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An Exploratory Study of Archers: Use of Different Frequencies of Pettlep Imagery Technique On Shooting Performance

Abstract

The primary purpose of the present research study was to examine the use of different frequencies of PETTLEP imagery trainings on shooting performance of Archers over a period of two weeks. Participants (n=160) invited from Clubs, Colleges, Universities, Academies and Departments: with a gender ratio of 90:70 for male and female respectively. The sample was randomly divided into four groups with 40 participants in each: PETTLEP Imagery Practice twice per week (2x/wk), PETTLEP Imagery Practice four times per week (4x/wk) and PETTLEP Imagery Practice six times per week (6x/wk) and a control group. During the pre-test and post-test, participants were required to complete a total of 3 rounds comprising five shots in each round (total of 15 shots on target) from a distance of 30 meters with 10 minutes rest in between each round. The maximum possible score was 150 points and 10 points were awarded if the bull's eye was hit. The standard Archery equipment was used with Hoyt/Fivics complete recurve Bow weighing 38-40 lbs, and Easton Carbon One arrows. Following the pre-test, each participant imagined twenty shots per practice session with frequency of sessions per week as per group confines. The control group only completed some archery specific stretching exercises. SPSS 21 was used for data analysis. Paired sample t test was used to identify the significant differences between pre and post-test scores of Archers and it showed that all three intervention groups improved significantly (p<.05) after intervention, with 6x/wk group showing the most improvement with an average improvement value of 31.01 (58.42%, followed by 17.74 (33.25%) for 4x/wk and 13.66 (25.86%) for 2x/wk. The control group showed an overall decline in performance by 8.96%. Results extend prior research findings to authenticate that PETTLEP Imagery practice has a substantial impact on improving skill precision levels of players. Our current findings suggest that if the frequency of practice is set to at least 6 times x per week, the improvement in performance will be the highest. However; there is room for further research to

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investigate and determine the optimum number of practice sessions in a fixed period of time.

Keywords: Imagery, PETTLEP, MST, Archery, Frequency, ASPT, Bow, Arrows.

Introduction:

Research on the improvement of Mental Skills Training (MST) programs in brain game science has to a great extent of expansion as sports has turned out to be progressively focused. MST projects have been believed to improve the sports performance of competitors. Imagery can be used in different areas to enhance performance, and it is a popular technique in sports. Like physical practice, motor imagery (MI) can result in brain plasticity. Research shows that imagining a skill (mental practice) often facilitates performance and in some cases can almost be as effective as physical practice (Feltz and Landers, 1983). Imagery can be used as a technique to enhance sport performance (Arvinen-Barrow, Weigand, Thomas, Hemmings and Walley, 2007). It has been reported to be the most common technique used among athletes in an aim to enhance performance (Parnabas and Parnabas, 2015). It has been demonstrated that 90% of the Olympic athletes in America use imagery and 97% of them believe imagery to have a positive effect on their performance (Weinberg and Gould, 2008).

As the prominence of archery has expanded, the requirement for utilizing mental abilities to help archers in execution improvement which has turned out to be more prominent. In a brandishing sports domain, it can regularly mean the distinction among losing and winning, particularly in a subjective game, for example, archery, which involves the utilization of physical as well as mental abilities (Ruis and Stevenson, 2004). Because of the idea of archery, archer who can control their feelings perform superior to anything the individuals who can't (Robazza and Bortoli, 1998). Archers utilize some type of mental abilities, for example, excitement control and centering attention before, during and after sports competitions (Lee, 2009; Robazza and Bortoli, 1998). Research in archery and MST projects has to a great extent managed proficient world class archers and few research exists that spotlights on high class archers who are additionally involved in some academic activity at university level (Hung *et al*., 2008; Hung *et al*., 2009). Since archery includes a great deal of subjective mental abilities, MST projects have been grown generally in Europe, Asia and North America to enable archers to turn out to be progressively able in creating mental aptitudes for better performance in their sporting activity (Hung *et al*., 2008; Robazza and Bortoli, 1998).

No studies on the impact of psychological training on archery performance have been conducted in Pakistan. This research study was focused on exploration of the appropriate amount of Imagery frequency for performance enhancement of professional Archers. Imagery training program was especially designed and tailored exclusively to find out the impact of different frequencies of Imagery training on Archers from different organizations. Specifically, the PETTLEP Imagery technique was used for this experiment since it has proven to be the most effective type of Imagery training available. A comparison was made between

PETTLEP based imagery and traditional mental practice techniques and empirical results showed that PETTLEP group improved its proficiency in these skills, whereas traditional imagery group did not improve significantly (Smith *et al.,* 2007. **Research on PETTLEP Imagery Model in Sports**

There are research evidences regarding the use of PETTLEP model in sports like Netball, Dart throwing, Basketball, Volleyball, Gymnastics, Golf and Tennis. Past research has been around reducing competitive anxiety in archery athletes using PETTLEP Imagery, e.g. in Indahwati, Nanik and Ristanto, Kolektus, (2016), or around the motivational effects of this practice in high school student athletes, as in Lin (2017). There are also a few researches which have combined such psychological practices while comparing the performance of elite level archers, such as Bebetsos, (2015), however; these do not clearly address the importance of session frequency with performance improvement.

PETTLEP approach suggests that characteristics related with practice should be included to optimize imagery and action observation, such as possession of equipment required for the skill or adopting accurate body postures required to perform that skill. PETTLEP model was proposed by Holmes and Collins, (2001), based on Lang's (1977, 1979) functional equivalence theory (Decety, 1996). They stated that it is a set of guidelines for producing functionally equivalent imagery such that the imagery is as realistic and as similar to physical practice as possible. The name, PETTLEP, is an acronym for 7 important components that need to be included in the imagery process: Physical, Environmental, Task, Timing, Learning, Emotion and Perspective.

Smith *et al. (*2007) have compared the effectiveness of PETTLEP imagery to traditional imagery in two experiments: The first experiment involved 48 varsity hockey players, assigned to four groups ("sport specific" imagery in uniforms, standing on the hockey pitch, "clothing" imagery in uniforms, traditional imagery, and control). Performance on penalty flicks was assessed in a pre-test trial and in a post-test trial, after six weeks of imagery training. The second experiment involved forty junior gymnasts divided into similar experimental groups (PETTLEP, physical practice, stimulus sensory modalities only, and control) and assessed in balance beam pre-test and post-test trials. The "sport-specific" PETTLEP imagery groups scored significantly higher in the post-test than the "clothing" / physical practice imagery groups who scored significantly higher than the other two groups. The results therefore provided support for the efficacy of PETTLEP-based imagery over traditional imagery. Similar results have been obtained by Smith, *et al.* (2008) for golf bunker shots.

Matthews (2003) gave a premise of mental aptitudes that are required in archery. Matthews (2003), utilizing the 4 C's model of mental strength by Clough, Earle and Sewell (2002) thought of the psychological aptitudes. Clough, Earle, and Sewell (2002) developed Kobassa's (1979) theory on mental toughness which had proposed three parts that are significant for mental sturdiness that is control, challenge and commitment. Clough *et al*., (2002) recognized confidence as a fourth segment. The four components are defined as Control, Commitment, Challenge, and Confidence.

MATERIALS AND METHODS

The sample (n=160) comprised of archers from clubs, colleges, universities, departments, regional and national academies of Pakistan with the ratio of 90:70 for male and female participants respectively who were assigned different groups randomly: Group 1 PETTLEP Imagery Practice Two Times a Week (2x/wk), Group 2 PETTLEP Imagery Practice Four Times a Week 4x/wk, Group 3 PETTLEP Imagery Practice Six Times a Week 6x/wk, and Group 4 with no PETTLEP Imagery Practice i.e. the Control Group. The archers were equally distributed with n=40 in each group.

All participants were asked to report any visual or hearing impairments. All participants reported to have normal vision and were free of any recent injury that resulted in affecting their execution of the sport. For the purpose of achieving accurate results and to avoid accustomed responses, the groups only knew regarding their own particular intervention programs and did not know about the specifics or frequency differences in the intervention programs of other groups. To guarantee this, all the groups were put through several interventions in succession separately. Before the study, research procedure was explained to the participants, and ethical approval from the concerned office was taken, however; no information was provided about the objectives of the study and dependent variables of research interest.

Development of Archery Skill Precision Test (ASPT)

Development of the Archery Skill Precision Test (ASPT) was established under the recommendations from German Tennis Federation "Deutscher Tennis Bund" (DTB), as used by Hegazy (2012) All participants were required to complete a total of 3 rounds comprising five shots in each round (total of 15 shots on target) from a distance of 30 meters.

Rest of 10 minutes was given between each round for participants to regain focus and to avoid fatigue. The maximum possible score was 150 points and the 10-zone scoring method was followed. 10 points were awarded if the bull's eye was hit and the points kept reducing as the participant shot further away from the bull's eye. Arrow touching a line scores the higher scoring ring. The numbers of shots with score was also recorded.

Segmentation of PETTLEP Imagery Sessions Time (Minutes)						
Relaxation	Action Picture	Videos Tapes	Audio Instructions	Imagery Session	Time/ Duration	Rest
10	05	08	06	3x3=06 2 repetitions	35 x 35 =70	20 min 70+20 = 90
Total time = 90 minutes. 35 min each x 2 sessions 20 min rest in between each session						

Figure 1. Showing the standard target sheet used to measure pre and post test scores on ASPT.

Figure 2. Showing the segmentation of PETTLEP Imagery protocol sessions with time in minutes.

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Development of PETTLEP based Imagery Scripts

Experts from several concerned sports organizations including Government of the Punjab, Department of Applied Psychology, University of the Punjab in Lahore and Pakistan Archery Federation (PAF) were consulted to prepare PETTLEP based Imagery scripts used in the present study.

Imagery scripts were designed in a way that the skill was broken down into various stages of archery explained in imagery scripts.

The imagery scripts comprised of a maximum of 6 sessions per week, with step by step progression, starting from the proper stance and holding the bow up until the follow through. Scripts were based on all seven components of PETTLEP Imagery technique, which allowed the subjects to work on specific aspects of archery skill (Haywood and Lewis, 1989). Each session lasted for approximately 100 minutes with a 10-minute break in between. Subjects were asked to close their eyes and listen to instructions in the audio imagery script. The script asked them to imagine various components of the skill.

In addition to the audio imagery script, participants followed several phases of PETTLEP intervention, including holding a bow and arrow in hand, wearing the full kit and holding the right stance in the archery field where the target shots are performed. Subjects were also exposed to break down sequence of action-based pictures of the skill and action-based audio/ video tapes.

Subsequently after the audio instructions, the subjects were asked to close their eyes and imagine the segment of the skill in sequence integrating all of the essentials of the drag flick into one smooth continuous movement in slow motion and in real time, a 06 (3x3) minutes PETTLEP based Imagery practice intervention was carried out in which the subjects were engaged in imaging the drag flick skill according to the instructions and to create visual images from both internal and external perspectives.

Pre-Tests of ASPT followed by Experimental Study on all Four Groups

Pre-Tests of ASPT were conducted separately on each group before the start of experimental procedure. ASPT scores and number of shots as the score progressed were used to determine the subject's archery skill proficiency. The pre-tests of ASPT were followed by the administering of experimental study carried out on total sample n=160, divided into four groups one by one for a duration of 2 weeks each at different stations. These 3 out of 4 groups mentally rehearsed the skill through PETTLEP based Imagery scripts with the researcher over a period of 12 sessions maximum (12 for 6x/week, 8 for 4x/wk and 4 for 2x/wk) comprising 100 minutes each, over a span of two weeks.

Group 1: PETTLEP Imagery Practice Two Times a Week (2x/wk)

This group (n=40) was given PETTLEP Imagery training. A total number of 4 sessions were conducted in 2 weeks, with 2 sessions every week, each one lasting for 100 minutes, with a 10-minute break in between.

The training sessions were scheduled on every 2nd and 5th day of the week.

Group 2: PETTLEP Imagery Practice Four Times a Week (4x/wk)

This group (n=40) was given PETTLEP Imagery training 4 times a week; 8 times in total. Each session lasted for 100 minutes.

The training sessions were scheduled on every 1st, 3rd, 5th and 7th day of the week.

Group 3: PETTLEP Imagery Practice Six Times a Week (6x/wk)

This group (n=40) was given PETTLEP Imagery training 6 times a week (6x/wk), so 12 sessions in total. The schedule of training was such that it was conducted on each day of the week for 100 minutes excluding the rest day.

Group 4: No Practice Group (NP)

The fourth group n=40 (Control Group) was formulated to make sure the post-test results of all groups are comparable. This group was given no imagery training, was retained and was made to do a few relevant stretching exercises and made to read books.

Inferential Analyses of Groups

The analyses were carried out using Statistical Procedure for Social Sciences (SPSS) version 21.0 to draw conclusions. The alpha level of significance was set at $P < 0.05$ for all the statistical tests. Statistics were calculated for each subject according to their intervention groups in line with the objectives of the study. ASPT pre-test and post-test scores were calculated, tabulated and graphed to illustrate the significant differences in the measured precision levels of archers in all four groups. Paired Sample *t* test was conducted to test the significant differences between pre and post test scores. The results indicated that there was significant difference between the pre-test and post-test ASPT scores of all intervention groups.

Highest mean difference percentage was recorded by Group 3 6x/wk on ASPT post test scores, which were noted as 58.32% ($p < 0.05$) as improvement (Table 1), while Group 4 (NP) showed lowest mean difference of -8.96% ($p < 0.05$) as decline in performance which has substantiated the effectiveness of PETTLEP Imagery Practice technique to improve skill precision levels. The results show that Group 3 has improved performance more than Group 1 (with mean difference 25.86% and $p < 0.05$) and Group 2 (with mean difference 33.25% and $p < 0.05$).

The result strengthens the earlier findings that more PETTLEP imagery practices results into higher improvement percentage. The results are also in accordance with the available literature and a host of researches that have been discussed earlier.

Table 1. Showing results of the paired sample t test, including pre and post-test scores (Mean ± S.D.), Mean Difference (%) and p values of Archery Skill Precision Test (ASPT), noted before and after completing PETTLEP imagery interventions for 2 weeks with different frequencies for the Archers (n=160) from different organizations of Pakistan. Significant level is represented by $p < 0.05$* and $p \geq 0.05$**.

Paired Sample t test

PETTLEP Imagery Intervention	Archery Precision Scores				
	Pre Test	**Post test**	**Mean Difference (%)**	***t* value**	**P Value**
2 Days per Week	52.82±18.52	66.48±26.95	13.66* (25.86%)	-10.16	0.00
4 Days per Week	53.35±18.96	71.09±24.89	17.74* (33.25%)	-16.02	0.00
6 Days per Week	53.08±17.51	84.09±26.52	31.01* (58.42%)	-16.55	0.00
Control Group	57.83±20.25	52.65±18.58	-5.18* (-8.96%)	9.69	0.00
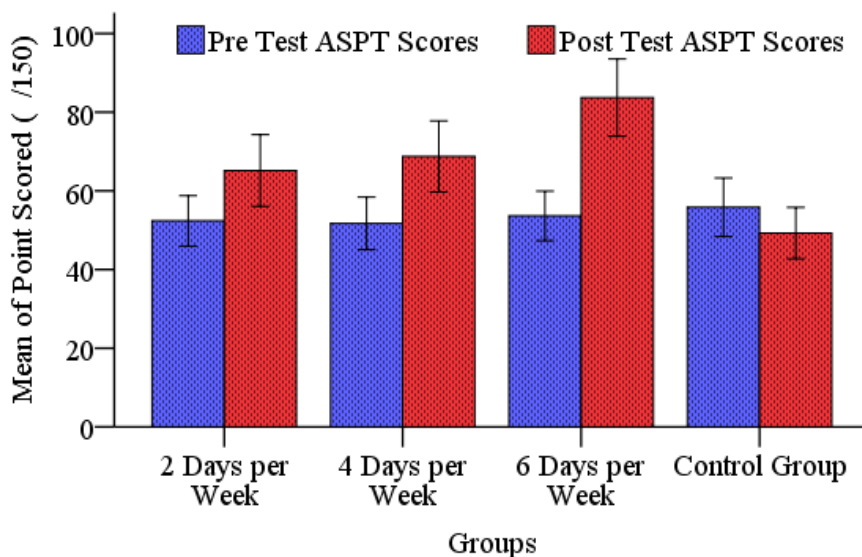
Figure 2. Showing result comparisons (Mean ± S.D.) of Pre and Post test scores of Archery Skill Precision Test (ASPT) of the Archers (n=160) from different organizations of Pakistan before and after completing PETTLEP imagery interventions for 2 weeks with different frequencies (2 days/week, 4 days/week, 6 days/week).
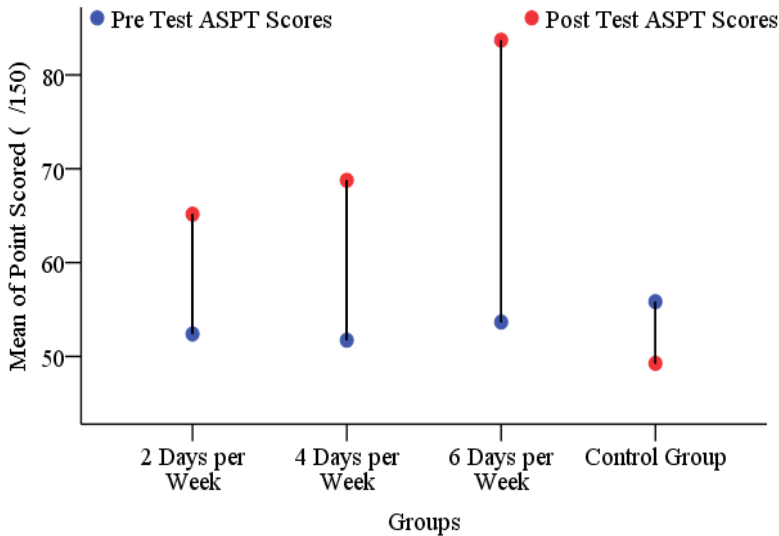
Figure 3. Showing result comparisons (Mean ± S.D.), of Pre and Post test scores of Archery Skill Precision Test (ASPT) of the Male and Female Archers (n=160) from different organizations of Pakistan after completing PETTLEP imagery interventions for 2 weeks with different frequencies (2 days/week, 4 days/week, 6 days/week). **Analysis of Variance (ANOVA)**

To measure the performance improvement in Archery Skill Precision Test (ASPT) scores between the intervention groups including PETTLEP imagery for 2 days per week, PETTLEP imagery 4 days per week, PETTLEP imagery 6 days per week and control group, a one-way ANOVA was run on the performance scores. The mean differences indicated that there was a significant performance change ($p<0.05$) in ASPT (Archery Skill Precision Test) scores between all four intervention groups shown in Table 2 with F value = 128.83 and P value of 0.00.

Multiple Comparisons (Tukey's HSD)

To find out exact differences, Post Hoc Tukey's test was also conducted. The result of Tukey's HSD showed that 6 Days per week PETTLEP Imagery practice intervention group showed a maximum significant difference as compared to the other groups (2 days/week, 4 days/week and control group). While insignificant difference was noted between the groups who practice PETTLEP imagery for 2 days per week and 4 days per week.

Table 2. Showing analysis of variance (ANOVA) based on improvement in Archery Skill Precision Test (ASPT) between and within all intervention groups along with sum of squares, mean square, F stats and P value noted after completing 2 days/week, 4 days/week, 6 days/week and control group interventions by the Archers (n=160) from different organizations of Pakistan. Significant level is represented by $p<0.05^*$ and $p \geq 0.05^{**}$.

ANOVA

Variance	Sum of squares	df	Mean Square	F	P value
Between Groups	25524.480	3	8508.160	128.830	0.00*
Within Groups	10302.531	156	66.042		
Total	35827.010	159			

Table 3. Showing exact mean differences (I-J) (where I is representing groups and J is representing groups compared with) based on Archery Skill Precision Test (ASPT) scores on all interventions groups along with p values noted after completing PETTLEP imagery for 2 weeks with different frequencies (2 days/week, 4 days/week, 6 days/week) by the archers from different organizations of Pakistan.

(I) Groups	(J) Groups	Mean Difference (I-J)	S.E.	P value
2 Days per Week	4 Days per Week	-4.09	1.82	0.11*
	6 Days per Week	-16.35	1.82	0.00*
	Control Group	18.83	1.82	0.00*
4 Days per Week	2 Days per Week	4.09	1.82	0.11*
	6 Days per Week	-12.26	1.82	0.00*
	Control Group	22.92	1.82	0.00*
6 Days per Week	2 Days per Week	16.35	1.82	0.00*
	4 Days per Week	12.26	1.82	0.00*
	Control Group	35.18	1.82	0.00*
Control Group	2 Days per Week	-18.83	1.82	0.00*
	4 Days per Week	-22.92	1.82	0.00*
	6 Days per Week	-35.18	1.82	0.00*

Discussion And Conclusion:

Sport research on archery in Pakistan is non-existent. The major purpose of this study was to examine effects of PETTLEP imagery technique based on all seven components on the execution of archery skill. This was done so that an imagery intervention focused on psychological factors that facilitates precision could be developed and implemented to benefit the archers in the country and to corroborate the findings of previous researches. Imagery use has been stressed upon by several sports coaches; and according to them it is the most effective

mental training method they used with their players (Bloom *et al.*, 1997). Existing research has indicated that PETTLEP Imagery technique is a sustainable strategy to improve skill precision levels. This research support to that players' performance in archery sports not dependent alone on physical skill but also on psychological skills.

According to suggestion of this research high class players use imagery skills more in comparison to less experienced novice players (Callow & Hardy, 2001; Cumming & Hall, 2002a, 2002b). This could be another aspect that can be explored via further research and will answer our question if skill-level in Archers plays a major role in accounting for the variance in results. PETTLEP imagery may be a useful strategy to further improve performance of elite performers specifically. Hall *et al.* (1990) also stated that there is greater imagery use among higher-level athletes than lower-level athletes. Research also indicates that elite athletes imagine the processes involved in executing specific sport skills (CS imagery), as well as the strategies and technical aspects of their sport (CG imagery), more so than less-elite athletes. This may be, because elite athletes have a clearer image of what an accurate skill should look like (Vealey and Greenleaf, 1998).

One major limitation of the study is that we only tested for Imagery practice frequency per week for up to 6 times. For us to know whether this frequency is optimum i.e. no more or no less frequency of PETTLEP Imagery sessions per week can render greater performance improvement results, we need to compare it with higher frequency levels, e.g. 8 times per week or more. This sort of research has been carried out for Netball; i.e. the impact of differing frequencies of PETTLEP Imagery on Netball shooting performance (Wakefield, 2009), however; no such result has ever been conducted for Archery in this regard. This leaves room for further research. Moreover, another question that arises is what if the intervention was carried on for longer than two weeks? Will it result in a further increase in performance? If so, how much? If not, what time duration is optimum to obtain the most favorable results?

Another interesting aspect that can be explored is the result of PETTLEP Imagery practice on male and female archers separately to gauge if gender is a variable that influences results. According to previous research, upon examination of the amount of variance in imagery scores that was accounted for by gender differences, it was determined that this effect was not very meaningful. More specifically, 1.9% of the total variance in imagery scores was accounted for by gender differences, and the remaining variance, 98.1% was accounted for by other factors (Cumming and Hall, 2002). However, more recent researches around PETTLEP Imagery show gender to play an important role in accounting for the variance. Further research should be conducted to confirm and validate the findings of these researches.

References

Arvinen-Barrow, M., Weigand, D. A., Thomas, S., Hemmings, B., & Walley, M. (2007). Elite and Novice Athletes Imagery Use in Open and Closed Sports. *Journal of Applied Sport Psychology, 19(1),* 93–104. doi: 10.1080/10413200601102912

Bebetsos, E. (2015). Psychological skills of elite archery athletes. Journal of Human Sport and Exercise, 10(2). doi: 10.14198/jhse.2015.102.09

Callow, N., & Hardy, L. (2001). Types of Imagery Associated with Sport Confidence in Netball Players of Varying Skill Levels. *Journal of Applied Sport Psychology, 13(1),* 1–17. doi: 10.1080/10413200109339001

Clough, P., Earle, K., & Sewell, D. (2002). Mental toughness: The Concept and its

measurement. In I. Cockerill (Ed.), *Solutions in sport psychology* (pp. 32-43).

Cornwall: Thomson

Cumming, J., & Hall, C. (2002a). Athletes' Use of Imagery in the Off-Season. *The Sport Psychologist, 16(2),* 160–172. doi: 10.1123/tsp.16.2.160

Cumming, J., & Hall, C. (2002b). Deliberate imagery practice: the development of imagery skills in competitive athletes. *Journal of Sports Sciences, 20(2),* 137–145. doi: 10.1080/026404102317200846

Feltz, D. L., & Landers, D. M. (1983). The Effects of Mental Practice on Motor Skill Learning and Performance: A Meta-analysis. *Journal of Sport Psychology, 5(1),* 25–57. doi: 10.1123/jsp.5.1.25

Glass, G. V., Peckham, P. D., and Sanders, J. R. (1972). Consequences of failure to meet assumptions underlying the fixed effects analyses of variance and covariance. *Review of educational research*, *42*(3), 237-288.

Hung, T.-M., Huang, S.-H., & Lo, C.-T. (2008). A study of the relationship between heart rate variability and archery performance. *International Journal of Psychophysiology, 69(3),* 276. doi: 10.1016/j.ijpsycho.2008.05.231

Hung, T. M., Tang, W. T., & Shiang, T. Y. (2009). A case study of integrated sport sciences for an olympic archer. *Journal of Medical and Biological Engineering, 29(4),* 164-171.

Indahwati, Nanik and Ristanto, Kolektus, (2016). The Application of Pettlep Imagery Exercise to Competitive Anxiety and Concentration in Surabaya Archery Athletes (June 30, 2016). *International Journal of Educational Science and Research (IJESR)*, Vol. 6, Issue 3, June 2016. Available at SSRN: https://ssrn.com/abstract=2838163

Kobasa, S. C. (1979). Stressful life events, personality, and health: An inquiry into hardiness. *Journal of Personality and Social Psychology, 37(1),* 1–11. doi: 10.1037//0022-3514.37.1.1

Lin, C.-H. (2017). Application of PETTLEP Imagery and Motivational Imagery Type: A Case Study on Senior High School Archers. *Sports & Exercise Research, 19(4),* 341–360. doi: 10.5297/ser.1904.004

Lee, K. H. (2009). Evaluation of Attention and Relaxation Levels of Archers in Shooting Process using Brain Wave Signal Analysis Algorithms. Retrieved from http://kslinternationalarchery.com/Sport Psychology/FinalVersion_Evaluation_of_Attention_and_Relaxation.pdf

Matthews, R. (2003). *Archery in Earnest*. London: Crowood Press.

Morris, T., & Thomas, P. (1995). Approaches to applied sport psychology. In T. Morris and J.Summers (Eds.), *Sport Psychology: Theory, Applications and Issues* (pp. 215–258). Milton, Australia: Wiley.

Orlick, T., & Partington, J. (1988). Mental Links to Excellence. *The Sport Psychologist, 2(2),* 105–130. doi: 10.1123/tsp.2.2.105

Ruis, S., & Stevenson, C. (2004*). Precision archery*. Champaign, IL: Human Kinetics.

Robazza, C., & Bortoli, L. (1998). Mental Preparation Strategies of Olympic Archers During Competition: an exploratory investigation. *High Ability Studies, 9(2),* 219–235. doi: 10.1080/1359813980090207

Smith, D., Wright, C., Allsopp, A., and Westhead, H. (2007). It's all in the mind: PETTLEP-based imagery and sports performance. *Journal of Applied Sport Psychology, 19(1),* 80-92.

Smith, D., Wright, C. J., and Cantwell, C. (2008). Beating the bunker: The effect of PETTLEP imagery on golf bunker shot performance. *Research quarterly for exercise and sport, 79(3)*, 385-391.

Vealey, R. S., Armstrong, L., Comar, W., & Greenleaf, C. A. (1998). Influence of perceived coaching behaviors on burnout and competitive anxiety in female college athletes. *Journal of Applied Sport Psychology, 10(2),* 297–318. doi: 10.1080/10413209808406395

Wakefield, C. J., & Smith, D. (2009). Impact of Differing Frequencies of PETTLEP Imagery on Netball Shooting Performance. *Journal of Imagery Research in Sport and Physical Activity, 4(1).* doi: 10.2202/1932-0191.1043