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A Comparison of the Effectiveness of Two Free Throw Shooting Methods

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ABSTRACT

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The purpose of this study was to compare the effectiveness of two free throw shooting methods, the Ed Palubinskas Method (PM) and the Free Shoot Method (FSM), and their ability to improve free throw shooting accuracy. The experimental group, using the PM, and the control group, using the FSM, shot the same amount of free throws over a 13 week period. Subjects were 33 male intermediate basketball students at Brigham Young University. Subjects in both groups shot 26 free throws twice a week. Subjects were tested once every other week by shooting and recording the amount made out of nine attempts. There was no significant improvement for trials for both groups over the 13 weeks ($F=1.583$, $p=.154$). There was also no significant difference between groups ($F=.445$, $p=.510$) nor any interaction between groups ($F=.642$, $p=.696$). There was no significant difference in free throw shooting accuracy between the PM and FSM for the selected groups.

Keywords: free throw, repetitions, motor learning

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I recognize and appreciate the great help by each of my committee members and support of my family. I give a special thanks to Ed Palubinskas for his willingness to put his shooting principles and products under scrutiny and experimental analysis.

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Introduction

Free throw shooting is a vital skill in the game of basketball. Sampaio and Janiera (2003) found while studying three different professional leagues, including the NBA, that free throws made up 19-25% of the points in a game with teams shooting 70-75% from the foul line. Therefore, a fifth to a fourth of points scored in basketball games come from the free throw line. Pim (1986) studied 316 Division I basketball games and found that 71.53% of the time the winning team shot the most free throws. Kozar et.al (1994) studied 490 Division I games where they found that in games decided by nine or fewer points, free throws made up on average 48.4% of the points in the final five minutes and 69% during the last minute. These studies highlight the crucial nature of free throw shooting as related to winning, and in particular, winning close games.

Because of the rule structure of basketball, it is important to realize that in game situations the first free throw is the critical shot. In a one and one situation you do not get the second free throw unless the first free throw is made. For example, if a person attempted 10 free throws in a row in practice and misses the first shot this would be a shooting percentage of 90% which appears very good. However, in actual game situations, because the first free throw was missed, this would indicate a poor free throw shooting capability in the case of a one and one. Emphasizing the first free throw has been under utilized in most studies, but Kozar et al. (1995) and Whitehead et al. (1996) have shown that the first two free throws in practice correspond more to actual game percentages and will thus, be a pertinent method in comparing the efficacy of different shooting methods or systems.

Because of the significance of free throw shooting, much research has been accomplished in free throw methodology to improve shooting accuracy. Traditionally, coaches would employ a free shoot method where players would shoot many uninstructed attempts. The philosophy was based on the principle of specificity that suggests that practicing the specific task over and over will increase proficiency. Then methodology evolved to focus not just on repetitions, but on specific mechanics. While the single-hand push shot is undoubtedly the most popular method among professionals, it is ironic to note that the best free throw percentage ever shot at the highest level of basketball, the NBA, was accomplished by Rick Berry via a two-hand underhand toss. Studies were performed to calculate the ideal dynamics of free throw shooting (Lang & Gablonsky, 2005; Okubo & Hubbard, 2006; Silverberg & Tran, 2008).

Studies were completed to show the improvements in free throw accuracy gained from a consistent pre-shot throw routine (Cohn, 1990; Czech, Ploszay, & Burke, 2004; Lobmeyer & Wasserman, 1986; Lonsdale & Tam, 2008; Wrisberg & Pein, 1992). Studies have also shown that there is no difference in duration of pre-shot routines and accuracy ($p>.05$) (Gooding & Gardner, 2009; Lonsdale & Tam, 2008; Wrisberg & Pein, 1992). Mack (2001) likewise confirmed this relationship, while adding that alterations to routine sequence significantly diminished free throw accuracy. Hadad & Tremayne (2009) found a significant improvement of free throw accuracy when incorporating a “centering” breath into their pre-shot routine ($p<.05$).

Two other related free-throw accuracy improvement methodologies frequently studied are mental imaging and technique modeling. Predebon & Docker (1992) compared a pre-shot routine group to a group that performed a mental rehearsal of the pre-shot routine and execution of the free throw prior to the physical execution of the process. This study showed a significantly higher mean difference between the imagery groups and pre-shot routine group. Carboni et. al

(2002) supported imagery techniques in a qualitative study, but Lerner et al. (1996) found there was no significant improvement in using mental practice techniques. It should be noted that the mental practice techniques were provided by subjects listening to headphones that gave them verbal explanations of what they should be imagining rather than self-directed mental practice. Wrisberg & Pein (1992) found imaging combined with arousal adjustment (relaxation techniques) to be significantly higher in free throw accuracy ($p<.05$) in comparison with either imaging or arousal adjustment alone. To aid subjects in proper imagery acquisition, studies have been performed to investigate the effectiveness of video modeling. Video modeling studies have shown that there is significant improvement in free-throw accuracy (Erffmeyer, 1987; Hall & Erffmeyer, 1983; Kwok Mun, Cruz, & Fu Po Lin, 2009), while Onestak (1997) found no difference between three groups in which one used VMBR (visuo-motor behavior rehearsal), the other used VMBR and Video-taped modeling, while the last used Video-taped modeling only. All of those groups did improve, but there was no difference between the groups in amount of improvement.

It has been established that pre-shot routines and video modeling are effective in improving free throw accuracy. Thus, exploring whether whole shooting systems that employ verbal explanations and demonstrations of mechanical principles in addition to pre-shot routines and video modeling are effective is a cogent next step. Nationally acclaimed shooting coach Ed Palubinskas has developed a marketed shooting method in DVD form that involves a pre-shot routine and video modeling and includes 22 principles of accurate shooting. Palubinskas not only holds many free throw world records himself, but in individual cases, has helped improve NBA players' free throw accuracy. Therefore, studying the effects of the highly touted Ed Palubinskas' method (PM) in his DVD "Secrets to 'Perfect Shooting Principles'" seems not only

to be a sensible and research-warranted treatment, but practically applicable to coaches and the average person interested in improving free throw accuracy.[1] Thus, testing the effectiveness of the PM in a study that accounts for the game-like importance of the first three free throw attempts versus a control group employing the free shoot method, is a reasonably progressive step in accumulating knowledge of effective free throw shooting.

The purpose of this study was to compare the effectiveness of two free throw shooting methods, the Ed Palubinskas Method (PM) and the Free Shoot Method (FSM), and their ability to improve free throw shooting accuracy.

Methods

Subjects

Thirty-three male college students from 2 intermediate basketball classes at Brigham Young University participated in this study. Intermediate basketball classes were chosen after a pilot study revealed no significant difference between intermediate and beginning free throw shooting accuracy ($p>.05$)(Appendix A). Subjects were informed that this study would have no bearing on the outcome of their grade in the class. Each subject filled out a demographic questionnaire (Appendix B) including their name, height, weight, BMI (calculated), age, and basketball playing experience. (Table 1 contains a summary of the demographic information) This study was approved by the IRB and all participating subjects signed an approved IRB informed consent form. One intermediate basketball classes was randomly selected as the experimental group with the other class acting as the control group.

Free Throw Shooting Methods

The Palubinskas Method (PM) - This method is contained on a DVD recording entitled "Secrets to 'Perfect Shooting Principles.'" It consists of approximately 60 minutes of explanations and demonstrations by Palubinskas on 22 principles deemed most valuable for accurate free throw shooting (See Appendix C). Subjects viewed this DVD during the first, fifth and ninth weeks of the semester. The DVD was checked out and watched in the Learning Resource Center in the Smith Field House, where the date and amount of time that the DVD was checked out was monitored. Subjects were given monetary incentives to watch the DVD. The first and second viewing earned subjects $5 per viewing, with the third viewing earning them $20 if they viewed the previous two times. Subjects also filled out a sheet recording the names of the 22 principles in the video to ensure compliance (See Appendix D). Also, a one-page summary of the five most important shooting principles, deemed so by Palubinskas, was given to each student to use *ad libitum* throughout the semester (See Appendix E). Subjects in the experimental group participated in all practice and test days using the Palubinskas' "SMART" BALL ™ (which shows where the fingers should be placed during shooting).[1]

The Free Shoot Method (FSM) - This method was uninstructed time in which the only source of feedback will be the result of the free throw attempt. Subjects also watched an hour long basketball DVD during the first, fifth and ninth weeks of the semester. Subjects were given the same monetary incentives as the experimental groups for watching the DVD the required number times.

Explanation of How the Methods Were Presented

Palubinskas Method

PM was explained to subjects in the experimental group by reading a standardized statement of instructions. (Appendix F) A written copy of this instruction was given to the subjects.

Free Shoot Method

FSM was explained to subjects in the control group by reading a standardized statement of instructions. (Appendix F) A written copy of this instruction was given to the subjects.

Procedures

Subjects from both groups participated in this study twice a week for 13 weeks. Testing procedures took place in classes taught in the Richards Building at Brigham Young University, Provo, Utah. Students were prohibited from shooting free throws in their leisure time during the semester. Subjects were disqualified from participation in this study for any of the following reasons:

- Any physical disabilities or injury during the semester in a way that impedes normal motor function required for free throw shooting
- Missing more than five classes
- Not watching the DVD the three times it is offered during the semester

In order to simulate a more season-like experience, the attempts were divided up into two types of days: practice and test.

Practice Day

Practice days included 10 warm up attempts at the beginning of class. Then two different times during class subjects shot a set of 3 free throws and then at the end of class with a set of 10 free throws. The sets of 10 at the beginning and end of class were chosen to provide sufficient repetitions to incorporate the method.

Test Day

Test days consisted of four different times shooting a set of three attempts with the first three being warm up and the final nine were the performance. Subjects were tested at least six times throughout the semester. Three sets of three free throws each were chosen to correspond with the maximum amount of free throws that could be attempted consecutively for any single infraction. Kozar et. al (1995) found that shooting free throws in sets of five to ten were not specific enough to transfer well. They reported that there was a similar percentage of the first two attempted practice free throws and game free throw shooting percentage. Thus, three shots were chosen because of their relationship to the maximum attempts in any single free throw series in a game of basketball. Nine free throw attempts were chosen to be a reasonable number because of their relationship to the averages of free throw shots attempted by collegiate teams (Kozar, et al., 1995; Whitehead, et al., 1996). The study facilitator announced to all subjects that that day was a "test" day. The purpose of this was to simulate pressure by increasing the significance of the day. The study facilitator explained to the class that this test day was designed to simulate pressure during a game situation. Subject partners were assigned to record each other's score out of nine on the Free Throw Record Sheet. (Appendix H) Subjects who missed a test day were tested the following class which they attended.

Testing schedule

Students were tested after the initial pretest every other Monday until the posttest. This provided a minimum of 14 practice days to eight test days which is similar to the ratio of practices to games in a normal basketball season schedule.

Statistical Methods

Independent variables tested: Group assignment and treatment training in applications of PM to the experimental group. Dependent variable to be tested: free throw accuracy in a pre-test, six intermediate tests and post-test free throw accuracy. To analyze the data to be collected, a "Between Within Analysis of Variance" with Repeated Measures was conducted. ANOVA for groups, trials and interaction were assessed (2 groups x 8 trials). The level of confidence used to reject the null hypothesis was at 95% ($p<.05$). Data were analyzed for group means for total free throws made, first free throw made, and first two free throws made.

Results

For total free throws made group mean, there was no significant improvement for trials for both groups over the 13 weeks ($F=1.583$, $p=.154$). Figure 1 and Table 2 contain the information concerning this finding. This finding shows that the groups did not significantly improve their free throw percentage over the 13 week period in either the control or experimental group. There was also no significant difference between groups ($F=.445$, $p=.510$) nor any interaction between groups ($F=.642$, $p=.696$). We cannot therefore predict that there would be any future difference between the groups because of lack of interaction.

Because of the critical nature of the first free throw of a series based on the one and one rules of basketball, statistical analysis was performed to see if there was any difference within and between groups. For first free throw made group mean, there was no significant improvement for trials for both groups over the seven trials (F=.295, p=.939). Figure 2 and Table 3 contain the information concerning this finding. This finding shows that the groups did not significantly improve their first free throw accuracy over the 13-week period in either the control or experimental group. There was also no significant difference between groups (F=.716, p=.404) nor any interaction between groups (F=.142, p=.990). We cannot therefore predict that there would be any future difference between the groups because of lack of interaction.

Because of the game-like specificity of shooting just two free throws in a series and the relationship found by Kozar et al.(1995), that their first two free throws shot in a series during practice are indicative of accuracy in a game, statitical analysis was performed on the first two free throws of every set to see if there was any difference within and between groups. For the first two free throw made group mean, there was no significant improvement for trials for both groups over the seven trials (F=1.16, p=.330). Figure 3 and Table 4 contain the information concerning this finding. This finding shows that the groups did not significantly improve their first two free throws accuracy over the 13-week period in either the control or experimental group. There was also no significant difference between groups (F=.116, p=.736) nor any interaction between groups (F=.551, p=.769). We cannot therefore predict that there would be any future difference between the groups because of lack of interaction.

Discussion

The purpose of this study was to compare the effectiveness of two free throw shooting methods, the Ed Palubinskas Method (PM) and the Free Shoot Method (FSM), and their ability to improve the free throw shooting accuracy of intermediate college students over a 13-week period. In this study, the 526 total repetitions divided into 13 weeks with twice-a-week sessions by both groups might appear to be insufficient to cause a significant improvement within either group. Demographic data gathered showed that 83% of the experimental group and 100% of the control group had previously played non-organized basketball. 48% of the experimental group and 50% of the control group reported having played seventh or eighth grade basketball on a school team. The most striking demographic could be that 30% of the experimental group and 40% of the control group had played varsity high school basketball. This signifies the rather experienced subjects that made up an "intermediate" level subjects and how 526 free throws may represent, in the experience of intermediate level subjects, a minuscule percentage of total free throws shot. The fact that neither the control nor experimental group improved significantly points to a problem of already developed motor patterns that are difficult to change despite research that suggests that already-skilled players can incorporate new motor instruction more rapidly (Corbin, 1972; Epstein, 1980; Noel, 1980). Thus, influencing their shot patterns might not be possible with so few repetitions.

It should be noted that subjective observation suggested that the mechanics or motor patterns employed by the control group and the experimental group were generally similar. Most subjects in both groups employed the one-handed push shot, and it was noted that those participating in the control group, or FSM, demonstrated many of the principles prescribed in the

PM. It is possible that participants in the FSM had been taught many of the general principles of the PM in their basketball experience and therefore, no significant difference between groups. A cogent future study would be to take complete beginners and repeat the study. Perhaps adding an alternative instructional shooting method in addition to PM and FSM, would allow for a comparison between the alternative method and PM versus the FSM control group. Again, 526 repetitions is not an exorbitant amount, but to see if the PM is effective at such a novice level might indicate a practical significance to receiving motor instruction to improve free throw shooting among beginners.

Knowledge of the effectiveness of the PM versus FSM among beginners might be important to coaches and players alike, as both are interested in the most effective methods in increasing free throw shooting accuracy to enhance basketball performance. If the PM produces greater free throw gains in accuracy with beginners over a standardized time period than FSM, coaches perhaps could be justified in choosing this method for implementation with their players as a more effective use of time versus the FSM. Also, the PM is dispersed via DVD and is a practical option for coaches and players if deemed effective among beginners.

Conclusion

It was concluded that there was no significant difference in free throw shooting accuracy between the PM and FSM for the selected groups.

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Product Footnote

1. Ed Palubinskas Instructional DVD, “Secrets to Perfect Free Throw Shooting Principles”

   and Smart Ball available at www.freethrowmaster.com

Table 1. Demographic Information

Variable	PM (experimental group)* n = 23	FSM (control group)* n = 10
Age	21.3 ± 3.2	22 ± .5
Height (cm)	183.8 ± 7.0	180.9 ± 8.1
Weight (kg)	76.0 ± 12.3	78.1 ± 12.5
BMI (kg/m^2)	22.5 ± 3.3	23.8 ± 3.2
School Year Average	2.2 ± 1.3	2.1 ± .6
* Mean and SD	PM (experimental group)	FSM (control group)
Previous Basketball Experience	n = 23	n = 10
Non Organized Basketball	83%	100%
Church Basketball	65%	80%
Youth or Adult Recreation	48%	80%
7th or 8th Grade School Team	30%	50%
Freshman School Team	17%	50%
Sophomore High School Team	30%	50%
Junior Varsity High School Team	30%	40%
Varsity High School Team	0%	40%
Junior College Team	4%	0%
Collegiate Team	0%	0%

Table 2. Total Free Throws Made (Group Means)

Trial	PM (experimental group)* n = 23	FSM (control group)* n = 10
Pre Test	4.35 ± 1.8	4.20 ± 1.9
Mid Test 1	4.83 ± 2.0	5.30 ± 1.5
Mid Test 2	4.96 ± 2.1	5.30 ± 2.5
Mid Test 3	4.70 ± 2.0	5.40 ± 1.0
Mid Test 4	4.78 ± 1.9	5.50 ± 1.7
Mid Test 5	5.17 ± 2.3	5.17 ± 2.3
Post Test	5.04 ± 2.3	5.80 ± 1.9

*Mean ± SD

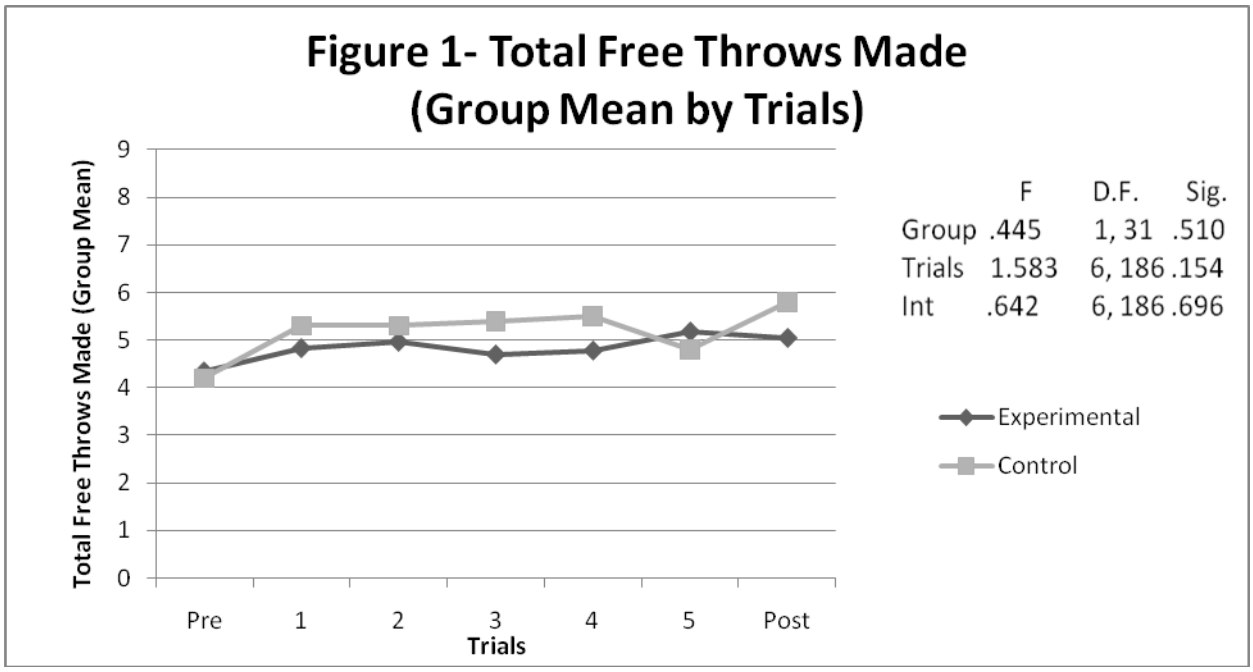


Table 3. Sum of First Free Throw Made Over 3 Sets (Group Means)

Trial	PM (experimental group) n = 23	FSM (control group) n = 10
Pre Test	1.48 ± 1.0	1.60 ± 1.1
Mid Test 1	1.43 ± 1.1	1.70 ± 0.8
Mid Test 2	1.43 ± 1.2	1.60 ± 1.3
Mid Test 3	1.39 ± 0.9	1.50 ± 0.7
Mid Test 4	1.39 ± 1.2	1.70 ± 0.8
Mid Test 5	1.57 ± 1.0	1.50 ± 0.9
Post Test	1.61 ± 1.0	1.90 ± 0.7

*Mean ± SD

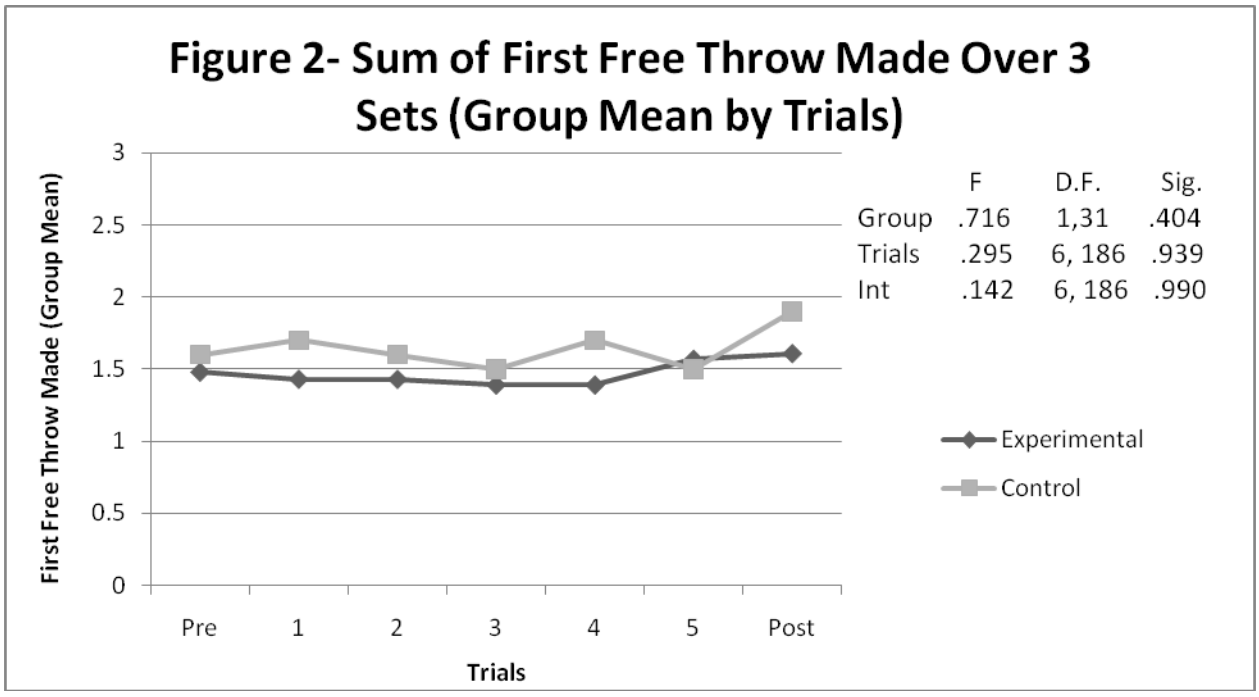
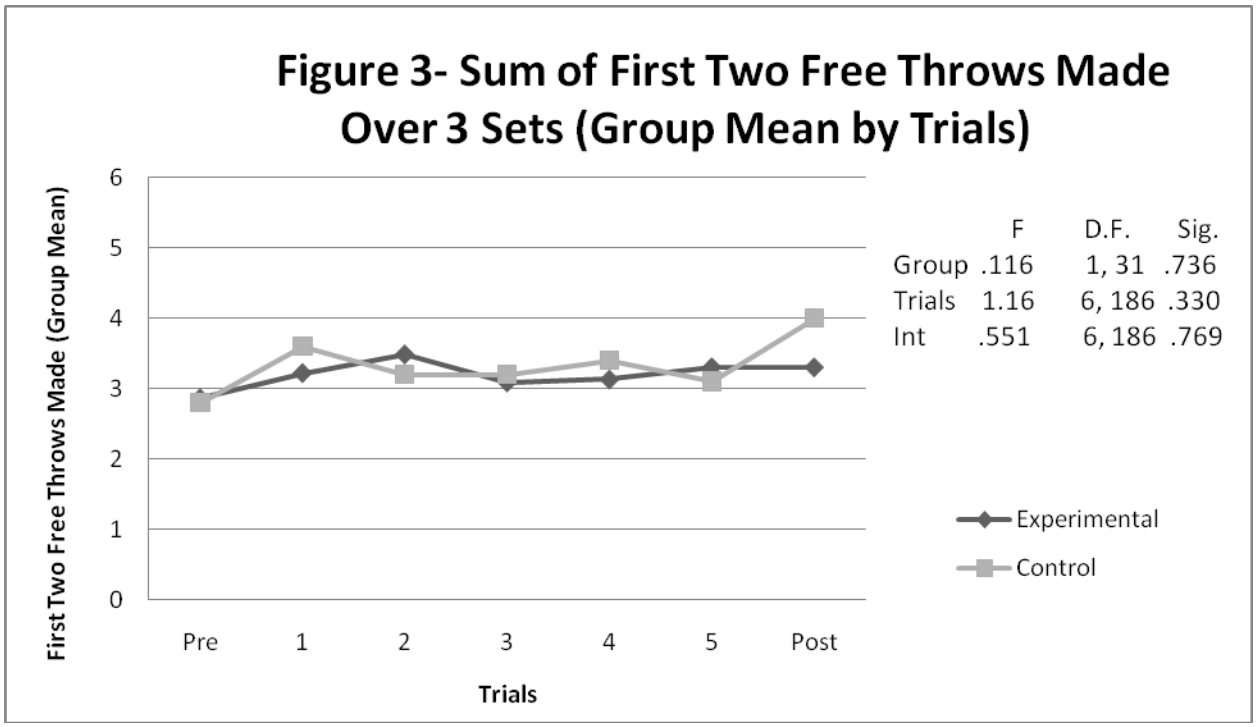


Table 4. Sum of First Two Free Throws Made Over 3 Sets (Group Means)

Trial	PM (experimental group)* n = 23	FSM (control group)* n = 10
Pre Test	2.87 ± 1.5	2.80 ± 1.4
Mid Test 1	3.22 ± 1.6	3.60 ± 1.0
Mid Test 2	3.48 ± 1.6	3.20 ± 2.0
Mid Test 3	3.09 ± 1.3	3.20 ± 1.1
Mid Test 4	3.13 ± 1.6	3.40 ± 1.5
Mid Test 5	3.30 ± 1.7	3.10 ± 1.1
Post Test	3.30 ± 1.6	4.00 ± 1.4

*Mean ± SD



Prospectus

Introduction

Free throw shooting is a vital skill in the game of basketball. Sampaio and Janiera (2003) found while studying three different professional leagues, including the NBA, that free throws made up 19-25% of the points in a game with teams shooting 70-75% from the foul line. Therefore, a fourth to a fifth of points scored in basketball games come from the free throw line. Pim (1986) studied 316 Division I basketball games and found that 71.53% of the time the winning team shot the most free throws. Kozar et.al (1994) studied 490 Division I games where they found that in games decided by nine or fewer points, free throws made up on average 48.4% of the points in the final 5 minutes and 69% during the last minute. These studies highlight the crucial nature of free throw shooting as related to winning, and in particular, winning close games.

Basketball, especially in collegiate and professional levels, is a fast paced, explosive, multi-faceted game that combines speed, agility, jumping, stopping, sliding, passing, dribbling and of course, shooting. Contrastingly, free throws become an ironic respite to the typically intense aspects of the game of basketball. Free throw shooting is a closed motor skill that occurs from the same distance from the basket with the same time allotted for each attempt. Free throws come in sets of one, two or three attempts depending on the type and circumstance of the infraction. The free throw is the only type of shot that occurs outside the time of the running clock and the only possible way to score one point, because every other shot is either worth two or three.

Because of the rule structure of basketball, it is important to realize that in game situations the first free throw is the critical shot. In a one and one situation you do not get the

second free throw unless the first free throw is made. For example, if a person attempted 10 free throws in a row in practice and misses the first shot this would be a shooting percentage of 90% which appears very good. However, in actual game situations the missed first free throw would indicate a poor free throw shooting capability in the case of a one and one. Emphasizing the first free throw has been under utilized in most studies, but Kozar et al. (1995) and Whitehead et al. (1996) have shown that the first two free throws in practice correspond more to actual game percentages and will thus, be a pertinent method in comparing the efficacy of different shooting methods or systems.

Because of the significance of free throw shooting, much research has been accomplished in free throw methodology to improve shooting accuracy. Traditionally, coaches would employ a free shoot method where players would shoot many uninstructed attempts. The philosophy was based on the principle of specificity that suggests that practicing the specific task over and over will increase proficiency. Then methodology evolved to focus not just on repetitions, but on specific mechanics. While the single-hand push shot is undoubtedly the most popular method among professionals, it is ironic to note that the best free throw percentage ever shot at the highest level of basketball, the NBA, was accomplished by Rick Berry via a two-hand underhand toss. Studies were performed to calculate the ideal dynamics of free throw shooting (Lang & Gablonsky, 2005; Okubo & Hubbard, 2006; Silverberg & Tran, 2008).

Studies were completed to show the improvements in free throw accuracy gained from a consistent pre-shot throw routine (Cohn, 1990; Czech, et al., 2004; Lobmeyer & Wasserman, 1986; Lonsdale & Tam, 2008; Wrisberg & Pein, 1992). Studies have also shown that there is no difference in duration of pre-shot routines and accuracy ($p>.05$) (Gooding & Gardner, 2009; Lonsdale & Tam, 2008; Wrisberg & Pein, 1992). Mack (2001) likewise confirmed this

relationship, while adding that alterations to routine sequence significantly diminished free throw accuracy. Hadad & Tremayne (2009) found a significant improvement of free throw accuracy when incorporating a “centering” breath into their pre-shot routine ($p<.05$).

Two other related free-throw accuracy improvement methodologies frequently studied are mental imaging and technique modeling. Predebon & Docker (1992) compared a pre-shot routine group to a group that performed a mental rehearsal of the pre-shot routine and execution of the free throw prior to the physical execution of the process. This study showed a significantly higher mean difference between the imagery groups and pre-shot routine group. Carboni et. al (2002) supported imagery techniques in a qualitative study, but Lerner et al. (1996) found there was no significant improvement in using mental practice techniques. It should be noted that the mental practice techniques were provided by subjects listening to headphones that gave them verbal explanations of what they should be imagining rather than self-directed mental practice. Wrisberg & Pein (1992) found imaging combined with arousal adjustment (relaxation techniques) to be significantly higher in free throw accuracy ($p<.05$) in comparison with either imaging or arousal adjustment alone. To aid subjects in proper imagery acquisition, studies have been performed to investigate the effectiveness of video modeling. Video-modeling studies have shown that there is significant improvement in free-throw accuracy (Erffmeyer, 1987; Hall & Erffmeyer, 1983; Kwok Mun, et al., 2009), while Onestak (1997) found no difference between three groups that one used VMBR (visuo-motor behavior rehearsal), the other used VMBR and Video-taped modeling, while the last used Video-taped modeling only. All of those groups did improve, but there was no difference between the groups in amount of improvement.

It has been established that pre-shot routines and video modeling are effective in improving free throw accuracy. Thus, exploring whether whole shooting systems that employee

verbal explanations and demonstrations of mechanical principles in addition to pre-shot routines and video modeling are effective is a cogent next step. Nationally acclaimed shooting coach Ed Palubinskas has developed a marketed shooting method in DVD form that involves a pre-shot routine and video modeling and includes 22 principles of accurate shooting. Palubinskas not only holds many free throw world records himself, but in individual cases, has helped improve NBA players' free throw accuracy. Therefore, studying the effects of the highly touted Ed Palubinskas' method (PM) in his DVD "Secrets to 'Perfect Shooting Principles'" seems not only to be a sensible and research-warranted treatment, but practically applicable to coaches and the average person interested in improving free throw accuracy. Thus, testing the effectiveness of the PM in a study that accounts for the game-like importance of the first three free throw attempts versus a control group employing the free shoot method, is a reasonably progressive step in accumulating knowledge of effective free throw shooting.

Statement of the Problem

The purpose of this study is to compare the effectiveness of two free throw shooting methods, the Ed Palubinskas Method (PM) and the Free Shoot Method (FSM), and their ability to improve free throw shooting accuracy.

Hypothesis

There will be no significant difference in free throw shooting accuracy between the PM and the FSM.

Assumptions

1. Subjects in these classes are emotionally and physically healthy and are representative of typical college students.
2. All subjects will give maximal effort and focus in attempt to improve their free throw shooting.
3. Subjects will attend all days of class, but subjects will not miss more than five days of class or they will fail the class. If subjects miss a test day they will subsequently tested on the next class period.
4. Subjects will follow the instruction to not practice free throw shooting in their leisure time outside of class.

Significance

Knowledge of the effectiveness of the PM versus FSM is important to coaches and players alike, as both are interested in the most effective methods in increasing free throw shooting accuracy to enhance basketball performance. If the PM produces greater free throw gains in accuracy over a standardized time period and with a controlled group, then choosing this method for implementation with players would be justified as a more effective use of time versus the FSM. Also, the PM is dispersed via DVD and is a practical option for coaches and players if deemed effective. It should be noted that the research subjects are intermediate basketball players and further research might be conducted to determine if results hold true to all levels of basketball.

Literature Review

In the context of the game of basketball, free throw shooting is an extremely important skill that is influential in the outcomes of basketball games. Kozar et al. (1995)showed a consensus among coaches in highlighting that importance of free throw shooting in game outcomes. Sampaio and Janiera (2003) found while studying three different professional leagues, including the NBA, that free throws made up 19-25% of the points with teams shooting 70-75% from the foul line. Similar percentages of points from free throws have been confirmed in other studies (Kozar, et al., 1994; Mersky, 1987; Pelcher, 1981).

Free throw studies have been performed to show correlation between winning and free throw performance. Pim (1986)studied 316 Division I basketball games and found that 71.53% of the time the winning team shot the most free throws. Kozar et al (1994) studied 490 Division I games where they found that in games decided by nine or fewer points, free throws contributed to, on average, 48.4% of the points in the final five minutes and 69% during the last minute. In games decided by nine points or less, as well as those decided by 10 points or more, the winning teams scored a significantly higher percentage of their total points from free-throws than did the losing teams ($p<.001$). They found that among winning teams free throws became two-thirds of the points in the last minute of the game, whereas the losing team had no such increase.

Sampaio and Janiera's study showed that winning teams had higher percent of points from free throws then losing teams (23% -19%). Furthermore, they found that in the playoffs more fouls were committed thus increasing the quantity and importance of free throws. Because this study was completed using playoff games only, it assumes that scores will be relatively closer on average than regular season games. It is therefore compelling to see the repeated correlation between free throw success and winning.

It should be noted that all of these studies were influenced by the free throw bonus rules that require a one and one situation when a seventh team foul occurs as a common foul. This bonus allows a second free throw attempt only after successfully making the first. These studies did not consider the effect of missing the front end of a one and one, nor the implications of free throws unattempted because of failure to make the first in these bonus situations.

Because it has been established that free throws play a pivotal role in basketball success, studies have been performed to investigate effective techniques in improving free throw shooting accuracy. Many studies have been completed to show the improvements gained from a consistent pre-shot throw routine (Cohn, 1990; Czech, et al., 2004; Lobmeyer & Wasserman, 1986). Lonsdale and Tam (2008) studied 284 free throw attempts in 14 NBA playoff games and found no difference in duration of pre-shot routines and accuracy ($p>.05$), but did find that players were more successful when they followed "their dominant behavioral sequence than when they deviated from their specific behavioral pattern" ($p< 0.05$). Wrisberg & Pein (1992) confirmed the negative correlation between the amount of deviation from pre-shot routine to free throw percentage, while confirming with Gooding & Gardiner (2009) that there was no significant relationship between duration of pre-shot routines and free throw percentage. Mack (2001) likewise confirmed this relationship, while adding that "alterations to routine sequence significantly diminished free throw accuracy" ($p<.05$). Hadad & Tremayne (2009) found a significant improvement of free throw accuracy ($p<.05$) when incorporating a “centering” breath into their pre-shot routine.

Studies were also performed to identify the mechanism that explains the effectiveness of employing a pre-shot routine. Boutcher and Crews (1987) suggested that there are three main reasons for success with pre-shot routines: 1) attentional control, 2) warm-up decrement, and 3)

automatic skill execution. A study on superstition vs. pre-shot routines showed no significant difference in accuracy between a “superstitious behavior” and a standardized pre-shot routine ($p>.05$), but there was a significantly lower accuracy when neither treatment was used ($p<.05$) (Foster, Weigand, & Baines, 2006). Contrasting to other studies, Southard & Miracle (1993) found that the total time of a pre-shot routine was the (Foster, et al., 2006)most important variable that was significantly related to success in free throw shooting. They found that the shorter the total time and duration of component behaviors of the pre-shot routine, the more likely to have a successful shot. Overall, the literature supports pre-shot routines as a favorable technique for improving free throw shooting.

While pre-shot routines are an important aspect of improved free throw shooting, Predebon & Locker (1992) found a significantly higher mean difference between those who were in an imagery group, where students would mentally visualize the mechanics of the shot and those who were in the physical pre-shot routine group ($p < 0.05$). The imagery group was told simply to imagine the whole pre-shot routine first, including the made basket and then execute the imagined process. This study warranted further investigation into the effects of imaging on free throw performance. Carboni et. al (2002) did a qualitative study on the effects of imaging and all five participants found it beneficial and two of them were planning on continuing to use imaging techniques. Lerner et al. (1996)found there was no significant improvement when employing imaging techniques, but it should be noted that the imaging techniques were provided by subjects listening to headphones that gave them verbal explanations of what they should be imagining rather than self-directed imaging. Wrisberg & Pein (1992) found imaging combined with arousal adjustment (relaxation techniques) to be significantly higher in free throw accuracy

($p<.05$) in comparison with either imaging or arousal adjustment alone. The use of imaging combined with arousal adjustment is known as visuomotor behavior rehearsal (VMBR).

Studies have measured the effectiveness of VMBR. Hall and Erffmeyer (1983)showed more improvements in free throw percentage of female collegiate basketball players when they viewed a video-taped model of the ideal free throw attempt than by just imaging alone. Erffmeyer (1987)then followed up with a two-year study that showed improvement after video modeling and her recommendation was for further study of transferring free throw success to game experience. Kwok (2009) demonstrated significant improvement when employing a video model ($p<.05$). Onestak (1997) found no significant differences between a video model group, VMBR group, and a combined VMBR group, but did show that all three improved from a pre-test. Al-bood et al. (2002)found that a video model focused on movement effects, or external foci, benefited observers more than a dynamic, internal foci or movement form, model.

In summary, free throw shooting has been shown to be a vital factor in the outcome of basketball games. Also, it has been demonstrated that the first two practice free throws are most representative of game free throw percentages. Pre-shot routines and video modeling have been shown to be effective in improving free shooting versus control groups. As a result, studying the effectiveness of the PM, which employs a pre-shot and video modeling in a practically applicable DVD, might be a sensible and research-warranted treatment. This method combined with a study that accounts for the game-like specificity of three free throw attempts per set, is a reasonably progressive step in accumulating knowledge of effective free throw shooting.

Methods

Subjects

Approximately 100 male college students (age 18-30) from 4 intermediate basketball classes at Brigham Young University will participate in this study. Intermediate basketball classes were chosen after a pilot study revealed no significant difference between intermediate and beginning free throw shooting accuracy ($p>.05$) (Appendix B). Subjects will be informed that this study will have no bearing on the outcome of their grade in the class. Each subject will fill out a demographic questionnaire including their name, height, weight (BMI will be calculated), age, and basketball playing experience (Appendix C). Two intermediate basketball classes will be selected as the experimental group with the other two classes will act as the control group. Pre-test data will be analyzed to assure no initial significant difference between groups.

Free Throw Shooting Methods

The Palubinskas Method (PM) - This method is contained on a DVD recording entitled "Secrets to 'Perfect Shooting Principles'". It consists of approximately 60 minutes of explanations and demonstrations by Mr. Palubinskas on 22 principles deemed most valuable for accurate free throw shooting (see video summary Appendix D). Subjects will view this DVD during the first, fifth and ninth weeks of the semester. The DVD will be checked out and watched in the Learning Resource Center in the Smith Field House, where the date and amount of time that the DVD is checked out will be monitored. Subjects will be given monetary incentives to watch the DVD. The first and second viewing will earn subjects $5 per viewing, with the third viewing earning

them $20 if they have viewed the previous two times. Subjects will also fill out a sheet recording the names of the 22 principles in the video to ensure compliance. (Appendix E) Also, a one page summary of the five most important shooting principles, deemed so by Mr. Palubinskas, will be given to each student to use *ad libitum* throughout the semester (Appendix F). Subjects in the experimental group will do all practice and test days using the Palubinskas' "SMART" BALL ™ (which shows where the fingers should be placed during shooting).[1]

The Free Shoot Method (FSM) - This method will be uninstructed time in which the only source of feedback will be the result of the free throw attempt. Subjects will also watch an hour long basketball DVD during the first, fifth and ninth weeks of the semester. Subjects will be given the same monetary incentives as the experimental groups for watching the DVD the required times.

Explanation of How the Methods Will Be Presented

Palubinskas Method

PM will be explained to students in a selected basketball class on the first day of class by reading a standardized statement of instructions. (Appendix G) A written copy of this instruction will be given to the subjects.

Free Shoot Method

FSM will be explained to subjects in a selected basketball class on the first day of class by reading a standardized statement of instructions. (Appendix G) A written copy of this instruction will be given to the subjects.

Procedures

Subjects from both groups will be participating in this study twice a week for a minimum of 10 weeks. Subjects will be tested beyond the 10 weeks depending on availability. Testing procedures will take place in classes taught in the Richards Building at Brigham Young University, Provo, Utah. Subjects will be shooting an approximate total of 590 free throws in class throughout the semester. Students will be prohibited from shooting free throws in their leisure time during the semester. Subjects will be disqualified from participation in this study for any of the following reasons:

- Any physical disabilities or injury during the semester in a way that impedes normal motor function required for free throw shooting
- Missing five classes
- Not watching the DVD the three times it is offered during the semester

In order to simulate a more season-like experience, the attempts are divided up into two types of days: practice and test. .

Practice Day

Practice days will include 10 warm-up attempts at the beginning of class. Then two different times during class you will shoot a set of three free throws and then end class with a set of 10 free throws. The sets of 10 at the beginning and end of class were chosen to give sufficient repetitions to incorporate the method.

Test Day

Test days will consist of 4 different times shooting a set of 3 attempts with the first 3 being warm up and the final 9 will be the performance. Subjects will be tested at least 6 times

throughout the semester. Sets of 3 free throws were chosen to correspond with the maximum amount of free throws that could be attempted consecutively for any single infraction. Kozar et. al (1995) found that shooting free throws in sets of 5 to 10 were not specific enough to transfer well. They reported that there was a similar percentage of the first 2 attempted practice free throws and game free throw shooting percentage. Thus, 3 shots have been chosen because of their relationship to the maximum attempts in any single free throw series in a game of basketball. Nine free throw attempts were chosen to be a reasonable number because of their relationship to the averages of free throw shots attempted by collegiate teams (Kozar et. al, 1995; Whitehead et al. 1996). The study facilitator will announce to all subjects that that day is a "test" day. The purpose of this is to simulate pressure by increasing the significance of the day. The study facilitator will explain to the class that this test day is designed to simulate pressure during a game situation. Subject partners will be assigned to record each other's score out of 9 on the Free Throw Record Sheet (Appendix H). Subjects who miss a test day will be tested the following class which they attend.

Testing schedule

Students will be tested after the initial pre-test every other Monday until the post-test. This will provide a minimum of 14 practice days to eight test days which is similar to the ratio of practices to games in a normal basketball season schedule. This schedule is found on their Free Throw Record Sheet.

Statistical Methods

Independent variables to be tested: Group assignment and treatment training in applications of PM to the experimental group. Dependent variable to be tested: free throw accuracy in a pre-test, six intermediate tests and post-test free throw accuracy. To analyze the data to be collected, a Between Within Analysis of Variance with Repeated Measures will be conducted. ANOVA for groups, trials and interaction will be assessed (2 groups x 8 trials). If significant F's are found between groups and/or within trials, a Tukey's Honestly Significant Difference (HSD) will be conducted. The level of confidence to be used to reject the null hypothesis will be at 95% ($p<.05$).

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Appendix A

Pilot Study t-Test Results

Free Throw Percentages for Beginning Basketball Classes @ BYU July 15, 2010

Subject	FT Made	Attempted	%
1	6	9	0.67
2	1	9	0.11
3	4	9	0.44
4	5	9	0.56
5	7	9	0.78
6	5	9	0.56
7	4	9	0.44
8	6	9	0.67
9	4	9	0.44
10	3	9	0.33
TOTAL	45	90	0.50

Free Throw Percentages for Intermediate Basketball Classes @ BYU July 15, 2010

Subject	FT Made	Attempted	%
1	7	9	0.78
2	7	9	0.78
3	8	9	0.89
4	7	9	0.78
5	6	9	0.67
6	5	9	0.56
7	4	9	0.44
8	6	9	0.67
9	5	9	0.56
10	3	9	0.33
11	2	9	0.22
12	6	9	0.67
13	3	9	0.33
TOTAL	69	117	0.59

t-Test

Group Statistics

Group	N	d.f.	Mean	Std Deviation	Std. Error Mean	t	p (2-tailed)
Beginning	10	21	4.5	1.716	0.543	1.073	0.295
Intermediate	13		5.31	1.843	0.511		

* Levene's Test for Equality of Variance (F= .267, p= .611)

Appendix B

Demographic Form

Name_____

Email address_____

Year:

Freshman Sophomore Junior Senior

Age at last birthday _____

Height ___’___”

Weight _____ lbs.

Circle each in which you have competed

1. None
2. Non-organized basketball
3. Church Basketball
4. Youth or Adult Recreation
5. 7th or 8th grade School Team
6. Freshman School Team
7. Sophomore High School Team
8. Junior Varsity High School Team
9. Varsity High School Team
10. Junior College Team
11. Collegiate Team

Appendix C

DVD Content Summary of Ed Palubinskas' Secrets to Principles of Perfect Shooting

Ed Palubinskas Secrets to Perfect Shooting Video Content Summary

Intro: A review of Ed's Credentials as a 2 time Olympian, Olympic Scoring Champion, National Free Throw Champion 1972 with 94.2%, All American All-Sec (LSU), 2-Time All-World Selection, Presently Shooting at 99% from the stripe

Ed's Claim: You will learn a formula and see visuals combining scientific principles and natural laws that must be adhered to, in order to experience shooting excellence. 95% of shooting from the free throw line is the goal. With anything less, there must be shooting flaws to correct.

22 Principles of perfect shooting:

1. The Palubinskas' Perfect Shooting Triangle
    - Ball is separated into thirds, middle third being the most important, index finger going straight down the middle of the middle third, the tips of the thumb to index finger to the pinky forms an isosceles triangle, Palubinskas perfect shooting triangle and must be mastered before you do anything else
2. The Numbered Fingered Principle
    - Thumb is given the number 0 because it does nothing but stay wide and thus providing stability and ball control through the whole shot process
    - Index finger is number 1 because it is the most important finger in the shoot, it should be the last finger to touch the ball on the release and goes right down the middle of the ball, it is responsible for "pure touch", number 1 finger should be in a straight line with the knuckle, wrist, elbow and shoulder joint
    - Middle finger is the number 2 finger and ring finger is the number 3 finger and pinky is number 4 finger, no function on the shot except stability, maintaining of the width, and control, but should never touch the ball last, there should be no movement in any of the fingers from cocking, or wrist extension, through the release of the ball, or wrist flexion
3. The Guide Hand Principle
    - Guide hand or non shooting hand is responsible for letting go and nothing else. Once the ball is balanced on the shooting hand, the guide hand is removed enough to let the ball move freely on the shooting hand, but the guide hand should not be dropped or thrown in order to maintain shoulder integrity
4. The Wide Hand Principle
    - Simply states that fingers should stay wide and in the same position throughout the whole shot process
5. The Ball-Palm Principle
    - A space or gap is necessary between the ball and the palm of the hand. The weight of the ball should be supported by the pads of the fingers.
6. The Angle of Release Principle

- First movement on the shot is up instead of at the basket or perpendicular to the body
- There are two types of problematic angles: the first is the finishing with the arm extended next to the ear, which would be larger than a 50 degrees angle off the ground The second problematic angle is finishing at less than a 45 degrees angle off the ground

7. The One Movement Principle
    - The less movement you have the more pure you shot will be
    - The knee, elbow, and wrist joints should all lock at the same time
8. The Wrist Joint Principle
    - At the finish of the shot the wrist joint location is critical, it should as well should freeze upon releasing of the ball at around 45 to 50 degrees
    - Do not drop the wrist, pull it back, etc just leave it alone
9. The Shooting Line Principle
    - After the shot has been released, take your eye of rim or the ball depending on what you watch during flight, and look down the line of your forearm. Line it up with the finger and the center of the rim
    - Make sure that the arm is 90 degrees to the floor and to the center of the rim or perpendicularly bisects both the plane of the floor and rim
10. The Pre-Shot Preparation Principle
    - Take a few practice dribbles which should be treated as practice shots using the same hand alignment and wrist flick that you would use to shoot, to dribble the ball into the ground. So the shooting triangle should be maintained during the dribbles
11. The Freeze Follow Through Principle
    - Fingers and elbow must be maintained through the lifecycle of the shot without excessive movement in finger or knuckles
    - The perfect follow through is found by pointing your index finger straight ahead with arm extended parallel to the floor, then spread wide the hand with pinky and thumb parallel to the floor and then simply raise up the arm to a 45□ angle while maintaining the hand in the same position
12. The Pure Follow Through Principle
    - Wide finger spread, no movement of finger joints or the knuckles
13. The Forearm Follow Through Principle
    - Elbow needs to be directly under the center of the ball because it is the power source
14. The Finger Knuckle Principle
    - There should be a happy medium of stiffness in the hand and softness
15. The Shoulder Rim Principle

- You generally should keep you shoulder square to the basketball, there should be an isosceles triangle made between the shoulders and the rim

16. The Shoot Height Principle
    - Shots too flat are less accurate with less margin for error, shots that are too high take too much energy
    - The proper max height of the ball during a shot would be parallel to the top of the backboard.
17. The Ball Eye Principle
    - Two options: You can either watch the ball in flight after the release or stayed focused on the rim during the life cycle of the shot, there is no recommendation, but experiment with either
18. The Missed-Shot Feedback Principle
    - There is a reason for missing shots, so learn from why you are missing and then understand which mechanics can correct the mistake, this is the basis of all shooting principles, learning why I am missing that way and what can be done to correct it
19. The Self-Check Principle
    - After the shot, take your eyes off the rim and ball and look at the alignment of the hand and elbow, most people have the intense feeling that they should see the basket, but you should learn to take your focus of the making of the basket and focus more on yourself
20. The Ball Rotation Principle
    - This happens naturally with the pure wrist snap and wide hand. It should be a perpendicular rotation to the plane of the rim, the ball coming of the index finger last is key
21. The Speed of Ball Release Principle
    - Advanced and complex concept with two variables. The first variable is if the shot rebounds hard consistently it may be that the speed of your release is too quick
    - The optimal release speed is generated by the pure follow through principle without knuckle or finger bending, you want the ball on the hand as long as possible to give you the time needed to judge the distance and aim etc
22. Poor Shooting Percentage Principle
    - NBA shoots 71%, College 66%, High School 64% from the free throw line
    - Every shooting flaw that you have you can deduct approximately 5 points from 100% to understand how many flaws you have. So flaws like guide hand interference or inconsistent/lazy wrist snap, bent knuckles etc. will cost you 5% points

Appendix D

DVD Compliance Sheet

Principles of Perfect Shooting by Ed Palubinskas

Name_____ Time Started_____

Date_____ Time Finished_____

Name the 22 principles highlighted at the beginning of each section

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____
11. _____
12. _____
13. _____
14. _____
15. _____
16. _____
17. _____
18. _____
19. _____
20. _____
21. _____
22. _____

Appendix E

Five Principles of Perfect Shooting by Ed Palubinskas

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1. Never, ever, ever, ever, ever, ever, ever think of making the basket. You must always focus on your personal mechanical flaws. There is no time to think of making the basket. Only time to think of where you are sending the ball.

2. Never allow any LATERAL movement in any joint or body parts. The more lateral movement, the more chance of error. You don't move a rifle barrel prior to shooting do you?

3. 3 joints only bend. The knees, elbow and wrist. Period. Especially watch the hand and fingers closing or dropping to the floor. This is where all the problems lie.

4. No assistance from the guide hand. This is a national epidemic. Especially for players who learned when they were kids and no one ever told them of the problematic guide hand.

5. The way the wide hand is on the ball is the way the hand should finish after release. The (PPST) Palubinskas perfect shooters triangle should be perfected for consistency, efficiency and perfection.

Appendix F

Explanation of Study to Student for PM and FSM

PM

You will be taught a free throw shooting method by watching an approximately 60 minute DVD entitled "Secrets to 'Perfect Shooting Principles'" by shooting coach Ed Palubinskas. You must watch this DVD during the first, fifth and ninth weeks of the semester. The DVD will be available in the Learning Resource Center in the Smith Field House to be seen at your convenience, but must be seen during the aforementioned weeks. Your student ID card will be required to watch it, and you will be monitored to confirm the day and amount of time you had it checked out. While you are watching the DVD, you must fill out a sheet recording the names of the 22 principles described by Mr. Palubinskas. There will be monetary incentives for watching the DVD. After finishing the DVD, take your sheet to SFH 106 to Sharron Collier to receive your money. You will be given $5 for each of the first and second viewings. You will be then given $20 upon viewing the third viewing after completing the previous two viewings.

You will also be given a one page summary of the five most important shooting principles from the video to use at your discretion. You will then shoot free throws every day of class throughout the semester with the Palubinskas "SMART" BALL™ to improve your free throw shooting accuracy. Each day of class will either be a practice or test day. Practice days will include 10 warm-up attempts at the beginning of class. Then two different times during class you will shoot a set of 3 free throws and then end class with a set of 10 free throws. Test days will consist of shooting 4 sets of 3 attempts intermittently throughout class with the first 3 being warm up and the final 9 will be your performance. You will be tested at least 6 times throughout the semester. Shooting free throws outside of class during leisure time will be prohibited during the semester. Oversight of practice and test days will be supervised by Andrew May.

FSM

You will practice shooting free throws every day of class during this semester and will receive self-regulated feedback by the result of each free throw attempt to improve your free throw shooting accuracy. To increase your motivation, you will watch a basketball game DVD in the first, fifth and ninth weeks of the semester. The DVD will be available in the Learning Resource Center in the Smith Field House to be seen at your convenience, but must be seen during the aforementioned weeks. Your student ID card will be required to watch it, and you will be monitored to confirm the day and amount of time you checked it out. There will be monetary incentives for watching the DVD. After finishing the DVD, the LRC will give you a certificate to take to SFH 106 to Sharron Collier to receive your money. You will be given $5 for each of the first and second viewings. You will be then given $20 upon viewing the third viewing after completing the previous two viewings. Each day of class will either be a practice or test day. Practice days will include 10 warm up attempts at the beginning of class. Then two different times during class you will shoot a set of 3 free throws and then end class with a set of 10 free throws. Test days will consist of 4 different times shooting a set of 3 attempts with the first 3 being warm up and the final 9 will be your performance. You will be tested at least 8 times throughout the semester. Shooting free throws outside of class during leisure time will be prohibited during the semester. Oversight of practice and test days will be supervised by Michael Dunn.

Appendix G

Free Throw Record Sheet

Name:_____

Date		Set 1	Set 2	Set 3	Total	
_____	**Test Day 1**	1 2 3	1 2 3	1 2 3		Movie LRC
_____	Day 2					
_____	Day 3					
_____	**Test Day** 4	1 2 3	1 2 3	1 2 3		
_____	Day 5					
_____	Day 6					
_____	Day 7					
_____	**Test Day 8**	1 2 3	1 2 3	1 2 3		
_____	Day 9					
_____	Day 10					Movie LRC
_____	Day 11					
_____	**Test Day 12**	1 2 3	1 2 3	1 2 3		
_____	Day 13					
_____	Day 14					
_____	Day 15					
_____	**Test Day 16**	1 2 3	1 2 3	1 2 3		
_____	Day 17					
_____	Day 18					
_____	Day 19					Movie LRC
_____	**Test Day 20**	1 2 3	1 2 3	1 2 3		
_____	Day 21					
_____	Day 22					
_____	Day 23					
_____	**Test Day 24**	1 2 3	1 2 3	1 2 3		
_____	Day 25					
_____	**Test Day 26**	1 2 3	1 2 3	1 2 3		

On non test days subjects shoot 26 practice free throws without recording

Legend

X=Make

O=Miss