

A PILOT STUDY: THE RELATIONSHIP BETWEEN SELF-EFFICACY AND BIO-MECHANICS TO IMPROVE FREE-THROW SHOOTING: A BRIEF INTERVENTION

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Very little attention has been given to the relationship between a player's self-efficacy and their bio-mechanics to improve their number of successful free-throw shots. This pilot study consisted of 17 male and female participants. The age range was 13-17 years. The participants were asked to complete four questionnaires and perform two free-throw shooting tasks that consisted of 23 shots. After analyzing the data, this study points to implication for further research to determine the effectiveness of combining the recommended bio-mechanics for shooting free-throws and the enhancement of a player's self efficacy to improve their free-throw shooting percentage.

In one of the most popular sports internationally, basketball, the game can be won or lost by one point. One free-throw can be worth that one point. To date, very little research has been directed toward free-throw shooting and its relationship to proper bio-mechanic and self-efficacy in the field of Sports Psychology. Most free-throw shots are awarded to a player after being fouled by an opponent. It can be argued that free throw shots can determine the outcome of a basketball game. Poor free-throw shooting can be seen among players at both professional and non-professional playing levels. The objective of this pilot study is to determine the effectiveness of a brief intervention that will focus on the principles of self-efficacy and the recommended biomechanics for a player to shoot free throws.

In reviewing the literature of Pruitt (1980), author and coach, observed that most children with the arm and wrist strength shoot a basketball with a push from the chest style. With consistency of shooting the basketball using that form, many of their shots are successful. Yet, he suggests that a coach should attempt to correct the child by showing them the most commonly used form. He also mentioned that most of the children will resent the new shooting technique because they will become frustrated because the decrease of successful shots. The recommended shooting technique is for the player to stand with his feet shoulder width apart or one foot dropped half a step behind with knees bent. Next, the player should release the ball and straighten his knees in one fluid motion. (Coleman, 1978).

In the game of basketball, there are many models for a player to imitate for example Michael Jordan, Kobe Bryant or Shaquille O'Neal. It can be assumed that the player is following the observational learning process (OLP). The concept of the OLP is that a behavior is performed; the observer can gain knowledge and may change their behavior. The findings of Bird and Cripe (1986), considers the OLP as one of the most effective concepts in teaching sport skills. There are two cognitive representational systems that are associated with the OLP, verbal and imaginal. In respect to motor skills that are needed in any form of sport, the more prominent of the two systems is the imaginal. It is assumed that the observer transforms the vision of the model into a symbolic code or mental image. To add weight to the imaginal system, a study showed that free-throw shooting increased significantly with the usage of mental imagery (Peynircioglu, Thompson, & Tanielian, 2000). Other findings showed that visual imagery helped some athletes to plan strategies before attempting the task (Rotella, Cansneder, & Billing, 1980).

The verbal component of OLP is done in the form of feedback. The findings of Kladopoulos and McComas, (2001), found a significant increase in the percentage of successful free-throws attempts by three female collegiate basketball players after receiving feedback. In order for feedback to be effective, coaches need to give feedback in the most honest and direct manner. This type of feedback allows the athlete to make the needed adjustment(s) (Cummings, Schwab, & Rosen 1971).

Before feedback can be given or received, the player and coach should establish and agree upon a goal. This introduces the other sector in the aim of this pilot study, the concept of self-efficacy. Bandura (1995) explained self-efficacy as the perceived beliefs that people have in their abilities to perform certain situations. Based upon Bandura's concepts and his findings, there are four sources of the Self Efficacy Theory: mastery experiences

(overcoming obstacles to be successful, vicarious experiences (modeling), social persuasion (verbal influences) and physiological and emotional states (positive mood/stress reduction). Bird and Cripe (1986) credits Bandura's work as being an important contribution to sports. The literature of Iso-Ahola and Hatfield (1986) shows support for the Self-Efficacy Theory.

Self-Efficacy can be measured by using the Rotter's Locus of Control Scale. The findings of Saccuzzo and Ingram (2004) defines locus of control as the extent to which a person feels responsible for their own outcomes. There are two types of locus of control: internal and external. Based on the findings of Brandwein (2003), participants who indicated that they had an internal locus of control showed more commitment, more respect for social conventions and were more positive in their athletic activities than the participants who showed an ego-orientation and an external locus of control.

It can be assumed that a person's self efficacy can only be enhanced because they want it to be enhanced. Positive self-talk can be considered as a useful tool to enhance self-efficacy. In reviewing literature concerning self-talk, Zastoney, Kirschenbaum, & Mag (1986) showed that anxiety was reduced when children practiced positive self-talk. In an interesting study that reflected the opposite of positive talk, it was shown that in stressful situations heart rates were higher for participants who engaged in negative self-talk (Vera, Vila, & Gody, 1994). Positive self-talk can be used when teaching a person a novel task (Solley, & Payne, 1992). When combined with other tools for teaching a skill, self-talk has been shown to be the most effective tool (Oei, & Barber, 1989). Perkos, Theodorakis, & Chroni, (2002) supported the importance of players having high self-efficacy by having them privately give themselves self-talks before shooting free-throws in a successful performance. The study consisted of a control group and an experimental group with instructional self-talk as the independent variable. The experimental group used self-talk while performing dribbling, passing and shooting drills. In the control group, the three drills were practiced without instructional self-talk. Results showed that the experimental group performed better than the control group in the practice drills of dribbling and passing. The participants and coaches of the study reported using less self-talk with the shooting drills.

It can be assumed that a player will never make every free-throw shot they attempt. Yet, it is possible that a player can increase their number of successful free-throw attempts. This notion lends itself to the importance of this pilot study. The goal of this pilot study is to yield results and information that can be used to further test the effectiveness of combining the recommended proper bio-mechanics and the concept of self-efficacy in shooting free-throw shots. It is hypothesized that players who have been instructed to use the proper recommended body mechanics and asked to think that they can make their shots will increase their free-throw percentage more than players who were only instructed to use the proper recommended body mechanics.

Method

Participants

A total of 17 children volunteered from a local church participated in this pilot study. The majority of the participants was female (n=12). The average age was 14.19 (SD = 2.0). The average number of siblings reported was 5.18 (SD = 4.03).

Survey Development

Basketball Involvement. This survey consisted of 10 questions (See Appendix 1). The participants were instructed to respond with a yes, no or not sure. One question from this survey "How many free-throws out of 10 do you think you can make?" was repeated on the post survey.

Nowicki-Strickland Internal-External Locus of Control Scale for Children (CNS-IE). This 40-item scale consist of 40 yes-no items that have shown test-retest reliability (Nowicki & Strickland, 1973). This scale is a widely used scale to measure locus of control in children (See Appendix 2). Rohrbeck, Azar, & Wagner (1991) used the CNS-IE to validate the reliability of the measure, Child Self-Control Rating Scale. Of the 40-items, five items were selected for the post survey (See Appendix 3).

Procedure

The participants arrived at the gym with their parents’ consent forms. The assent forms and surveys were read by the researcher. After completing the forms, the participants were asked to randomly draw a number from a container to determine their participant number and the group they would be random assigned. The numbers were from 1-30. Even numbers were assigned to Group A. Odd numbers were assigned to Group B. Each group went to opposite ends of the court and was asked to perform a pre- free-throw shooting task. The task consisted of each participant shooting two shots and rotating around the free-throw perimeter for a total of 10 shots to get a baseline. The pre-free-throw task was completed and recorded for each group.

Group A participants (n=8) were asked to watch a skilled basketball player shoot a total of five shots using the recommended bio-mechanic techniques. Each participant was instructed to shoot three practice shots modeling the skilled player. After their practice shots, they were given a 10 minute break. Upon returning from their break, they were instructed to perform the post-free-throw task. That task consisted of using the technique that was shown to them, shoot two shots and rotate around the free-throw perimeter for a total of 10 shots. After completing their shots, they were asked to complete the post survey. They were debriefed, allowed to ask questions concerning the experiment, and thanked for their participation.

Group B participants (n=8) was asked to listen to a short talk concerning self-efficacy. The researcher explained the definition and gave examples of both low and high self-efficacy. The participants were asked to write a positive self-statement on an index card. They were asked to privately repeat the statement five times to themselves. In addition to the short talk, the participants were asked to watch a skilled basketball player shoot a total of five shots using the recommended bio-mechanic techniques. They repeated the same procedure as Group A that included taking three practice shots, taking a 10 minute break. Upon returning from their break, they were reminded to privately repeat their positive statements while performing the post free-throw task. They were asked to complete the post survey, debriefed, allowed to ask questions concerning the experiment, and thanked for their participation.

Results

Results for Group A and B were obtained and compared for their overall basketball involvement, overall locus of control, post CNS-IE/Basketball Involvement, number of successful free-throw shots, and improvement.

Table 1. Means and Standard Deviations for Overall Basketball Involvement

	Group A or B	N	Mean	Std. Deviation	Std. Error Mean
Overall basketball involvement score	Group A	8	1.98	4.95E-02	1.75E-02
	Group B	8	1.77	.35	.12

Table 2. Means Comparisons for Basketball Involvement

		Independent Samples Test									
		Levene's Test for Equality of Variances		t-test for Equality of Means						95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper	
Overall basketball involvement score	Equal variances assumed	8.264	.012	1.722	14	.107	.21	.12	-5.28E-02	.48	
	Equal variances not assumed			1.722	7.280	.127	.21	.12	-7.80E-02	.51	

The basketball involvement scale consisted of three ranges: low involvement, unsure of involvement and high involvement. As seen in Table 1, Group B showed a slightly lower overall involvement than Group A (M = 1.77, SD

= .35). The results in Table 2 shows a significant difference between the groups mean, $t(14) = 1.722$, $p < .05$. The results are significant at the .05 level indicating that one can be 95% confident that the results are not due to chance.

Table 3. Means and Standard Deviation for Overall Locus of Control

Group A or B		N	Mean	Std. Deviation	Std. Error Mean
Overall Score on CNS-IE Scale	Group A	8	1.88	.35	.13
	Group B	8	2.00	.53	.19

Table 4. Means Comparisons for Overall Locus of Control

		Levene's Test for Equality of Variances		t-test for Equality of Means					95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Overall Score on CNS-IE Scale	Equal variances assumed	.027	.871	-.552	14	.590	-.13	.23	-.61	.36
	Equal variances not assumed			-.552	12.141	.591	-.13	.23	-.62	.37

As seen in Table 3, Group B showed a slightly higher score for their overall locus of control ($M = 2.00$, $SD = .53$). Table 4 results shows that there was no significant difference between the groups $t(14) = -.552$, $p > .05$. Both groups were considered to be average scorers based on the CNS-IE Scale.

Table 5. Means and Standard Deviations for Post CNS-IE and Basketball Involvement Paired Items

Group A or B		N	Mean	Std. Deviation	Std. Error Mean
1. Do you feel that most of the time that it doesn't pay to try hard because things never turn out right anyway	Group A	8	1.88	.35	.13
	Group B	8	1.88	.35	.13
2. Do you think cheering more than luck helps a team win	Group A	8	1.75	.46	.16
	Group B	8	1.88	.35	.13
3. Do you feel that most people are just born	Group A	8	1.50	.53	.19
	Group B	8	1.63	.52	.18
4. Do you feel that when good things	Group A	8	1.88	.35	.13
	Group B	7	2.00	.00	.00
5. Are you the kind of person who believes	Group A	8	2.00	.00 ^a	.00
	Group B	8	2.00	.00 ^a	.00
6. Write the number of free throws shots of 10	Group A	8	3.88	2.47	.88
	Group B	8	2.63	2.26	.80

a. t cannot be computed because the standard deviations of both groups are 0.

Table 6. Means Comparisons for Post CNS-IE and Basketball Involvement

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
1. Do you feel that most of the time that it doesn't pay to try hard because things never turn out right anyway	Equal variances assumed	.000	1.000	.000	14	1.000	.00	.18	-.38	.38
	Equal variances not assumed			.000	14.000	1.000	.00	.18	-.38	.38
2. Do you think cheering more than luck helps a team win	Equal variances assumed	1.577	.230	-.607	14	.554	-.13	.21	-.57	.32
	Equal variances not assumed			-.607	13.093	.554	-.13	.21	-.57	.32
3. Do you feel that most people are just born good at sports	Equal variances assumed	.467	.506	-.475	14	.642	-.13	.26	-.69	.44
	Equal variances not assumed			-.475	13.985	.642	-.13	.26	-.69	.44
5. Do you feel that when good things happen they happen because of hard work	Equal variances assumed	4.719	.049	-.931	13	.369	-.13	.13	-.42	.17
	Equal variances not assumed			-1.000	7.000	.351	-.13	.13	-.42	.17
6. Write the number of free throws shots of 10 do you think you can make	Equal variances assumed	.487	.497	1.054	14	.310	1.25	1.19	-1.29	3.79
	Equal variances not assumed			1.054	13.890	.310	1.25	1.19	-1.30	3.80

Table 5 presents the mean and standard deviation for items 1-65 for the Post CNS-IE/ Basketball Involvement Survey. Item 1 in Table 5 showed the mean for both group to be the same (M=1.88, SD=.35). Table 6 showed no significance for Item 1. As seen in Table 5, Item 2 is slightly higher for Group B (M = 1.88, SD = .35). Table 6 represents no significant difference between the results. Group B is slightly higher for Item 3 than Group A (M= 1.63, SD = .52); Table 6 showed no significance. Item 4 is higher for Group B (M=2.00). No computation could be made for the significance for Item 4. Item5 in Table 5 is shown to be the same for both groups (M = 2.00) with table 6 showing no significance. In Table 5, Item 6 is higher for Group A than Group B (M = 3.88, SD = 2.47). Table 6 shows that the results are not significant at the .05 level.

Table 7. Means and Standard Deviation for Successful Pre Free-Throw Shots

GROUP		N	Mean	Std. Deviation	Std. Error Mean
PREMADE	Group A	8	2.75	1.58	.56
	Group B	8	1.88	1.89	.67

Table 8. Means Comparisons for Successful Pre Free-Throw Shots

		Levene's Test for Equality of Variances		t-test for Equality of Means					95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
PREMADE	Equal variances assumed	.076	.786	1.006	14	.332	.88	.87	-.99	2.74
	Equal variances not assumed			1.006	13.588	.332	.88	.87	-1.00	2.75

As seen in Table 7, Group A members was slightly more successful in completing their free- shots than Group B members (M = 2.75, SD = 1.58). No significant difference is shown between the groups in Table 8 t (14) = 1.006, p > .05.

Table 9. Means and Standard Deviation for Post Free-throw Shots

GROUP		N	Mean	Std. Deviation	Std. Error Mean
POSTMADE	Group A	8	3.13	2.10	.74
	Group B	8	1.63	1.92	.68

Table 10. Means Comparisons for Post Free-Throw Shots

		Levene's Test for Equality of Variances		t-test for Equality of Means					95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
POSTMADE	Equal variances assumed	.363	.556	1.490	14	.158	1.50	1.01	-.66	3.66
	Equal variances not assumed			1.490	13.892	.159	1.50	1.01	-.66	3.66

The mean post successful free-throw shots are seen in Table 9. As seen in the table, Group A results are higher than Group B (M=3.13, SD=2.10). Table 10 represents the significance between the groups difference t (14) = 1.490, p < .05. The results indicate that one can be 95% confident that the results are not due to chance.

Table 11. Means and Standard Deviations for Free-Throw Improvement

GROUP		N	Mean	Std. Deviation	Std. Error Mean
IMPROV	Group A	8	.38	1.85	.65
	Group B	8	-.25	2.60	.92

Table 12. Means Comparisons for Free-Throw Improvement

		Levene's Test for Equality of Variances		t-test for Equality of Means					95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
IMPROV	Equal variances assumed	.082	.779	.554	14	.589	.63	1.13	-1.80	3.05
	Equal variances not assumed			.554	12.618	.590	.63	1.13	-1.82	3.07

As can be seen in Table 11, the mean for Group A was greater than the mean for Group B ($M=.38$ $SD=1.55$). No significant difference is seen in Table 12 between the groups mean $t(14)=.554$, $p > .05$.

Discussion

Although the hypothesis of this pilot study was unable to be tested, the goal of the study was met by the overall findings. As stated earlier, the goal of this study was to gain knowledge that can be applied to design a future and broader study.

As it was shown with the participants overall involvement, basketball can be played as a leisure sport as well as competitive one. The Basketball Involvement questionnaire can serve as an important tool to pre-screen future participants. In the future, the participants who score as low involvers could possibly placed in the control group. It is suggested that more items be used on the questionnaire to effectively measure involvement.

In respect to the widely used CNS-IE scale, it is recommended to employ a scale that is designed to measure an athlete's locus of control. It can be argued that more positive self-talk is used; it will enhance self-efficacy. Questions on the post CNS-IE should be asked to assess and measure the usage of private talk other than for sports related issues.

The pre-free-throw task was shown to be useful in establishing a baseline. It was observed that the demonstrator and participants in Group A interacted more with each other than the model and participants in Group B. Although the improvement for Group A was not significant, it can be argued that they show support to the OLP. It is suggested for future study that models be similar in their interactions with the experimental groups.

This pilot study had several limitations. The small sample size could have been a factor for the results not being statistically significant. It is possible with a larger sample size the results could have continued in the direction of being significant. Practice is needed to learn any sport skill. The short duration of the study could have contributed to the low overall improvement in free-throw shooting.

In conclusion, free-throws can be crucial to the outcome of a basketball game. All players need to know how to shoot free-throws and be confident in themselves when attempting the shot. Therefore, future studies of this current pilot study's interest are needed to possibly improve a player's percentage in free-throw shooting that will be beneficial to the team.

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Appendix

Appendix 1. Basketball Involvement Survey

1. Do you like basketball?
2. How many months or years have you played basketball?
3. Do you play or have played on a team?
4. Do you watch the NBA games?
5. Can you shoot a 3-point shot?
6. Are free-throw shots important in a game?
7. How many free-throw shots out of 10 can you make?
8. How many times a week do you play basketball?
9. Do you plan on playing pro-basketball?
10. Have you ever heard of "Hack-A-Shaq"?

Appendix 2. CNS-IE Scale

1. Do you believe that you can stop yourself from catching a cold? Yes or No
2. Are some people just born lucky? Yes or No
3. Do you believe that most problems will solve themselves if you just don't fool with them? Yes or No
4. Most of the time, do feel that good grades meant a great deal to you? Yes or No
5. Are you often blamed for things that aren't your fault? Yes or No
6. Do you believe that if somebody studies hard enough he or she can pass any subject?
7. Do you feel that most of the time that it doesn't pay to try hard because things never turn out right anyway? Yes or No
8. Do you feel that if things start out well in the morning it's going to be a good day no matter what you do?
9. Do you feel that most of the time parents listen to what their children have to say? Yes or NO
10. Do you believe that wishing can make good things happen? Yes or No
11. When you get punished does it usually seem it for no good reason at all? Yes or No
12. Most of the time do you find it hard to change a friend's opinion? Yes or No
13. Do you think cheering more than luck helps a team win? Yes or No
14. Do you feel that it was nearly impossible to change your parents' minds about anything? Yes or No
15. Do you believe that parents' should allow children to make most of their own decisions? Yes or No
16. Do you feel that most people are just born good at sports? Yes or No
17. Do you feel that when you do something wrong there is very little you can do to make it right? Yes or No
18. Are most other people your age stronger than you? Yes or No
19. Do you feel that one of the best ways to handle most problems is just not to think about them? Yes or No
20. Do you feel that you have a lot of choices in deciding who your friends are? Yes or No
21. If you find a four leaf clover, do you believe that it might bring you good luck? Yes or No
22. Do you often feel when a person your age is angry with you, there is little that you can do to stop him or her? Yes or No
23. Do you often feel that whether or not you did your homework had much to do with what kind of grades you got? Yes or No
24. Have you ever had a good luck charm? Yes or No
25. Do you believe that whether or not people like you depend on how much you act? Yes or No
26. Did your parents usually help you if you asked them to? Yes or No
27. Have you ever felt that when people were angry with you it was usually for no reason at all?
28. Most of the time, do you feel that you can change what might happen tomorrow by what you do today? Yes or No
29. Do you believe that when bad things are going to happen they are going to happen no matter what you try to do to stop them? Yes or No
30. Do you think that people can get their own way if they just keep trying? Yes or No
31. Most of the time, do you find it useless to try to get your own way at home? Yes or No
32. Do you feel that when good things happen they happen because of hard work? Yes or No
33. Do you feel that when somebody your age wants to be your enemy there is little that you can do to change matters? Yes or No
34. Do you feel that it's easy to get friends to do what you want them to do? Yes or No
35. Do you usually feel that you have little to say about what you get to eat at home? Yes or No
36. Do you feel that when someone doesn't like you there is little you can do about it? Yes or No
37. Do you usually feel it was almost useless to try in school because most of other children were just plain smarter than you were? Yes or No
38. Are you the kind of person who believes that planning ahead makes things turn out better? Yes or No
39. Most of the time, do you feel that you have little to say about what your family decides to do? Yes or No
40. Do you think it's better to be smart than lucky? Yes or No

Appendix 3. Post CNS-IE/Basketball Involvement Survey

1. Do you feel that most of the time that it doesn't pay to try hard because things never turn out right anyway? Yes or No
2. Do you think cheering more than luck helps a team win? Yes or No
3. Do you feel that most people are just born good at sports? Yes or No
4. Do you feel that when good things happen they happen because of hard work? Yes or No
5. Are you the kind of person who believes that planning ahead makes things turn out better? Yes or No
6. Write the number of free-throw shots out of 10 you think you can make?

