate timing of their normal routines (see Appendix E). When the minimum time expired, the research assistant said "shot" and the subject was then allowed to shoot. If the subject executed the shot before time was up, the shot was not counted. The subject was again reminded of the time constraints, and the ball was returned to the subject. Subjects were allowed five practice attempts before testing began.

In the altered routine condition subjects used a new routine provided by the researcher but were told to maintain their normal length of preshot routine time. Subjects were taught the new routine and allowed to practice five times using this routine (Appendix F). Subjects were told to perform the new routine using the same amount of time they would use for their old routine. An experimental assistant recorded their times and worked with the subjects during their practice shots in order to maintain their normal routine time. The new preshot routine consisted of: (a) slapping the ball from one hand to the other three times, (b) throwing the ball up in the air with two hands, (c) catching it with two hands, (d) focusing on the target, and (e) shooting.

The final condition consisted of both an altered preshot routine and an altered length of routine time. Subjects were instructed to use the new preshot routine and to lengthen the time for executing the routine by 200% of their baseline routine time. Subjects were given specific instructions to maintain the proportionate timing of the routine (see Appendix G). When the minimum time expired, the research assistant said "shot" and the subject was then allowed to shoot. If the subject executed the shot before time was up, the shot was not counted. The subject was again reminded of the time constraints and the ball was returned to the subject. Subjects were allowed to practice the new routine five times while using the correct amount of time. Research assistants corrected any timing problems or incorrect sequencing during this practice time.

Data Description

Preshot routine times were timed to the nearest 1/hundredth of a second and then rounded off to the nearest 1/tenth of a second. Ten baseline free throw attempts for each subject were timed (see Appendix H). For these times the mean was calculated and used as the baseline time for each separate subject.

The objective rating scale ranging from 1 to 5 was used to measure free throw shooting performance. All 20 scores for each condition were recorded (see Appendix I). The maximum score was 100 points for each condition (5 points x 20 shots) and the minimum score for each condition was 20 points (1 point x 20 shots). The cumulative score for each subject in each condition was then calculated.

Data Analysis

Various descriptive statistics, including measures of central tendency, were used to describe the subjects. The mean, mode, and percentages for the subjects' ages were computed.

The objective rating scale for measuring free throw shooting performance provided a score for each subject in each of four conditions (normal, normal routine with altered time, normal time with altered routine, altered time and altered routine). The cumulative performance score for each subject in each condition was calculated. The subjects' scores were used to calculate a group mean for each condition. The mean length of time for each subject's baseline routine time was determined. Additionally the cumulative score for each subject's four conditional performances was calculated in order to determine the top two shooting performances. The groups' mean score for each condition was tabulated.

A multivariate analysis of variance (MANOVA) was done to test the hypothesis that free throw shooting performance would be negatively affected by altering both the actions and the length of the preshot routine. The MANOVA was also used to test the hypothesis that changing the actions of the routine would result in a greater decrement than lengthening the time allowed for the routine. An alpha level of $p < .05$ was selected for the level of significance.

CHAPTER IV

RESULTS

The purpose of this study was to examine the effects length of preshot routine and preshot routine pattern sequences have on free throw shooting performance. This chapter contains results of the study. A multivariate procedure, MANOVA, was used to test the research hypothesis that altering either the length of the routine or the movements of the routine would negatively effect free throw shooting performance.

Subjects

The subjects consisted of 17 volunteer members of the National Collegiate Athletic Association (NCAA) Division I-AA men's basketball team at the University of Northern Iowa. The mean age of the 17 members was 21.0 years with the range being from 18 to 23 years old. The mode was 22 years of age. Five squad members were freshman (29%), 1 was a sophomore (6%), 7 were juniors (41%), and 4 were classified as seniors (24%).

Performance

The group mean (see Table 2) was calculated for each of the four conditions. There was a 2.71 point difference between the maximum (80.12) and minimum (77.41) mean scores on a 100 point scoring system. Subjects shooting free throws while using their normal routine (Condition 1) had a mean score of 79.76. The highest mean score was 80.12 which was obtained in the normal routine with altered time condition (Condition 2). In the normal time with altered routine condition (3), subjects had a mean score of 78.88. Subjects using an altered routine and altered time (Condition 4) had a mean score of 77.41.

A MANOVA (see Table 3) was done using the Statistical Analysis System (SAS).

Results indicated a significant routine effect with F (1,16) = 5.9548, $p < .05$. However, results indicated that there was not a significant time effect with F (1,16) = 0.2164, $p > .05$. The MANOVA also revealed that there was not a routine by time effect [F (1,16) = 0.8987, $p > .05$]. Therefore the results of this study indicated that the movement pattern of the routine did have a significant effect on free throw shooting performance while increasing the length of routine did not.

Table 2

Means and Standard Deviations for Performance Scores

Condition	M	SD
Normal Routine		
Normal Time	79.76	6.18
Altered Time	80.12	6.18
Altered Routine		
Normal Time	78.88	6.62
Altered Time	77.41	5.46

Note: N = 17.

Table 3

MANOVA Results

Effect	Statistic	Value	F	df	p
Routine	Wilks' Lambda	0.7287	5.9548	1,16	.0267*
Time	Wilks' Lambda	0.9866	0.2164	1,16	.6480
Rout*Time	Wilks' Lambda	0.9468	0.8987	1,16	.3572

*$p < .05$.

CHAPTER V

DISCUSSION

This study was designed to examine the effects altering the preshot routine would have on free throw shooting performance. The performance scores for the four conditions were compared in an attempt to find the most effective preshot routine for free throw shooting performance.

The use of a preshot routine has been prevalent in sports such as tennis, basketball, and golf for many years. Researchers have recently started to search for empirical evidence as to the possible benefits of using a preshot routine. Various studies have found the use of a preshot routine to have a positive effect on performance. The purpose of this experiment was to determine whether the length of the preshot routine or the specific movements of the routine were critical factors in the effectiveness of a preshot routine.

The results of this study indicated that altering the established sequence of movements in the subject's preshot routine did have a significant effect on free throw shooting performance. It had been hypothesized that altering the routine movements would have a negative effect on performance. This was confirmed by the MANOVA results. Therefore it was concluded that altering the routine movements did have a negative effect on the performance of free throw shooting.

The other part of the research hypothesis was not supported by the results. The results obtained from the present study show that requiring the use of additional time in which to perform the preshot routine had no significant effect on performance. This finding, coupled with previous studies (Gayton et al., 1989; Lobmeyer & Wasserman, 1986), suggests that time is a factor only when it is restricted such that a preshot

routine cannot be used. Furthermore, Southard et al. (1989) had suggested that preshot rituals short in total time were more likely to be successful. This was not substantiated by the results of this study. Therefore it can be suggested that time may not be a critical factor in the effectiveness of preshot routines.

The results of this study have varying psychological implications. Preshot routines are used by athletes in an attempt to control their environment, to provide focus, to trigger concentration, and to allow the incorporation of other psychological skills. Altering the time or movement pattern was hypothesized to negatively effect this process. Specifically it was proposed that altering the movement pattern would have a negative effect on the confidence of the shooter standing at the free throw line, thus causing a decrement in performance. The negative effect of altering the movement pattern was verified by the results of this study. Furthermore if testing were done under more competitive conditions even greater differences between conditions might occur. This was shown in the study by Gayton et al. (1989).

Increasing the overall time of the routine was predicted to have a "paralysis by analysis" effect. Over-thinking about a well-learned skill has been found to cause a decrease in performance (Boder, 1935). However for 7 (41%) of the subjects in this study the additional time seemed to positively effect performance. Perhaps this extra time was used to provide more focus and concentration instead of being used to think about the task or on negative self-talk or doubt.

An alternative explanation might be made concerning the experimental methods involved. Perhaps requiring the subject to use additional time is different from a self -imposed lengthened time. It was noted during the experiment that some subjects grew

impatient waiting for the signal to shoot. It is possible that their thoughts were preoccupied with listening for the signal and not on negative thoughts or thinking about the skill to be executed.

The motoric implications of these results must also be addressed. Sport psychologists have used different motor learning theories in an attempt to explain the benefits of using a preshot routine. Two of the possible explanations are the schema theory (Schmidt, 1975) and the autonomous stage of motor learning (Fitts & Posner, 1967). If the preshot routine had become part of the sequence of the generalized motor program, according to the schema theory, it would be hypothesized that changing the overall timing of the movement would effect performance. The relative timing would remain constant and this would cause the shot to be changed. The results of the study would appear to contradict this prediction. However it should be noted that the shortest mean preshot time for a subject was 2.8 seconds. This is probably too long of a time to require only one programmed movement.

A second proposal based on schema theory suggests that preshot routines are used to assist the performer in selecting the proper motor program with correct parameters. Based on past experience, an established routine helps select specific force-duration parameters needed to produce the desired movement. If the existing preshot routine assists in establishing needed parameters, it can be hypothesized that altering the routine would negatively affect performance. The results obtained support this prediction.

The autonomous stage of motor learning has also been used to explain the benefits that preshot routines have produced. This theory of automaticity suggests that preshot

routines should assist the athlete in automatically producing the proper motor response without conscious control. Support for this prediction can be inferred based on the results of the current study.

Summary and Conclusions

Prior research has found the use of preshot routines to have a positive effect on performance in basketball (Gayton et al., 1989; Lobmeyer & Wasserman, 1986) and in golf (Boutcher & Crews, 1987; Crews & Boutcher, 1986a, 1986b). Gayton et al. (1989) and Lobmeyer and Wasserman (1986) found that shooting performances using a preshot routine were superior to performances without a preshot routine. Two behavioral analyses (Crews & Boutcher, 1986b; Walker et al., 1977) reported that length of preshot routine had an effect on performance with longer times associated with poorer performances. This study however, is the only study that investigated the effects of altering the time and movements of the subject's existing preshot routine prior to performance. The results indicated that the movements in the routine had a significant effect on performance but the length of time had little effect on performance.

Implications

Certain implications can be drawn from the results of this study. It might be implied that coaches and athletes need to emphasize the importance of consistently using a set preshot routine. A routine that the athlete is comfortable with needs to be established and then consistently repeated prior to the actual motor response. Once established the movements of the routine should not be altered under most circumstances. While the movements appear to be an important factor, an imposed increase in the time used to perform the routine does not appear to be a critical factor. Therefore the movement

pattern should be emphasized with less concern regarding the precise timing in performing that routine.

Recommendations for Further Study

Based on the results of the present study, the following recommendations for further study are suggested:

1. Replication of this study using college athletes in a more competitive situation.

2. Use of psychological testing to investigate the effects of altering a preshot routine on the athlete's self-efficacy.

3. Do a correlational study using a large sample size to study whether there is a relationship between number of behaviors, which indirectly influences the overall length of routine, and free throw shooting performance.

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Appendix A

Informed Consent Form

INFORMED CONSENT

Title of Research: "Effects of Preshot Routine on Free Throw Shooting Performance"

Principle Investigator: Mick Mack
Graduate Assistant
Physical Education
273-6346

Explanation of Test: The purpose of this test is to investigate the effectiveness of using a set preshot routine prior to shooting free throws. You will be tested with four different conditions regarding preshot routines. In each condition you will shoot 20 free throws while your performance is recorded. The four conditions are: normal routine, normal routine using more time, normal time using prescribed routine, and prescribed routine using more time. It is anticipated that the outcomes of this study will provide additional information concerning the use of preshot routines.

Your participation in this study is voluntary and you may discontinue participation at any time without penalty or loss of benefits. You have the right to ask any questions about the study and are encouraged to seek explanations about any phase of the testing procedures that are unclear. Data obtained from this study will be utilized for analysis purposes only and any personal information will not be released to anyone other than the investigators without your permission.

If you have any questions about the research or your rights as a subject, you may contact the UNI Graduate College office at 273-2748.

I am fully aware of the nature and extent of my participation in this project as stated above and the possible risks arising from it. I hereby agree to participate in this project. I acknowledge that I have received a copy of this consent statement.

_____ _____

(signature of subject or responsible agent) (date)

_____

(printed name of subject)

_____

(signature of investigator)

Appendix B

General Session Instructions

General Session Instructions

The purpose of this test is to investigate the effectiveness of using a set preshot routine prior to shooting free throws. You will be tested in four different conditions regarding preshot routines. More specific instructions will be read to you by a research assistant prior to each shooting session.

In each condition you will shoot 20 free throws while your performance is recorded. You are to shoot each group of 20 free throws trying as if you were in a real game situation. You will be required to leave the free throw circle and reenter after each shot. Your scores will be recorded and the top 2 performers will receive a plaque. Scoring is on a 5 point scale with 5 being a swish and 1 being an air ball. The scoring system and four conditions are further explained on the informed consent form that you have already received.

Appendix C

Random Test Assignments

Random Test Assignments

Subject Number	Order of Tests (Appendix D, E, F, G)			
1	E	F	D	G
2	G	E	F	D
3	D	G	E	F
4	D	F	E	G
5	F	G	D	E
6	E	D	F	G
7	F	G	E	D
8	G	D	E	F
9	D	E	F	G
10	G	E	D	F
11	E	G	F	D
12	F	E	D	G
13	E	F	G	D
14	E	D	G	F
15	G	D	F	E
16	F	E	G	D
17	D	F	G	E

Appendix D

Unaltered Normal Routine Instructions

Unaltered Normal Routine Instructions

In this condition you are to shoot 20 free throws as if you were in a game situation. Do whatever you would normally do before shooting a free throw in a game. You are allowed 5 warm-up shots. Tell me when you are ready to start. (Subjects are allowed 5 warm-up shots.)

Appendix E

Normal Routine with Lengthened Time Instructions

Normal Routine with Lengthened Time Instructions

In this condition you will shoot 20 free throws. Try to perform the actual shot as much like normal as possible. Just spread out your regular pattern of movements in order to take up twice as much time as normal. As soon as you touch the ball I will start timing. I will say "shot" when time is up and you are allowed to shoot. Five practice attempts at using the correct amount of time will be allowed before testing begins. (Subjects are allowed to practice 5 shots and become familiar with the signal.)

Appendix F

Altered Routine with Normal Time Instructions

Altered Routine with Normal Time Instructions

In this condition you will learn and use a different set of actions before shooting 20 free throws. The actions are (demonstrate as give instructions orally): (a) slapping the ball from 1 hand to the other 3 times, (b) throwing the ball up into the air using both hands, (c) catching it with 2 hands, (d) focusing on the target, and (e) shooting. You are to use your normal length of action time and can practice 5 times before starting. Tell me when you are ready to start. (Subjects are allowed to practice 5 shots and should be corrected for using incorrect sequencing or overall timing extremes.)

Appendix G

Altered Routine with Lengthened Time Instructions

Altered Routine with Lengthened Time Instructions

In this condition you are to learn and use a different set of actions before shooting and will be required to use twice as much time as you would normally. The actions are (demonstrate as give instructions orally): (a) slapping the ball from 1 hand to the other 3 times, (b) throwing the ball up into the air using both hands, (c) catching it with 2 hands, (d) focusing on the target, and (e) shooting. As soon as you touch the ball I will start timing. I will say "shot" when time is up and you are allowed to shoot. You will be allowed to practice using this altered routine 5 times before testing begins. (Subjects are allowed to practice 5 times and should be corrected as needed.)

Appendix H

Baseline Routine Time Results

Baseline Routine Times

Sub	# 1	# 2	# 3	# 4	# 5	# 6	# 7	# 8	# 9	# 1 0	Ave.
1	8.5	8.0	8.0	6.4	5.1	4.1	11.0	4.6	3.5	4.6	6.4
2	4.5	4.2	4.7	4.7	4.9	4.9	5.1	4.5	4.4	4.5	4.6
3	4.3	3.9	3.9	3.2	4.0	3.7	4.1	4.3	4.0	3.9	3.9
4	8.7	8.9	8.4	7.6	6.0	3.3	4.6	4.7	5.5	6.3	6.4
5	4.6	4.4	3.6	5.3	6.0	5.4	6.0	5.7	5.2	5.6	5.2
6	5.0	3.9	3.2	3.5	3.0	2.9	2.4	3.1	3.3	3.6	3.4
7	6.5	5.9	5.6	6.6	7.8	7.0	6.8	7.6	7.3	4.5	6.6
8	4.6	3.3	3.8	3.3	4.3	3.4	4.1	4.8	4.0	3.6	3.9
9	4.5	5.2	6.7	6.5	5.6	5.7	5.7	5.2	5.2	5.9	5.6
10	3.8	2.8	2.9	3.0	5.0	3.1	3.4	4.3	4.4	4.5	3.7
11	3.0	2.5	2.9	2.7	3.3	2.4	2.8	2.5	2.9	2.7	2.8
12	4.3	4.5	5.1	4.8	5.8	4.8	4.1	4.5	4.7	5.2	4.8
13	3.1	3.0	2.7	3.0	2.9	2.6	2.7	3.0	3.1	2.5	2.8
14	6.9	6.6	10.7	6.4	5.4	11.0	12.3	13.4	6.3	10.8	9.0
15	4.8	3.7	4.4	3.6	5.2	4.2	5.6	3.9	7.3	4.3	4.7
16	4.9	5.1	4.5	4.0	5.5	6.4	5.2	4.9	5.2	5.3	5.1
17	3.1	3.5	3.8	4.1	4.0	5.2	4.3	4.2	4.1	4.1	4.0

All ten trials during games
(Subjects 7, 8, 14, 15)

Some trials during games and some trials during practice
(Subjects 1, 2, 3, 4, 5, 6)

All ten trials during practice
(Subjects 9, 10, 11, 12, 13, 16, 17)

Appendix I

Free Throw Performance Scores

Free Throw Performance Scores

Subject	Condition 1 Baseline	Condition 2 Norm routine Alter time	Condition 3 Alter routine Norm time	Condition 4 Alt routine Alter time
1	82	84	84	78
2	77	74	75	69
3	80	89	78	77
4	83	86	89	81
5	83	72	82	75
6	78	82	76	85
7	82	84	84	82
8	89	91	86	83
9	74	78	80	80
10	85	84	84	80
11	87	75	80	84
12	65	80	67	65
13	88	82	85	79
14	77	67	72	70
15	72	78	65	77
16	78	80	75	76
17	76	76	79	75
M	79.76	80.12	78.88	77.41
SD	6.18	6.18	6.62	5.46