

The Effect of Video Imagery Training on Soccer Skills Performance of High School Players

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ABSTRACT

This study evaluated the effect of PETTLEP video imagery on reactive motor skill test (Total RMST time, sprint time, reactive agility time, passing time, and passing accuracy) among 32 Malaysian high school soccer players (mean age of 15.31±1.83) who were randomly assigned into an experimental group (N:16) and a control group (N:16). A pre-test-post-test design was used to evaluate the effect of the intervention on the high school players' soccer skill performance. The experimental group received 10-minute PETTLEP video imagery training before their regular soccer training for eight weeks in addition to their regular soccer training, while the control group only attended their regular soccer training. The data analysis revealed a significant effect of video imagery training on players' performance in the experimental group. The results showed that total RMST time, reactive agility time, passing time, and passing accuracy were statistically different within the experimental group $F(15, 154.993) = 14.440$, $p < .001$, Wilks' $\Lambda = .050$ and between groups $F(5, 56.00) = 379.774$, $p < .001$, Wilks' $\Lambda = .050$ after receiving the training, except for the sprint time which was not significant. The findings of this study provide evidence that eight weeks of PETTLEP video imagery training intervention can significantly improve soccer players' total RMST time, reactive agility time, passing time, and passing accuracy. These findings could be integrated into training programs by coaches and players in order to improve the performance of different soccer skills among high school players.

Key Words: PETTLEP Video Imagery, Soccer Skills, Reactive Motor Skills Test (RMST)

INTRODUCTION

The importance of imagery in enhancing sports performance, decision making, and reactive agility time has attracted researchers' attention recently [1, 2]. Imagery in sport refers to rehearsing physical skills cognitively without body movement [3] that can have a positive effect on both skill learning and competition preparation. Visualization and cognitive rehearsal are often used by sport psychologists to help individuals enhance their motivation and self-confidence and reduce their competition anxiety. Training the mind has been shown to be essential in successful sport performance, regardless of its application. Imagery can be beneficial in learning skills, especially if it is combined with physical practice. The cognitive practice of physical skills in the absence of overt physical movement involves imaging a skill or part of a skill [4]. Also,

it is the most common type of mental practice used in athletics [5, 6]. It includes several internal processes to enhance movement efficiencies including automaticity, precision, speed, and adaptability. It is believed that motor and sensory information is organized and integrated in these processes which are considered as complex central nervous system phenomena [7].

Based on previous research, imagery has been used for athletes in four functionally different categories including performance enhancement, affective and cognitive modification, rehabilitation and arousal regulation. Imagery has been used successfully within these categories in various sports and has been shown to be effective on self-confidence, skill acquisition, anxiety management, and pain control [8-10]. It has also been reported that athletes have used imagery for learning and rehearsal of tactics, strategies, and

game plans [11]. It has been suggested that imagery can be helpful in rehearsing tactical skills and strategies and solving problems arising unexpectedly in competitions [12]. The number of studies on the use of imagery in developing cognitive plans for athletes in competitions has been limited thus far. Developing and learning game plans and strategies using imagery first and subsequently practicing them mentally seems to be beneficial for athletes [12]. Positive images of what need to be performed and likely alternatives need to be incorporated by imagery to improve decision making during performance planning [13].

In team sports, especially soccer, players may improve their awareness of other members' respective roles and determine how to position themselves with regard to time and space among other players [14]. In addition, coaches and players may develop game strategies and plans to use in the face of particular opponents prior to competitions [13]. Thus, they can integrate imagery into the players' pre-performance routine to refine particular strategies before participating in a competition [15]. Imagery can be used by athletes to tackle technical, tactical or timing problems arising during a competition or against a particular opponent.

There are two perspectives regarding the use of imagery: external imagery and internal imagery. In the external perspective which is predominantly visual, an athlete views himself as if they were in a film. Unlike the external imagery that uses a third-person perspective, the internal imagery is characterized by using a first-person perspective. Based on the available evidence, internal imagery is more effective than external imagery regarding sport performance improvement [16, 17]. Internal imagery may have a more effective transfer to the learning of the skill. Holmes and Collins [18] suggested an internal imagery model that comprises physical, environment, task, timing, learning, emotion, and perspective factors (PETTLEP), on the basis of theory and research in cognitive psychology, sport psychology, and neuroscience, with the goal of providing practical guidelines for the use of imagery by practitioners. In neuroscience, action observation is when athletes watch someone perform an action or specific task that lies within their motor repertoire

and their brain stimulates the performance of that action. Imagery process and action observation have similar neural representations [19]. Such resonance supports the assumption that these common regions are essential in action anticipation, action recognition and goal recognition by the stimulation of the observed or imagined action. There is evidence to support the effectiveness of action observation through video imagery as a technique for improving sports performance [20, 21]. According to PETTLEP model, we can optimize imagery done through action observation videos with real practice-related features such as adopting relevant positions to do the action observation or holding task-specific sport equipment [18].

Past researches show that employing imagery has a positive impact on sports performance [22-28]. Furthermore, other studies have demonstrated that PETTLEP video imagery training positively affected athletes' performance in different sports [29-33]. However, the findings of previous studies have been mixed, and concerns about research methods used in those studies have limited the dependability of their positive findings and gaining a clear understanding, emphasizing the need for future studies in imagery area. The use of PETTLEP video imagery has not been sufficiently investigated as a practical method in soccer players in order to balance their autonomic response with effect on their skill performance and reactive agility time. One possible reason is that there should be an expert to run the training protocol, which makes it more complicated to use by athletes themselves. Thus, the present study aims to determine whether the use of PETTLEP video imagery training improves high school soccer players' skill performance in terms of total reactive motor skill test time, reactive agility time, sprint time, passing time, and passing accuracy.

METHOD

Participants

The participants of the study were 32 high school male Malaysian soccer players (age mean of 15.31 ± 1.83 years old) who were selected from a well-known international school and played in the school soccer team at the time of the study. They possessed good soccer skills as the high school players with minimum 2 years' experience in

playing soccer. The participants did not have any health and psychological issues. They participated in the school's soccer training three sessions a week for approximately 2 hours per session. All participants and their guardians were notified about the test procedure, and letters of consent were provided for all participants before conducting the study. Upon the beginning of the test, the researcher explained the research procedure to the participants, and they were assigned randomly into two groups, with 16 participants in each group using the Fishbowl technique.

Equipment and Measurements

In this study, a soccer field and futsal court were used for practice and experimental measurements. The equipment and material used in this study included the sport imagery ability questionnaire (SIAQ) developed and validated by Williams and Cumming [34], timing gates (Brower Timing System Speed Trap Ii) validated by Shalfawi, et al. [35], soccer balls (Adidas Brazuca size 5), headphones (Original Beats EP on-ear headphone), NEC projectors and an Apple iPad. The equipment was internationally standard and were calibrated prior to the intended testing according to the manufacturers' standardized procedures.

Data Collection

The present study aimed to investigate the effects of video imagery training on soccer players' performance. After gaining permission from the high school authorities to conduct the study using their facilities, and prior to the pre-test, the researcher explained to the participants the importance of this research, different training objectives, training length and procedure, and the reactive motor skills test (RMST). The RMST test is a valid test that evaluates 4 different skills (passing time, passing accuracy, sprint time and reactive agility) as well as the total time of doing RMST.[36].

Before training, all participants gathered in the futsal hall, and the SIAQ was distributed among them to test their imagery ability with the aim of ensuring that enhancing performance would not depend upon individual imagery abilities. On the first day, all participants were tested after doing specific soccer warm-up compiled by the researcher. Reactive motor skills test (RMST) was

performed three times to measure the participants' passing time, passing accuracy, speed, and reactive agility time, separated by at least three minutes of passive recovery. They were asked to do the test quickly and accurately. The time spent on each section was used to evaluate the performance outcome (sprint, reactive agility time and passing) and the Total reactive motor skill test time. The best timing was recorded for each participant for analysis. After the pre-test, the experimental training was implemented before players' usual soccer practice for eight weeks in the experiment group twice a week based on the research literature of effective duration for PETTLEP video imagery training. Each training session was 10 minutes.

All players had their usual soccer practice after school. For the training sessions, the players wore their soccer team shirts, shorts, proper soccer cleats, and used the same soccer field where they had their routine training to have all the components of PETTLEP imagery in their training. The researcher used a video clip consisting of sprint, reactive agility time skills, and successful soccer passing with the correct techniques. After participants watching each skill, a written note on the screen appeared and asked them to close their eyes and imagine the movements while they were standing on the soccer field and had the soccer ball. Then after the given time for imagery in the video, a countdown to 3 with audio played on the screen for them to be ready for watching the next skill. Players had the exact same amount of time for watching and imaging each skill in the video before the countdown started to watch the next video based on PETTLEP model components [18]. After that, they performed soccer short passes, sprint and reactive agility time to complete their PETTLEP video imagery session. The rest of the PETTLEP video imagery training sessions followed the same procedure. Participants who had been assigned to the control group had their usual soccer training organized and supervised by their school soccer coach. In the post-test phase of the study, the researcher implemented the exact procedure of the pre-test evaluation with the participants who had participated in all training sessions.

RESULTS

Prior to the inferential analysis of the data, the descriptive statistics including normality test, homogeneity of variance test, equality of groups at pre-test, were computed using exploratory data

Table 1.

Table 1: Descriptive Statistics for Dependent Variables

	Group I		Group C	
	Mean	SD	Mean	SD
Total RMST Time Pre test	7.74	0.12	7.75	0.17
Total RMST Time Post test	7.26	0.13	7.67	0.18
Sprint Time Pre test	1.36	0.04	1.37	0.04
Sprint Time Post test	1.32	0.05	1.35	0.06
Reactive agility time Pre test	1.94	0.06	1.94	0.08
Reactive agility time Post test	1.8	0.08	1.93	0.09
Passing Time Pre test	4.44	0.02	4.44	0.04
Passing Time Post test	4.14	0.02	4.4	0.05
Passing Accuracy Pre test	4.25	1.15	4.16	1.21
Passing Accuracy Post test	5.56	1.26	4.25	1.39

A normality test was run to evaluate the normal distribution of players in groups according to RMST test and imagery ability levels. To this end, Table 2, the values of kurtosis and skewness were between -2 and +2 that showed violation has not been occurred and players were normally

Table 2: Kurtosis/Skewness Analysis for RMST and Imagery Ability in pretest

		Group I		Group C	
		P.Value	Std.Error	P.Value	Std.Error
Total RMST Time	Skewness	-0.124	0.564	-0.017	0.564
	Kurtosis	-1.074	1.091	-0.905	1.091
Sprint Time	Skewness	0.197	0.564	-0.043	0.564
	Kurtosis	-0.515	1.091	-1.057	1.091
Reactive agility time	Skewness	-0.224	0.564	-0.109	0.564
	Kurtosis	-1.03	1.091	-0.849	1.091
Passing Time	Skewness	0.053	0.564	0.454	0.564
	Kurtosis	-1.138	1.091	-0.127	1.091
Passing Accuracy	Skewness	0.482	0.564	0.165	0.564
	Kurtosis	0.659	1.091	-0.684	1.091
Imagery Ability	Skewness	-0.032	0.564	0.843	0.564
	Kurtosis	-0.485	1.091	1.281	1.091

The Levene's test were interpreted for evaluating whether the variances of two groups were approximately equal or homogeneous. In this case, we expect or perhaps even want the

Table 3, the groups' variances are not significantly different, so equal variances are assumed, and in

analysis. This analysis aimed to test the normal distribution of the variables and homogeneity of variance between groups prior to conducting inferential analyses. The descriptive statistic for all dependent variable is shown in

kurtosis and skewness normality test were interpreted at the level of .05. As shown in

distributed between groups. Engagement scores were normally distributed for both groups in the pre-test before the beginning of the training.

variances of the groups in Levene's test to be non-significant at significance value greater than .05, which is the assumption of the factorial MANOVA test. As it is shown in

this case, the probability is even greater than 0.01. The assumption of homogeneity of variance has been met for both groups at Pre-test.

Table 3:Test of Homogeneity of Variances

Test of Homogeneity of Variances		
	Levene's Statistic	P.Value
Total RMST Time	1.505	0.222
Sprint Time	2.308	0.086
Reactive agility time	1.752	0.155
Passing Time	2.318	0.085
Passing Accuracy	0.174	0.913

All of the players were tested for their imagery ability through the SIAQ questionnaire. The results of the SIAQ questionnaire only reported

whether the players had an ability to do imagery, and the test did not rate them from the weakest to the strongest. As presented in

Table 4, both groups were homogeneous and there were no differences in the participants' imagery ability between groups at pretest.

Table 4: Imagery Ability Homogeneity

	Mean	SD	F	P.value
Group I	5.04	0.31	2.278	0.089
Group C	5.1	0.46		

Inferential Analyses

The research question of this study was Is there any significant difference in players' reactive

motor skills test (RMST) within and between groups?. As it presented in

Table 5,the results of the multivariate test show that there were statistically significant differences between and within groups and also there was a statistically significant interaction effect between

tests and groups of intervention on the combined dependent variables, $F(15, 154.993) = 20.280, p < .001, Wilks' \Lambda = .050.$

Table 5:Multivariate Test

Multivariate Tests							
			Value	F	df	Error df	Sig.
Effect Between Groups	Intercept	Wilks' Lambda	<0.001	52115.720	5	56.000	<0.001
	Group	Wilks' Lambda	0.089	14.440	15	154.993	<0.001
Within Groups	Tests	Wilks' Lambda	0.029	379.774	5	56.000	<0.001
	Tests * Group	Wilks' Lambda	0.050	20.280	15	154.993	<0.001

Furthermore, the results of pairwise comparison within groups as presented in Table 6, showed there were statistically significant differences within group in all RMST tests variables.According to

Table 6, the players' reactive motor skills test (RMST) value was, Total RMST time MD= 0.478, P <0.001, Sprint Time MD= .043, p<0.001, Reactive agility time skill MD=.134, p<0.001, passing time MD=.303, p<0.001, Passing Accuracy MD=-1.313, p<0.001inthe imagery groupthat shows there was a statistically

significant difference between pre-test and post-test in the experimental group; however, there was no significant difference in the control group. The mean of each group at pre- and post-test shows that the players' reactive motor skills test (RMST) improved after eight weeks of training in the video imagery group.

Table 6:Pairwise Comparison Within Groups

Measure	MD	Std. Error	Sig. ^b	95% Confidence Interval for Difference ^b		Mean Pre	Mean Post			
				Lower Bound	Upper Bound					
				Total RMST time	Group I			Pre	Post	.478*
	Group C	Pre	Post	0.074	0.048	0.123	-0.021	0.17	7.749	7.674
Sprint Time	Group I	Pre	Post	.043*	0.01	<0.001	0.023	0.062	1.364	1.321
	Group C	Pre	Post	0.013	0.01	0.185	-0.006	0.033	1.366	1.353
Reactive agility time	Group I	Pre	Post	.134*	0.012	<0.001	0.11	0.158	1.936	1.803
	Group C	Pre	Post	0.014	0.012	0.253	-0.01	0.038	1.939	1.926
Passing Time	Group I	Pre	Post	.303*	0.044	<0.001	0.215	0.391	4.439	4.136
	Group C	Pre	Post	0.047	0.044	0.289	-0.041	0.135	4.444	4.398
Passing Accuracy	Group I	Pre	Post	-1.313*	0.223	<0.001	-1.758	-0.867	4.25	5.563
	Group C	Pre	Post	-0.094	0.223	0.675	-0.539	0.352	4.156	4.25

The results of between group pairwise comparison in Table 7 showed that there is a statistically significant difference between groups in players' reactive motor skills (RMST) after eight weeks of experimental training. As Table 7 shows, the players' RMST value for PETTLEP imagery group (I) vs. control group (C) was, Total reactive motor skill test time MD= -414, p < .0001, Sprint time MD= -.031, p < .725, Reactive agility time skill MD= -.123, p < .0001, Passing Time MD= -.262, p < .001 and passing Accuracy MD= 1.188, p <

.044. Thus, the results showed there was a statistically significant difference between the groups in all RMST variable except sprint time that did not show any significant difference between groups after 8-week PETTLEP imagery training. The results show that eight weeks of PETTLEP video imagery intervention had a significant effect on players' reactive motor skills variables, however, did not have any significant impact on the players' sprint performance.

Table 7: Pairwise Comparison Between Groups

Measure	MD	Std. Error	Sig. ^b	95% Confidence Interval for Difference ^b				
				Lower Bound	Upper Bound			
Total RMST time	Pre	Group I	Group C	-0.011	0.052	1	-0.153	0.132
	Post	Group I	Group C	-.414*	0.083	<0.001	-0.641	-0.188
Sprint Time	Pre	Group I	Group C	-0.002	0.013	1	-0.038	0.034
	Post	Group I	Group C	-0.031	0.02	0.725	-0.085	0.023
Reactive agility time	Pre	Group I	Group C	-0.003	0.029	1	-0.081	0.075
	Post	Group I	Group C	-.123*	0.029	<0.001	-0.203	-0.043
Passing Time	Pre	Group I	Group C	-0.006	0.012	1	-0.038	0.026
	Post	Group I	Group C	-.262*	0.063	<0.001	-0.435	-0.089
Passing Accuracy	Pre	Group I	Group C	0.094	0.424	1	-1.064	1.252
	Post	Group I	Group C	1.313*	0.428	0.019	0.145	2.48

DISCUSSION

The current study evaluated the effects of an eight-week PETTLEP video imagery intervention, on high school soccer players' skill performance. The participants took RMST that covering sprint time, reactive agility time, passing time, and passing accuracy before and after the video imagery training. The research results showed that total RMST time significantly improved $F(3, 60) = 706.245, p = 0.001$ within group after eight weeks of PETTLEP video imagery MD= 0.478, $P < 0.001$. Therefore, reactive agility time, passing time and passing accuracy improved in the experimental group and these improvements

affected total RMST time positively, however, there was no significant improvement in the sprint time in the PETTLEP video imagery group. Although there was not any significant improvement in sprint time in the experimental group, it did not affect the overall improvement in total RMST time as the other test components significantly improved it.

Previous research findings showed that PETTLEP video imagery improved reactive agility time, passing time and passing accuracy [32, 37] which are supported by the findings of the current study. Therefore, soccer players and coaches can include PETTLEP video imagery in their exercise routine

to improve the performance of selected skills. It is possible that the duration of PETTLEP video imagery training was not enough to affect the players' sprint time or PETTLEP video imagery training with an internal perspective, did not affect the players' sprint time as much as the other training types.

However, various researchers, coaches and athletes use imagery since it is recognized as an effective tool for the successful performance of elite athletes through affecting their psychological state positively [38-41]. Studies have proven that the majority of elite athletes deliberately use imagery. Similarly, most sports psychologists apply imagery systematically to increase the athletes' performance [42, 43]. Hammoudi-Nassib, et al. [44] found that the imagery training improves the sprint performance that is support the finding of this study. Pain, et al. [45] theorized that imagery training not only improves the performance of athletes having specific training but the performance of athletes having non-specific training as well. Munroe-Chandler, et al. [46] suggested that imagery training evolves from early childhood to early adolescence among children. Although this study found no significant improvements as a result of PETTLEP video imagery training in sprint time, more research is necessary to explore the effect of PETTLEP video imagery on players' sprint time in longer durations and using different perspectives.

This study also examined the impact of PETTLEP video imagery on reactive agility time and the possibility of improving reaction to unpredictable stimuli using these interventions. The results showed significant improvements in players' reactive agility time, $F= 1053.497$, $p = <0.001$ as a result of PETTLEP video imagery within the experimental group. Based on the research findings, video imagery training, PETTLEP significantly improved reactive agility time after eight weeks of training, $MD=.134$, $p<0.001$. Thus, it could be recommended that soccer players use PETTLEP video imagery along with their usual soccer training to enhance their reactive agility time. The findings of this study related to reactive agility time are in line with the previous research that showed imagery training could improve decision time, which leads to better reaction [47].

The findings of this study showed that PETTLEP video imagery, HRVB and concurrent training improved the players' passing accuracy, $F= 142.318$, $p= <0.001$ and passing time, $F= 274.702$, $p= <0.001$ within the groups. The finding is in accord with the findings of past studies that revealed significant improvements in athletes' passing performance and accuracy after receiving PETTLEP video imagery training. Battaglia, et al. [48] demonstrated that using video for imagery training was highly advantageous as imagery is more beneficial when it is vivid and detailed. Besides, they suggested that it could be a suitable type of imagery training for all levels of imagery ability because players can see the successful desired performance very clearly and be mentally prepared for an actual event or competition.

In this study, the researcher used PETTLEP video imagery to help soccer players create a clear image with more detail and vividness. The previous findings by Mazli, et al. [32], who examined the effects of traditional imagery and PETTLEP model on netball players, showed that the participants in the PETTLEP video and audio imagery groups had better passing accuracy compared to the traditional imagery group. These findings are supported by the findings of the current study that showed PETTLEP video imagery could improve the passing accuracy of soccer players. One reason for these improvements can be the increase in the attention and focus as a result of PETTLEP video imagery training, which leads to accuracy improvement among athletes.

The findings of the present study related to the effectiveness of PETTLEP video imagery training on sports performance are also in line with the previous studies that showed PETTLEP video imagery training can improve players' passing accuracy and passing time [22, 26, 30, 49]. The PETTLEP video imagery has been used in other sports to improve athletic performance as well. Cumming, et al. [50] investigated the effect of video imagery training on female basketball players and concluded that PETTLEP video imagery training improved basketball players' shooting accuracy that supports the finding of this study about the impact of PETTLEP video imagery on male soccer players' passing accuracy.

While research literature on PETTLEP video imagery training is vast in other sports, this study focused on the use of video imagery training among high school soccer players.

CONCLUSION

The findings of this study show that eight weeks of PETTLEP video imagery had a significant within- and between- group effect on the soccer players' RMST, passing time, passing accuracy and reactive agility time, with the exception of sprint time which was not improved significantly between the groups as a result of imagery training in the study. The findings of the current study revealed that players' performance was significantly improved from pretest to posttest, so the PETTLEP video imagery intervention was helpful for athletes. Thus, it was concluded that PETTLEP video imagery helped soccer players to improve the selected soccer skills and it can be vital in helping athletes enhance their performance at all levels of competition. It can also be useful in future studies in sports psychology.

This study was conducted for 8 weeks among high school soccer players who played soccer at the

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