World Journal of Sport Sciences 6 (3): 306-313, 2012
ISSN 2078-4724

DOI: 10.5829/idosi.wjss.2012.6.3.6381

The Effectof Practice Length and Using Afferent Information in Physical and Imagery Practice on Learning: Exploring the Boundaries of the Specificity of Practice Hypothesis

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Abstract: The purpose of this study was to examine the similarities between physical and imagery perspective of practice with regard to the development of motor sensory-specific it representation to test the specificity of learning hypothesis. To accomplish this objective,100 female students of right hand who were all novitiate in the skill and have motor imagery ability were selected and according to practice conditions (normal visual, blindfolded, internal imagery, external imagery and combined imagery perspective) and length of practice session (2or8 session), randomly divided into 10 groups that each was 10 subjects. Participants fallowing participated in pretest, practiced 30 throwing in basketball with receive knowledge of results feedback in per sessions and then participated in first transfer test (performance with blindfolded) and second transfer test (performance with visual) without knowledge of results in transfer tests. Data has been analyzed by statistical methods of factorial ANOVA in transfer tests and Duncan post hoc test. The result showed that all of main effects and interaction effect in first transfer test was significant ($p<0.05$). the result of post hoc test showed that groups of practice of withdrawing visual in 8 session, withdrawing visual in 2 session and internal imagery in 8 session had better progress and groups external imagery with 8 session, with visual in 8 session and imagery combined in 2session had weaker groups. The results showed that all of main effects and interaction effect in second transfer test was significant ($p<0.05$). The result of post hoc test showed that groups of practice of with visual in 8 session, with visual in 2 session and external imagery in 8 session had better progress and groups internal imagery with 8 session, withdrawing visual in 8 session and internal and combined imagery in 2session had weaker groups. The results indicated that learning is specific to the sources of afferent information available during physical and imagery practice and it more dependence on the afferent resources available with increasing of practice time. Thus the specificity of practice hypothesis does apply to training throwing in asketball.

Key words: Specificity of Practice Hypothesis % Afferent Information % Imagery Practice % Physical Practice

INTRODUCTION

The role of afferent sensory information in learning and motor control has been controversial topics of much research in recent years. Schmidt [1] believed that afferent sensory information is essential and important for learning new tasks and training to help the persons gradually, used to make more efficient motor program without afferent sensory input.

Fleishman and Rich [2] based on their research findings concluded that afferent visual information in the early stages of learning to come as the main source of sensory information for person and coincided with exercise increasing, visual information are replaced by proprioceptive inputs.Also the researchers conducted by Pew [3] support the decreased role of sensory visual information and replacing the proprioception in the advanced stages of learning. But Cox and Valkasky [4] argued that proprioception cannot be completely replicable for Visual information. Also,Proteau and colleagues [5-6] with specific training hypothesis and testing and verification of this hypothesis in a variety of motor tasks, argued that learning firstly, based on similar sensory afferent information resource in training conditions and criteria is specific (the first principle of the first specific theory) and secondly, specificity of sensory

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afferent information can improve by increased efforts during the training sessions (the second principle of specific theories).

Using the pattern of brain electrical activity showed the activity of cortex visual area in external imagery and activity of sensorimotor area in internal imagery is more significant.

On the other hand, behavioral studies related to specificity of hypothesis have shown improving motor learning depends on the specific type of sensory information used during imagery practice [31]. For example researchers studied the effect of external imagery and physical training on amount of dependency on sensory resource in one experimental task (for testing the specificity of practice Hypothesis). This pilot study was performed with six groups (external imagery with great trial, external imaging with low effort, training with low trials and without vision, exercises with normal vision with great trial and practice with the vision and low trial) and get feedback about the results for all groups. Participants in the pre-test were tested with vision and in the transition test without vision and eliminate feedback. The results showed in the acquisition phase, visual group with extreme trials had best performance and group without vision with brief trials had a weakest performance. Transfer test results showed that visual group with extreme and low trials had the best performance and there weren't significant difference between the vision and external imagery groups.

This result support the first principle of training specificity in terms of imagery but did not support the second principle of specificity of practice theory because the performance of the four groups was not statistically significant and increasing training trials did not make the participants more dependent on sensory information [16]. in Laboratory tasks reviewed if use of afferent sensory information in internal and external imagery as well as the physical training can be specific. In the present study, three experimental groups (proprioceptive imagery, visual imagery and visuo- proprioceptive conditions) attended that after pretest in visual condition the groups in acquisition period trained the tasks based on the own instructions in brief trials and then in first transfer test subjects participated in without visual situation. All three groups continued implementing extreme trials again and then participated in the second transfer test. The performance of the three groups in terms of brief training in the first transfer test was not significant. The results of second transfer test showed that average error for the VPI and PI groups that had more practice was decreased rather than the VI group. The researchers proposed that the type of imagery which makes sweeping in the criteria or transfer situations, will be effective when used with a sense status in the practice sessions [25, 26].

Contradictory literature about the stability and specificity of afferent sensory information during different stages of learning and the effectiveness of session duration and a number of different trials to achieve optimal pattern of afferent information skills, was achieved on to do research on the specificity of practice in both practice and imagination status. Also, given that recent researches specificity of practice hypothesis dedicated solely in terms of physical training do not review and their emphasize in the use of afferent information specifically on the different training methods, the other aim of this study was to comparing the using of specific sensory information in physical practice situation, internal and external imagery during extreme and brief trials in field task. Since researchers were compared in six experimental groups, the external imagery situations with physical practice in their study and the others did studied training situations with extreme and brief trials in the three experimental groups (proprioceptive imagery, visual and visuo- proprioceptive) and know the skill type important in the approval or non-approval of two principle of practice [16, 20], Researchers of this study with using 10 experimental groups (EFV, BFV, ENV, BNV, EPI, BPI, EVI, BVI, EVPI, BVPI) in free basketball throwing.

This study aimed to examine the similarities between physical and imagery perspective of practice with regard to the development of motor sensory-specific it representation to test the specificity of learning hypothesis.

MATERIALS AND METHODS

This study method is Quasi-experimental. In order to accomplish the research objectives, the availability of non-random sampling method was used and the 100 students who entered the study had these features (Right hand, no history of illness, without organizational problems and lack of training experience in basketball and had imagery ability). Then the selected subjects randomly were divided into 10 groups of ten subjects.

Measurement Tool: This research tool was a standardized test of AAHPERD basketball throwing. In this test, participants were behind the basketball penalty line and did their throwing into the ring. Scores for this test was done based on AAHPERD basketball shot scoring

method. Thus, the ball that went into the basketball ring gives two points, the ball would hit the basketball ring and were not move to the rings did give 1 score and in the other situations was not considered a privilege. Validity and reliability of this test were acceptable [32]. Also for evaluation of participants' imagery ability the modality imagery questionnaire of the Hall and Martin (1997) was used.

Methods of Data Collection: First, subjects participated in familiarization session about how to perform skills (basketball free throw) to provide homework, education and instruction, display and patterning. Then the subject's imagery ability was assessed by the revised motion illustrator questionnaire and based on and the number of brief and intense training sessions (2 and 8 sessions) and training requirements were divided into 10 groups. Subjects in pretest performed 15 basketballs shooting in same training situations and with vision and without giving feedback from examiner. The first experimental group (training with vision) and second (practice without vision) with a large number of training sessions, was performed 8 sessions, 30 task in each session and the third experimental group (with vision) and fourth (without vision) with brief training sessions for 2 sessions and in each session 30 shooting task.Named experimental groups received result awareness feedback after each attempt. 5th experimental groups (internal imagery) and sixth (external imagery) with a large number of training sessions for 8 sessions, 30 shooting tasks in each session and the seventh group (internal imagery) and eighth (external imagery) with brief training sessions (two sessions) and 30 shooting tasks in each session was launched training in accordance with the internal and external imagery instructions. 9th experimental groups (combined: internal and external imagery) performed his imagery tasks with a large number of sessions (8 sessions) and 30 shooting tasks in each session (15 tasks with internal and 15 thrown with the external procedures) and 10th experimental group (combination: internal and external imagery) with brief sessions (2 sessions), 30 throw in each session (15 launchers and 15 thrown into the internal procedures and external procedures imagery) had visualization.

In imagery practices, the subjects lay supine in a quiet environment with minimal light, feet on floor, hands on the chest and eyes closed. Subjects experienced a period of progressive relaxation before entering the internal and external imagery then the instructions that related to the 30 efforts of educator groups (fifth to tenth) which was recorded completely uniform were used during the practice sessions.

Timing of the training effort in imagery (internal or external) was consistent with the timing of implementation efforts in physical training and rest periods between exercise reps of imagery or physical practices was 30 seconds. Experimental groups, 72 hours after their last training session attended in two transfer tests. Subjects in first transfer test performed 15 shooting tasks with blindfold and without receiving feedback and in the second transfer test performed 15 tasks with normal vision and without receiving feedback on their performance.

Statistical Analysis: Descriptive statistics were used for the main indexes, mean, standard deviation and standard error of mean. To investigate differences in the pre-test performance of 10 groups the one way ANOVA and in the transfer tests the factorial ANOVA (Practice conditions: FV, NV, VI, PI, VPI) 5 × 2 (duration of training: 2 sessions and 8 sessions) and Duncan post hoc test was used. Significant level in all analyzes was ($p<0.05$) and statistical analysis SPSS software 16 was conducted.

RESULTS

One-way ANOVA test results revealed that in the pretest there is no significant difference between the performance of 10 experimental groups with P=0.481 and F(9,90)=0.95.

The factorial ANOVA test results in the first transfer test (with blindfold] showed the main effect of training condition (5 situations) with P=0.001 and F (4, 90) =47.66 is significant. Duncan post hoc test results showed that training without vision significantly led to subject's better performance and training in VI and FV led to subject weaker performance. There is not significant statistically difference between the external imagery training situations with the visual training (Table 1).

Also, the main effect of training sessions (8 and 2 sessions) with P=0.002 and F (1, 90)=10.07 was significant and average practice for 8 sessions (M=4.10) was more than average in the second practice session (M=2.84). The interactive effects of practice situations during training sessions with P=0.01 and F (4 and 90)=3.53 was significant. Duncan post hoc test results showed the groups that have a practice for 8 sessions with blindfolded and PI have the best performance in the first transfer test and there is no significant difference between the performance of without vision groups at 2nd and 8th sessions.

The factorial ANOVA test results in the second transfer test (with FV) showed that the main effect of type training conditions (5 conditions) with P=0.001 and F(4 and 90)=115.20 is significant. Duncan post hoc test

Table 1: Duncan post hoc test results for comparing the performance scoresin different training conditions in the first transfer test

	Significant level=0.05			
	Mean			
Groups	4	3	2	1
VI				0.45
FV				0.95
VPI			3.15	
PI		4.85		
NV	7.95			
P	1.00	1.00	1.00	0.42

Table 2: Duncan post hoc test results for comparing the performance scoresin different training conditions and sessions in the first transfer test

	Significant level=0.05				
	Mean				
Group	5	4	3	2	1
VI(8 sessions)					0.20
FV(8 sessions)					0.71
VI(2 sessions)					0.70
FV(2 sessions)					1.20
VPI(8 sessions)					1.80
PI(2 sessions)				1.80	
VPI(8 sessions)			3.40	3.40	
PI(8 sessions)			4.50		
NV(2 sessions)		6.30			
NV(8 sessions)	8.00	7.10			
P	0.059	0.37	0.21	0.07	0.11

Table 3: Duncan post hoc test results for comparing the practice scoresin different training conditions in the second transfer test

	Significant level=0.05		
	Mean		
Group	3	2	1
PI			0.60
NV			0.71
VPI		5.05	1.75
VI			
FV	12.40		
P	1.00	1.00	1.00

results revealed that practice in visual conditions led to significantly better performance in subjects and the practice in PI, NV and VPI conditions led to poorer performance of subjects (Table 3).

Also, the main effect of training sessions (8 and 2 sessions) with P=0.001 and F (1, 90)=10.74 was significant and average practice for 8 sessions (M=4.78) was more than average in the second practice session (M=3.42). The interactive effect of practice situations during training

Table 4: Duncan post hoc test for comparing the performance scoresin different training conditions and sessions in the second transfer test

	Significant level=0.05				
	Mean				
Group	5	4	3	2	1
PI(8 sessions)					0.50
NV(8 sessions)					0.61
PI(2 sessions)					0.70
NV(2 sessions)					0.83
VPI(8 sessions)				2.10	1.40
VPI(2 sessions)			6.30	3.81	2.10
VI(2 sessions)		10.83			
VI(8 sessions)					
FV(2 sessions)	14.10				
FV(8 sessions)	10.00	1.00	1.00	0.07	
P					0.13

sessions with P=0.04 and F(4 and 90)=7.27 was significant. Duncan post hoc test results showed the groups that had trained a practice for 8 sessions with vision and external imagery had a best performance and there was no significant between the performance of internal imagery (PI) and without vision (NV) and VPI groups at 2nd and 8th sessions.

DISCUSSION AND CONCLUSION

This study aimed to apply the principles of specificity of practice hypothesis in terms of physical training (with vision and without vision) and imagery practice (VI, PI and VPI) to respond the following questions whether afferent sensory information representation in terms of physical training is specific?. Also representation and use of this information in other training conditions (training in the imagery conditions) is specific?. The afferent sensory information used during the training sessions in the internal and external imagery positions for learning the task as well as physical training situations in transfer condition also represented specifically?. For this reason the performance of 10 groups were evaluated in the first transfer test (test with a blindfold to identifying the specificity of afferent proprioceptive information in without vision and proprioceptive conditions and to determine the use of 10 experimental groups from afferent proprioceptive) and in the second transfer test (normal vision test to verify the specificity of visual sense information in terms of vision and external imagery practice and to determine the 10 experimental groups from the visual afferent information).

Results for comparison the duration of the sessions (2 and 8 sessions) and practice conditions (with vision, blindfolded, proprioceptive imagery, visual imagery and visuo- proprioceptive) in the first transfer test (practice without vision) showed the main effect of practice conditions on transfer test was practice in without visual and internal imagery conditions significantly led to better performance of subjects and practice in external imagery and with vision conditions led to weaker performance in transfer test. Therefore the representation of afferent information according to different practice conditions was dedicated. Because based on the specificity of practice theory, the amount of learning depends on the degree of similarity between the practice and test properties [18]. This results are consistent with the findings of many researchers [13, 27, 34-36]. With studying the practice specific conditions in different tasks showed that removing or adding sensory sources during practice simply in specific conditions can facilitate the learning process that the final performance under the same conditions (removing or adding a sensory source) should be tested. Otherwise removing or adding sensory sources during acquisition not only facilitate the learning, reaching process to the optimal coordinate pattern but also does impair the performance. Perhaps the best performance of the experimental trained groups [blindfolded and internal imagery conditions) in the transfer test can be justified by drawing the precise movements with efficient use of proprioceptive feedback by these groups than in the acquisition process. Also the main effect of practice session duration was significant and the increase of practice sessions due to enhance better learning in the transfer test.

The present findings is consistent with studies of many researchers who believed extreme number of efforts and practice sessions under specific practice conditions can led to more specific learning conditions and stronger support of specificity of practice Hypothesis [9, 20, 27, 37].

But inconsistent with the findings of many researchers that did not obtain the difference between the number of brief or extreme practice trials in the specific training conditions [5, 12, 16-19]. Probably the reason of this disagreement was due to task type, the complexity of skill and number of trials [16, 20].

Also the interactive effect of the number of practice sessions (2 and 8 sessions) and type of training conditions (with vision, blindfolded, proprioceptive imagery, visual imagery and visuo-proprioceptive condition) was significant. The results showed the groups that performed practice in 2 and 8 sessions with blindfolded and group that performed 8 sessions of internal imagery had the best performance in the transfer test and there was no significant differences between the performance of vision practice in 2 sessions, vision practice in 8 sessions, external imagery in 2 sessions, external imagery in 8 sessions and combined imagery group in 2 sessions.

These results indicate that practice in terms of vision and external imagery extremely can enhance dependency in subjects to use visual afferent information for movement control during the acquisition process and vision removal in the transfer test leading to weaker performance in these groups. The obtained results of the researches is consistent with results of many researchers that showed representation of afferent sensory information in physical and imagery practice conditions was specific and the increase of the number of practice trials can enhance dependency to specific afferent information [25-27]. Based on the obtained results can be inferred that outcomes of specificity of practice hypothesis makes in transfer test, the subjects use the same motor pattern and sensory- motor representation that previously used in skills acquisition.

But the participants that do not practice during the acquisition process similarly to criteria or specific learning, use the movement designed strategies that this movement strategies is dependent on available afferent information resources in practice sessions, conditions of practice sessions and duration of sessions or number of practice efforts and in the transfer conditions also act based on the same strategies therefore participants have weaker.

Many researchersknew the amount of learning a linear formula of the similarity between practice and test characteristics that is described the learning process as a sensitive and continuous network that has been established from internal communication sources of afferent information and believes that if this network is manipulated by their relevant information to the task or other external feedback can decrease the performance. Based on, they have suggested, specificity of available sensory information sources increase during practice sessions and a lot of effort in compared to a brief practice sessions and trials [13, 6]. Obtained results for comparing the duration of the sessions (2 and 8 sessions) and training conditions (with vision and blindfolded, proprioeptive imagery, visual imagery and visuo-proprioceptive imagery) in the second transfer test (visual practice) showed that the main effect of practice

conditions was significant and visual practice and external imagery practice significantly led to better performance in subjects and practice without vision, internal imagery and combined internal and external imagery resulted in weaker performance in transfer test. Therefore representation of afferent information in transfer test based on different practice conditions (physical practice with and without vision and imagery dimensions) was specific. The results are consistent with the findings of many researchers [13, 16, 24, 27, 34, 35, 36].

With studying the specific practice conditions in different tasks and different practice situations such as practice in physical or in imagery conditions showed that transfer of learning depends on the degree of similarity between the practice and testing characteristics [26, 27]. The results aren't consistent with the findings of many researchers[17, 22, 23, 24, 38].

These researchers believe that afferent sensory information [especially visual] in the early stages of learning are important for motor control but during practice and gradually their importance decreases. In the present study their importance not decreased in any situations but these groups demonstrated the best performance. The main effect of practice sessions is significant and practice sessions increasing enhance learning in the transfer period.

These findings are inconsistent with the results of many researchers who believed efforts and continues and additional practice sessions can led to reduce the role of visual afferent information in the early stages of learning rather than advanced stages [1-3]. Researchers believed that the trials, further practice sessions and achieving to optimal movement pattern makes the role of visual control decreased, to make optimal skill pattern of gradual replacement of this information by proprioception, afferent information from closed loop to open loopand stronger motor program that this finding is in contradiction with the present study [19]. The interactive effect of practice session number (2 and 8 sessions) and type of practice conditions (practice with vision, blindfolded, proprioceptive imagery, vision imagery and visuo- proprioceptive) in the visual test with normal vision were significant. The results showed groups that had 8 and 2 session of visual practice and group trained the visual imagery in 8 sessions significantly had best performance in the transfer test and there was no significant differences between performance of groups with 2 and 8 sessions of visual practice, external and combined imagery groups with 2 and 8 practice sessions. The results is consistent with the findings of many researchersthat showed afferent sensory information representation in the physical or imagery condition is specific and increased training efforts related to specific afferent information increases [24-27].

According to the obtained results in relation to the number of sessions and practice conditions, further researches seems necessary to assess the specificity of practice and exclusive representation of afferent sensory information.

Because Krigolson and Tremblay stated one of the reasons to not significantly increase during sessions and number of brief and extreme efforts in connection with the specificity of practice hypothesis, the level of complexity and difficulty of skills [20]. Based on this study results also suggest that educators can be in learning motor skills use the specificity of practice hypothesis of practice in their varied training methods and influence that the specific principle can have on the representation of sensory information is more than previous in mind.

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