Combining Effect of Observational Practice, Mental Imagery and Physical Practice on learning a Soccer Dribbling Task in Amateur Boys

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Abstract
This study aimed to investigate the facilitative effect of observational practice combined with mental imagery on learning of soccer dribbling. 140 young boys with the average age of 14.52 (±2.96) and mental imagery score of 48.69 (±5.1), who were unfamiliar with the research task, voluntarily participated in this study. The participants were assigned to homogenous groups according to their pre-tests results as follow: 1- physical practice; 2- observational practice; 3-mental imagery practice; 4- physical-observational practice; 5-physical-mental imagery practice; 6- observational-mental imagery practice and 7- physical-observational-mental imagery practice. Then the participants completed three sessions including ninety trials. At the end of the final training session, an immediate retention test was conducted that followed by a delayed retention test after 48 hours. The results of One-Way ANOVA test indicated that in both immediate and delayed retention tests, the physical-observational-mental imagery group and the physical group had a better performance compared with other groups (p<.05). Furthermore, the combined physical-mental imagery group obtained higher scores in soccer dribbling task in comparison with the combined physical-observational group. The findings support the beneficial effects of cognitive interventions as well as physical practice.

Keywords: Mental imagery; Observation practice; Cognitive practice; Cognitive intervention; Motor learning


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Introduction
Motor behavior scientists had previously tried to find the factors influencing motor skills learning and traditionally emphasized on the importance of practice and experience [1,2]. Since most of skill shaw both physical and cognitive aspects, it is suggested that cognitive interventions like mental imagery and observational practice can facilitate the learning...
of motor skills as well as physical practice [3-6]. Motor skill acquisition process usually occurs when information transfers between instructor and learner. One of the most current and efficient methods of information transfer is demonstration of action. Observational learning is the process in which learner acquires the necessary information of movement by observing a model while performing movement [7-9]. Review of literature in this area indicates that learner can improve his/her performance by observing others’ performance [10-13]. These findings can be explained by the social learning theory. When the individual observes a pattern, he/she translates the information of the observed action to the mental symbolic codes and these codes will be the basis for a mental image in the memory. This mental image is used as a guide for the performance of the skill and a criterion for detecting and correcting errors [14]. In general, observation of action is helpful for the representation of action, because it provides the obvious stimuli related to the movement [15-17].

One of the other methods of teaching motor skills is mental imagery which instructors use as an appropriate method to enhance performance and learning of movements [18-21]. Previous studies have revealed that mental practice is effective comparing no training situation but it is less effective than physical practice. The theory of symbolic learning claims that mental imagery creates a motor program in central nervous system and these mental programs representatively create a mental order to accomplish the action properly. Also, mental imagery helps the amateurs to learn the cognitive elements of task related to successful performance [9]. Mouton and colleagues [22], indicated that motor systems of central nerves are active in both observational practice and mental imagery. They showed that although in observational practice and mental imagery, activity in motor cortex is increased equally, but it is less than physical practice [22]. Kimet, et al (2011) investigated facilitative effect of differences between observational practice and mental imagery in motor skill learning and showed the facilitative effect of cognitive interventions in combination with physical practice. They also found that combination of observational practice with physical practice is more use full than the combination of mental imagery with physical practice. On the other hand, Weinberg, & Gould [9] stated that when the learner is capable to create an obvious image of the action, the efficiency of mental imagery will be increased. Many Studies argued that during modeling, the information related to the action is coded and representation of the action will be creating while an image retrieved from memory. In addition, some investigators believe that cognitive processes in modeling and mental imagery are similar to each other and both include coding and cognitive representation prior to physical performance [23]. In spite of this conclusion, mental imagery benefits from motor skill learning naturally, but it has a major problem in which there is any obvious external reference to compare an existing image with it such as the learner observes in observational practice [24,25]. By the way, these problems somewhat can be resolved by combining observational practice and mental imagery. Previous studies have indicated that in new and unfamiliar sport environments, observation is more influencing than mental imagery. In situations that complex skill smight be performed, observing a model helps the athletes to product an obvious and accurate image of movement [26,27].

Numerous studies have explored the role of observational practice and mental imagery on performance and learning of motor skills separately and indicated that these methods have more benefits when combined with physical practice than when used individually [8,12,28]. Since the previous researches frequently studied the neurological basis underlying of these methods rather than the behavioral mechanisms, the purpose of this
study was to investigate the combining effect of observational practice, mental imagery and physical practice on performance and learning of a soccer dribbling task in young amateur girls and boys.

Recently, Munroe-Chandler et al. (2007) studied the young (7-14 years) athletes’ imagery use. All age groups reported using all five functions of imagery. Results also revealed that children (7-10 years) reported using less MG-A and MG-M imagery than their older counterparts (11-14 years). This could be due, in part, to the fact that as children age, their long-term memory improves, allowing them to acquire and retain knowledge with less difficulty (Santrock & Yussen, 1992). As the participants of the present study were 12 to 16 years old boys, the experimental hypothesis of this study is that the mental imagery is the predominant method in learning soccer dribbling. It is hypothesized also that the combining effect of mental imagery and physical practice would cause the optimal learning effect.

Material and Method

Participants

Participants were 140 male young boys 12 to 16 years old (Mean=14.52±2.96) who participated in this study voluntarily. The entire participants were right-handed with no experience in the task. The participants were assigned to 7 homogenous groups; each group include 20 participants according to their pretest as follow: 1- physical practice; 2- observational practice; 3- mental imagery practice; 4-physical-observational practice; 5-physical- mental imagery practice; 6- observational-mental imagery practice; 7- physical-observational-mental imagery practice.

Task and Instrument

The task was the soccer dribbling. The experiments conducted in a standard soccer pitch using a standard ball. The soccer dribbling test required participants to dribble a soccer ball as fast as possible through a slalom course that consisted of six cones set 1 meter apart (based on Beilock, Carr, MacMahon and Starkes, 2002). We used the imagery questionnaire-revised (MIQ-R) to evaluate the participants' mental image reliability [26]. This questionnaire includes 8 items and measured both visual and kinesthetic mental imagery ability. Internal consistency of MIQ-R had been reported 0.87 for visual subscale and 0.91 for kinesthetic subscale.

Procedure

The program was conducted in five sessions including a pretest, three sessions practice and a post test. All of the stages were accomplished in a standard soccer pitch. In the pretest session, first the instructor presented the correct pattern of dribbling with verbal instruction. After 10 minutes, the soccer dribbling test was performed by the participants as pretest. Then, the participants were assigned to 7 homogenous groups According to their average scores in soccer dribbling task and mental imagery ability as follow: 1-physical practice, 2-observational practice, 3- mental imagery practice, 4-physical-observational practice, 5-physical-mental imagery practice, 6-observational-mental imagery practice and 7-physical-observational-mental imagery practice. Then the participants completed three sessions containing ninety trials. At the end of the final training session, an immediate retention test was conducted that followed by a delayed retention test after 48 hours. In every practice session, participants based on their own group, completed 90 trials containing 9 blocks that each block includes 10 trials. The practice procedures for different groups were as follow: the participants in group 1 performed all trials physically. Group 2 only observed the performance of the group1. The participants in
group 3 practiced all of their trials mentally without physical practice after the instructor demonstrated the task five times. The participants of group 4 were divided into two subgroups as A and B combining and practicing with each other. The participants in the subgroup A first practiced observationally while the subgroup B practiced physically. Accordingly, subgroup A practiced observationally in block 1, physically in block 2 and so on until completed all 9 blocks. Subgroup B went through the opposite order. The participants in group 5 and 6 were also practiced in combination with each other. Group 5 practiced in this manner: block 1 physical, block 2 mental imagery and so on until completed 8 blocks and in block 9 they performed 5 observational trials and 5 physical trials. Group 6 practiced a combination of observational practice and mental imagery as follow; block 1 observational practice, block 2 mental imagery, and so on until completed 8 blocks and in the block 9, 5 observational trials and 5 physical trials. Group 7 practiced a combination of the tree procedures. This group was also divided into two subgroups of C and D. Subgroup C first accomplished physical, next observational and then mental imagery practices. Subgroup D first accomplished observational, next physical and finally mental imagery practices. These two subgroups practiced in combination with each other in a way that when subgroup C practiced physically, subgroup D observed their performance and vice-versa and then in the end of practice, two subgroups practiced mentally. In the last practice session, an immediate retention test was administered that followed by a delayed retention test 48 hours later.

Data analyze

One-Way analysis of variance (One-Way ANOVA) with Tukey post hoc test was used to investigate the possible difference between the groups in a single-trial administration. T-test was used to study the possible extant difference in the participants’ obtained scores from their pre to post tests.

Results

Results from One-Way ANOVA for the immediate retention test revealed that there was a significant difference in the performance of the seven groups ($F_{(6, 77)} = 10.58$, $P<0.001$). Further analyses have been summarized on Table (1). The average scores of the groups in indicated that physical group (16.5), physical-observational-mental imagery group (15.42), mental imagery-physical group (13.58) and physical-observational group (8.25) gained the best results respectively. The results of paired-sample $t$-test showed that a significant difference existed in the performance of all groups in their pre and immediate retention tests ($P<0.05$), which reflects the improvement of the performance from pretest to immediate retention test (Figure 1).

**Figure 1**: The groups’ performance in the pretest, immediate and delay retention stages.
Delayed retention

One-Way ANOVA analysis procedure showed the significant main effect of group ($F(6, 77) = 7.372$, $p<0.001$) meaning that physical group (13.58), physical-observational-mental imagery group (12.75), mental imagery-physical group (10.17) and physical-observational group (8.83) achieved the best results respectively. Paired-sample t-test indicated that a significant difference governed the performance of all groups under study in their pre and delay retention tests ($p<0.05$), implying a progress for the groups in the delay retention test (Figure 1). In order to accurate analyses the performance of groups, their improvement percentage was calculated showing that in the immediate retention stage, physical group (%132), physical-observational-mental imagery group (%123), mental imagery-physical group (%108) and physical-observational group (%66) acquired the most improvements respectively. Also, in the delay retention stage, physical group (%108), physical-observational-mental imagery group (%101), mental imagery-physical group (%81) and finally physical-observational group (%70) obtained the most improvements respectively. Figure (2), delineates the results of the improvements of the groups in the immediate and delay retention stages.

Discussion and Conclusion

The purpose of this study was to investigate the facilitative effect of combining observational practice with mental imagery on immediate and delayed retention of soccer dribbling task. The findings indicated that all practice groups had a significant improvement on immediate retention and this improvement was retained by the groups on the delayed retention. Also, the group observation-mental imagery-physical had the best performance after the physical group. These findings revealed that besides physical practice, cognitive interventions such as mental imagery and observation could also influence the learning of the motor skills. This was in consistency with the prior researches of Buchanan [15], Hayes et al [23] and Shafizadeh [29].

It was also found in the current study that combined practice groups of physical-observational and physical-mental imagery attained better results in comparison with the mere observational and mental imagery groups.
This finding suggested that when the cognitive instruction methods are accompanied with physical practice, the learning will be strengthened compared with the mere use of the cognitive methods which is congruent with the findings of Shea, et al. [11], Taeho, et al. [12], Olsson et al. [24], Korobeynikov, Myshko, Pastukhova, & Smoliar, [30]. It is likely that the reason behind the improvement of learning in combined groups is the similar nervous mechanisms in physical and cognitive methods as the neurological researches investigating mind’s pattern of activity during mental imagery, observation and real performance have pointed to an overlap of the active areas of mind such as supplementary motor cortex, premotor cortex and cerebellum [11,12,23,31].

Furthermore, the findings showed that the combined group of mental imagery-physical gained better performance compared with the combined group of observation-physical. This part of our findings was in consistency with the studies of Taeho, et al. [11], on golf putting, on free throw and SooHoo, Takimoto, & Mc Coulagh [20], on weightlifting, Matvienko, & Kuznetsov [32], on play chess, Myshko [33], on sport dance. Since the proficiency pattern and the kind of task have been noticed as the factors influencing efficacy, the possible dissimilarity of this study and the studies mentioned above might be in the kind of pattern and the task used in the practice. Taeho Kim in his study used the task of golf putting and skilled pattern while active performance of a pattern during learning was used to perform soccer dribbling task in the current study.

In addition, results implied a better performance for the combined group of mental imagery-physical compared with the combined group of observation-physical. In the initial stage of learning motor skills, the learner must acquire the correct pattern of the action to perform and understand it. The learner can acquire necessary information to perform an action via observation of the pattern. In other words, observation can be effective for the creation of obvious and precise representation of the action. It has also been signified in the previous studies that mental imagery is also effective in the creation of representation of the action. In the literature on this area, the absence of an obvious and precise image in the memory to create and compare with an external image has been identified as a problem for the efficacy of mental imagery. Therefore, the combination of observation practice with mental imagery may probably be effective because an obvious image of the pattern of the action will be constructed in the mind via observing an action and this image will be used as a criterion to compare mental imagery with the observed action during mental imagery.

This study indicated that in immediate retention, both observational and mental imagery methods increased learning when used alone, however, their effect was not strongly evident as they were combined with physical practice. These methods were not efficient enough when they were combined with each other but yielded surprising results when combined with physical practices and the nominated group gained the best performance. Therefore, cognitive interventions increase learning, though to a smaller scale. However, when they were combined with physical practice, the learning would be multiplied. All in all, the finding of this study supports the prior researches concerning the facilitative effect of mental imagery and observation on the learning of motor skills [2,22,24,34]. While it is inconsistent with the studies of Te Ho Kim, et al. [12], and SooHoo, &Mc Coulagh (2004) in combining these methods with physical practice [35]. The current study suggested that in inexperienced amateurs, the combination of mental imagery-physical had a better outcome in comparison with the combination of observational-physical and the best result would be achieved when the three methods are combined together. Finally, it is suggested here that instructors utilize the combined practice.
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methods in the practice sessions to enhance the efficacy.

Reference

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