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The effects of attentional focus strategies on acquisition, retention and transfer of dart throwing task in children and adolescences

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ABSTRACT

Adults benefit more from external focus than internal focus when learning a new motor skill. Because learners from different age groups use different learning strategies, the purpose of this study was to investigate whether the effect of varies attention focus between children and adults. Twenty children and eighteen adults were randomly assigned to internal and external focus of attention practice groups. Dart throwing done toward a static target, participants performed 50 acquisition trials, 20 retention trials, and 20 transfer trials. The results indicate that focus of attention varied between children and adults in accuracy and variability of the acquisition, retention, and transfer phase and in accuracy of the transfer phase ($P<0.05$). This study suggests the need to develop appropriate selection criteria of participants according to their age. Physical therapists working with children should perhaps direct the client's attention internally; however, further study is needed.

Keyword: internal focus, external focus, motor skill learning

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INTRODUCTION

There are many factors which can influence the performance and acquisition of a motor skill. Focusing attention on aspects of the motor skill is an example. Motor behavior research has found that when utilizing strategies which enable no conscious attention to the execution of a motor task that often the performance of the task is more effectively carried out. Singer, Lidor, and Cauraugh (1993) found that when using a non awareness strategy (preplanning the movement and perform a task without conscious attention) and a Five-Step Approach (readying oneself, imaging the act, focusing attention on a cue, executing without thought, and evaluating the act) novices demonstrated greater accuracy when performing a non-dominant overhand ball throw to a target versus employing an awareness strategy (consciously attending to the motor action and execution) or a control condition (one's own approach) [1].

Research by Masters (1992), Maxwell, Masters, and Eves (2000) have suggested that through performing a secondary task, such as random letter generation or tone counting, learners can be distracted from skill execution and efficiently perform their motor task [2-3]. Another strategy which influences motor performance and learning is attentional focus (external vs. internal). Over the last ten years research by Wulf and colleagues and other researchers has found that through externally focusing attention away from the execution of a motor task (outcome of the task or movement effect) performers are more successful than when they internally focus on the task execution (movement of the task).

Extensive amount of research has observed this benefit of utilizing an external focus over an internal focus on motor performance and learning. This effectiveness has been observed among balancing tasks, such as on a ski-simulator [4-5], a stabilometer [6-8], a 2-axis wobble board [9], and on an inflated rubber disc [10]. This benefit has as well been observed in sport-related tasks; for example, basketball free-throw shooting [11], dart throwing [12-14], golf chip/pitch shots [15-17], jogging [18], soccer shooting [19], tennis serves and returns [20-21].

In addition, this advantage has been observed with tasks related to strength performance, such as isokinetic biceps curling [12, 22] and vertical jump-and-reach [10]. This advantage also has been demonstrated with varies tasks performed by special populations: children with balancing [23], young and elder adults with pursuit-rotor tracking [24], individuals with Parkinson's disease and tray carrying [25], individuals with Parkinson's disease and balancing [26], stroke patients and performing occupational therapy tasks [27].

The skill level of the performer in executing specific motor tasks while utilizing these attentional foci, or variations of these foci, has also been examined. It has been suggested that despite the skill level (novice or expert) of the performer the use of an external focus still is more beneficial; as long as the motor task is complex and not very simple [28]. Although, findings from a few studies have suggested that an internal focus or a focus which relates more to the motor skill being carried out and not completely on the movement effect (external or dual-task/skill-focus) would be more favorable for novices; an external focus entirely on a movement effect would only be beneficial for experienced/skilled performers. The motor tasks examined in these studies include: golf pitch shots [29], golf putting [30-31], soccer dribbling [30], and baseball batting [32-33].

One reason why novices should be more aware of the execution of their performance is that they need to become familiar with the movements of the motor skill before they can start attending to cues in the environment. Therefore, according to these few studies the different attentional foci or variation of an external-like focus could vary among performers of different levels of expertise.

The rate of utilizing external forces and coordinating them with movement can be learned with no awareness [4]. It has been found that through the use of an attentional focus on a movement effect (external focus) unawareness of the execution of a motor skill is enabled and enhances the learning and control of that motor skill. This is due to automatic processes being allowed to increase as attention is directed away from the execution of the movement and on the outcome that is produced [5]. An attentional focus on the movement itself (internal focus) would be less favorable according to the "constrained-action hypothesis" [6-7], because the motor system would be inhibited and the automatic control processes would be disrupted. During motor learning, when instructions and feedback on how to use an external attentional focus are presented this constraint of the motor system and disruption of the automatic control processes could be avoided. The underlining mechanism(s) though that influence this effect are poorly understood. Therefore, assessing other performance variables, such as arousal (awareness) and affect (feeling of pleasantness/unpleasantness), would be beneficial to help understand why the use of these attentional foci influenced motor learning.

It might be assumed that children are similar to novice players in their lack of experience, unfamiliarity with tasks, and limited motor repertoire [34]. In contrast, most adults have had some exposure to a greater diversity of motor tasks. In addition, young learners have difficulties focusing their attention during motor performance [35]. However, only one study has investigated (indirectly) focus of attention in children. In testing 4 different learning strategies, including external focus of attention, Cohen- Nachman and Madkar (2001) reported that external focus of attention interfered with the learning process, as exhibited by the children's inferior performance during the retention phase [36]. They did not examine internal focus of attention, however. Therefore, the purpose of our study was to examine the influence of focus of attention on the motor performance of children and adults. The results of this study could help clinicians to improve methods of training patients according to client age and experience. We hypothesized that adults would benefit more from external focus of attention and that children would benefit more from internal focus of attention.

MATERIALS AND METHODS

Participants

Twenty children and 18 adults participated in this study. Twenty boys, 8.6 to 10.1 years of age (X= 8.95, SD= 0.68), with no known delays or developmental concerns, were randomly selected from a mainstream elementary school

and then randomly assigned to 2 groups: 10 in an internal focus group (average age= 9.4 years, SD= 0.51) and 10 in an external focus group (average age= 8.5 years, SD= 0.52).

A convenience sample of 18 adults, 27.2 to 31.7 years of age (X=28.83, SD= 1.33), were randomly divided into 2 groups: 9 in an internal focus group (average age= 28.55 years, SD=1.33) and 9 in an external focus group (average age= 29.11 years, SD= 1.36). All of the participants were unfamiliar with the experimental task. All of the adult participants and the children's parents provided informed consent.

Apparatus and Task

The task was to throw darts into the center of a circular target, 1 m in diameter (Fig 1). As shown in Figure 1, the target's height and distance were altered according to the age group and the experimental condition, as recommended in the Keogh test [37]. In the acquisition and retention phases, the target's distance was the same; whereas in the transfer phase, the target's distance was extended by the same amount relative to the original distance for children and adults.

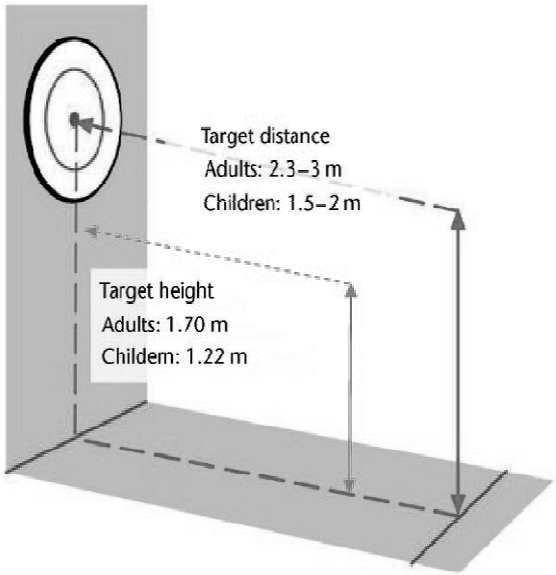

Figure1: The task setting

Ten standard soft-tip plastic-head darts were used for each trial block. After each trial block, the darts were collected from the target board by the experimenter and were used again for the next trial block.

Procedure

The experiment was conducted in a quiet room. Prior to the first (acquisition) phase, the experimenter spent 10 minutes with each participant to explain and demonstrate the basic technique of throwing darts. All participants were given the same general instructions regarding the task goal and the throwing position. Instructions for the internal focus group were directed at movements of the shoulder, arm, and fingers (eg, "attach your thumb, index finger, and third finger and then bend your elbow") (see Appendix for detailed instructions). Instructions for the external focus group were directed at the target, the darts, and the dart's course (eg, "hold the dart"). Each participant came for 2 consecutive days (the entire study). On the first day, during the acquisition phase, participants threw 50 times in 5 trial blocks (10 throws per block). At the end of each trial block, the experimenter marked where the dart hit the target, refreshed the focused instructions, and removed the darts from the target. At the end of the acquisition phase, each participant was asked what he or she focused on while practicing the task.

One day after the acquisition phase, both retention and transfer phases were conducted. In the retention phase, participants threw 20 darts (2 blocks of 10 throws each) from the same distance as in the acquisition phase. Several minutes later, the transfer phase was conducted, in which participants threw 20 darts (2 blocks of 10 throws each) from a further distance. No further instructions were given in both retention and transfer phases.

Data Analysis

The dependent measures included: accuracy (mean radial error [MRE]) and variability or inconsistency (bivariate variable error [BVE]) of throws. The MRE, analogous to absolute error in one-dimensional tasks, provides an indication of the average deviation of the darts from the center of the target (in centimeters). Lower scores indicate a more accurate performance. The BVE, analogous to variable error (VE) in one-dimensional tasks, provides an indication of the standard deviation of each of the participant's throws from a typically positioned trial. In order to calculate those measurements, the distance of the arrows on the X and Y axes (while the center of the target is the zero point) were measured (in centimeters) (see formula in Table 1). In order to ensure that baseline differences between the 2 groups were not significant, thus avoiding confounding comparison of absolute retention and transfer test results, a 2-way analysis of variance (ANOVA) (practice group × age group) was performed on the first trial block for each of the dependent variables.

For the acquisition phase, these data were combined to form 5 blocks of trials (10 trials per block) for each of the 2 dependent measures to allow analysis of the change as practice progressed. For the retention and transfer phases, an average of all 20 trials was calculated for each of the 2 dependent measures.

For analysis of the acquisition phase, a 3-way ANOVA — 2 (practice group) × 2 (age group) × 5 (trial block) — with repeated measures on the last factor was performed on each of the dependent measures. For analysis of the retention and transfer phases, a 2-way ANOVA—2 (practice group) × 2 (age group) — was performed on each of the dependent measures for each of the phases. Posthoc Scheffe´tests were performed if the ANOVAs were significant to test for significant differences between the means. The level of significance was set at .05 for all statistical tests. All statistical analyses were performed using SPSS-18.

RESULTS

The results of the 2-way ANOVA indicated that there were no significant differences between groups at baseline (Table 1). Therefore, performance of participants was analyzed for each study phase separately. Preliminary tests of the assumptions of the statistical tests, including normality, homogeneity of variance, and multisample sphericity, for the repeated-measures ANOVA were met.

Table 1: Analysis of Variance for Age and Practice Group: Error (in Centimeters) From Center (MRE[a]) and Variance (BVE[b])

Source	df	MRE		BVE	
First trial block		F	P	F	P
Practice group	1,34	2.001	0.166	1.03	0.315
Age	1,34	4.035	0.053	0.006	0.938
Practice group × age	1,34	0.583	0.450	0.403	0.530
Acquisition phase					
Practice group	1,34	4.963	0.033 [c]	4.714	0.037 [c]
Age	1,34	3.084	0.088	6.703	0.014 [c]
Practice group × age	1,34	5.551	0.024 [c]	5.657	0.022 [c]
Trial block	4.36	6.462	0.001 [d]	5.307	0.001 [d]
Trial block × practice group	4.36	1.829	0.127	1.521	0.2
Trial block × age	4.36	1.726	0.148	1.333	0.261
Trial block × practice group ×age	4.36	1.292	0.276	0.956	0.434
Retention phase					
Practice group	1,34	5.864	0.021 [c]	9.214	0.005 [d]
Age	1,34	22.737	0.001 [d]	28.496	0.001 [d]
Practice group × age	1,34	7.970	0.008 [d]	4.495	0.041 [c]
Transfer phase					
Practice group	1,34	2.399	0.131	4.65	0.038 [c]
Age	1,34	21.03	0.001 [d]	12.555	0.001 [d]
Practice group × age	1,34	7.862	0.008 [d]	15.142	0.001 [d]

[a]MRE mean radial error, calculated as:

MRE=$\overline{RE}\frac{1}{M}\sum_{i=1}^{M} REi$

RE=$\sqrt{X^2+Y^2}$

Where RE= radial error(distance between the throw and the center), m= number of trials, and i=a particular trial.

[b] BVE= bivariate variable error, calculated as:

BVE=$\sqrt{\frac{1}{K}\sum_{i=1}^{k}(x_i-x_c)^2+(y_i-y_c)^2}$

where k=number of trials, i=a particular trial, and Xc and Yc=the average distance from the X and Y axes, respectively.

[c] P<.05.; [d] P<01.

Acquisition Phase

The results of the ANOVA for the acquisition phase indicated there was significant interaction between age and focus of attention. In addition, either of the main effects for focus of attention or age group was significant (Table1). A significant main effect for trial blocks was found for the MRE and BVE measure. Collapsed overall other variables, Based on post hoc analysis, participants improved significantly from trial block 1to trial blocks 3, 4, and 5.

A significant 3-way interaction was not found among age, focus of attention, and trial block for both measures (MRE and BVE). Either of the Performance of the adults who practiced in the internal and external focus group improved significantly throughout subsequent trial blocks (Table 3). In the children's practice groups, no statistically consistent pattern of improvement was found along the trial blocks for either internal or external focus of attention.

Retention Phase

The results of the ANOVA for retention indicated that age contributed a significant main effect in both outcome measures (Tables 1 and 2). As expected, the adults performed more consistently and accurately than the children. The interaction effect between age and focus of attention was significant (Table 3).

Table2: Means (Standard Deviations) of Analysis of Variance for Interaction of Age Group × Practice Group during the Acquisition Phase [a]

	Focus of Attention	Trial Block				
		1	2	3	4	5
MRE						
Adults	Internal	13.43(3.1)	11.66(2.11)	10.57(1.92)	11.61(2.55)	9.11(2.05)
	External	13.91(5.55)	11.71(4.65)	9.75(3.64)	10.36(2.61)	9.95(3.07)
	Total	13.67(4.37)	11.69(3.5)	11.16(2.85)	10.98(2.58)	9.53(2.57)
Children	Internal	10.78(3.07)	9.49(1.39)	10.23(3.64)	11.38(4.02)	11.29(3.52)
	External	17.4(4.87)	16.33(7.64)	15.33(4.84)	14.33(4.26)	14.18(5.42)
	Total	14.09(5.21)	12.91(6.39)	12.87(4.86)	12.85(4.3)	12.73(4.69)
Total	Internal	12.03(3.29)	10.52(2.04)	10.39(2.76)	11.49(3.31)	10.25(3.05)
	External	15.74(5.36)	14.14(6.66)	12.69(5.08)	12.45(4.04)	12.17(4.86)
	Total	13.89(4.77)	12.33(5.19)	11.54(4.2)	11.97(3.67)	11.21(4.12)
BVE						
Adults	Internal	8.83(1.84)	8(1.51)	6.88(1.18)	7.9(2.32)	6.44(1.63)
	External	9.4(3.49)	7.97(2.54)	6.24(1.24)	6.84(1.58)	6.88(2.15)
	Total	9.11(2.72)	7.98(2.02)	6.56(1.22)	7.37(2)	6.66(1.86)
Children	Internal	7.7(3.04)	7.15(1.87)	7.6(3.26)	7.84(2.76)	8.35(3.27)
	External	12.2(3.31)	10.7(3.61)	10.18(2.93)	10.26(3.05)	9.62(2.27)
	Total	9.95(3.86)	8.93(3.34)	8.89(3.29)	9.05(3.09)	9(2.87)
Total	Internal	8.23(2.54)	7.55(1.72)	7.26(2.46)	7.87(2.49)	7.44(2.74)
	External	10.87(3.6)	9.4(3.37)	8.31(3.01)	8.6(2.97)	8.34(2.58)
	Total	9.55(3.35)	8.48(2.8)	7.79(2.76)	8.25(2.73)	7.89(2.66)

[a] MRE=mean radial error, BVE=bivariate variable error.

Transfer Phase

The ANOVA during the transfer phase indicated a significant 2-way interaction between age and practice group for the MRE measure (Table 3). In adults, the external focus group was more accurate than the internal focus group, whereas in the children, the internal focus group was more accurate than the external focus group (Table 3). Either age or focus of attention affected the performance of the participants during the retention and transfer phase. There was an interaction effect between practice group and age for the MRE and BVE measure.

DISCUSSION

We investigated the effect of focus of attention in 2 different age groups: elementary school children and young adults. In previous re-search [15, 29] it has been shown that external focus of attention is more beneficial than internal focus of attention for skill acquisition among adults. We investigated whether this also was true for children. Our results reinforced previous findings regarding the advantage of external focus of attention (focus on the action results) over internal focus of attention (paying attention to the body movements) in adults. Significant differences were found between the internal and external focus of attention among children, for advantage internal focus of attention in MRE and BVE during the retention and transfer phase.

Perkins-Ceccato et al. (2003) found that highly skilled golfers performed better with instructions on external focus of attention than with instructions on internal focus of attention [29]. Low-skilled golfers, however, performed better with instructions on internal focus of attention than with instructions on external focus of attention. Beilock et al., (2002) suggested that that external focus of attention might be more beneficial for skilled athletes than for less-skilled athletes due to the different level of movement automation they exhibit. Expert athletes have more highly developed automatic motor skills than recreational athletes [30].

Table3: Means (Standard Deviations) of Analysis of Variance for Interaction of Age Group ×Practice Group during the Retention and Transfer Phases [a]

Focus of Attention	Retention		Transfer	
	MRE	BVE	MRE	BVE
Adults				
Internal	9(1.59)	5.59(1.26)	12.81(1.52)	8.43(0.99)
External	8.72(2.12)	6.03(1.33)	11.57(3.64)	7.27(1.83)
Total	8.86(1.82)	5.81(1.28)	12.19(2.67)	7.85(1.55)
Children				
Internal	10.39(1.79)*	7.12(1.18) *	14.58(2.44) *	8.2(2.7) *
External	14.12(2.92)	9.58(1.91)	18.88(4.03)	12.25(2.2)
Total	12.25(3.04)	8.35(1.99)	16.73(2.92)	10.22(3.17)
Total				
Internal	9.73(1.8)	6.4(1.42)	13.74(2.19)	8.31(2.02)
External	11.56(3.73)	7.9(2.43)	15.42(5.24)	9.8(3.22)
Total	10.65(3.03)	7.15(2.11)	14.58(4.05)	9.1(2.78)

[a] *MRE=mean radial error, BVE=bivariate variable error.*
** P<.05, significant difference between Practice Groups in the children.*

Our results concur with those of the studies by Perkins-Ceccato et al (2003) and Beilock et al (2002) in which adults benefited from external focus of attention, but, in the children's groups, instructions aimed at internal focus of attention were more advantageous than those on external focus of attention in the transfer phase, and a similar trend seemed to show in the retention phase [29-30]. We can argue that the adults had relatively more motor experience than the children and thus performed the task more automatically, even though they had no specific dart throwing experience. Consequently, children may be more similar to low-skilled adult players who have no experience with such activities, exhibiting lower level of movement automation [36].

One of the main weaknesses of existing work on focus of attention in instructional constraints is the failure to precisely specify the skill level of participants, with the ‘catch-all’ term learners being used to describe most experimental groups [28]. Some studies have suggested that the effects of attentional focus instructions may depend on the skill level of participants and on the nature of the instructions provided [24, 28, 30, 33].

the present results appear to be more consistent with the proposal of Beilock et al. (2002), Gray (2004), and Wulf (2007) that all forms of environmental attention (whether attention is directed to an action effect) are detrimental to performance by less-skilled players because successful skill execution at this stage of expertise requires attention to each of the component stages of the motor act, that is, skill-focused attention [28, 30, 32].

These observations are important, because theoretically, we would expect that novices at the coordination stage would be more likely to benefit more from internal focus of attention instructions emphasizing movement dynamics than external focus of attention instructions. As noted earlier, novices at the coordination stage of learning are learners who are still engaged in assembling basic functional movement coordination patterns to achieve a task. Therefore, internal focus attention instructions would have been expected to enhance more successfully performance and learning because it would help performers to adjust the movement dynamics of the pattern coordination during the discovery of basic solution. On the other hand, advanced beginners or adult are learners that have already assembled the basic functional movement pattern which they then need to adapt to different environmental conditions. Therefore, learners would benefit more from an external focus emphasizing movement outcomes. That is, external focus instructions would be more beneficial than internal focus instructions because they would help performers to understand the effects of varying (or controlling) the basic patterns of movement on performance.

REFERENCES

[1] RN Singer; R Lidor; JH Cauraugh. *The Sport Psychologist*, **1993**, 7, 19-30.
[2] RSW Masters. *British Journal of Psychology*, **1992**,83,343-58.
[3] JP Maxwell; RSW Masters; FF Eves. *Journal of Sport Sciences*, **2000**,18,111- 20.
[4] G Wulf; C Weigelt. *Research Quarterly of Exercise and Sport*, **1997**,68, *4*,362-7.
[5] G Wulf; M Höß; W Prinz. *Journal of Motor Behavior*, **1998**,30, *2*, 169-79.
[6] G Wulf; N McNevin; CH Shea. *The Quarterly Journal of Experimental Psychology*, **2001**, 54A, *4*, 1143-54.
[7] NH McNevin; CH Shea; G Wulf. *Psychological Research*, **2003**, 67, 22-9.
[8] G Wulf; M Weigelt; D Poulter; N McNevin. *Quarterly Journal of Experimental Psychology*, **2003,** 56, *7*, 1191-212.
[9] JP Maxwell; RSW Master. *International Journal of Sport Sciences*, **2002,**14,70-88.
[10] G Wulf; T Tollner; CH Shea. *Research Quarterly for Exercise and Sport*, **2007**,78, *3*, 257-64.
[11] T Zachry; G Wulf; J Mercer; N Bezodis. *Brain Research Bulletin*, **2005**, 67, 304-9.
[12] DC Marchant; PJ Clough; M Crawshaw. *International Journal of Sport & Exercise Psychology*, **2007,** 5, *3*, 291-303.
[13] T Emanuel; M Jarus; Bart O. *Physical Therapy*, **2008**, 88, *2*, 251-60.
[14] SM Weiss; AS Reber; DR Owen. *Journal of Sports Sciences*, **2008**, 26, *10*,1049-57.
[15] G Wulf; B Lauterbach; T Toole. *Research Quarterly for Exercise and Sport*, **1999,** 70, *2*, 120-6.
[16] G Wulf; J Su. *Research Quarterly for Exercise and Sport*, **2007**,78, *4*, 384-9.
[17] JJ Bell; J Hardy. *Journal of Applied Sport Psychology*, **2009**, 21:163-77.
[18] K Zentgraf; J Munzert. *Psychology of Sport and Exercise*, **2009**, 10, *5*, 520-5.
[19] G Wulf; N McConnel; M Gartner; A Schwarz. *Journal of Motor Behavior*, **2002,** 34, *2*, 171-82.
[20] MD Maddox; G Wulf; DL Wright. *Journal of Exercise Psychology*, **1999**, 21, S78.
[21] P Caliari. *Journal of Applied Sport Psychology*, **2008**, 20, 88-96.
[22]J Vance; G Wulf; T Tollner; N McNevin; J Mercer. *Journal of Motor Behavior*, **2004**, 36, *4*, 450-9.
[23] J Thorn. PhD thesis, Florida State University (Tallahassee, USA, **2006)**.
[24] P Weir; NH McNevin; T Quinn; G Wulf. The effect of attentional focus and age on supra-postural task performance. the Annual Meeting of the Canadian Society for Psychomotor Learning and Sport Psychology (SCAPPS), Niagara Falls, Canada, **2005**.
[25] CG Canning. *Parkinsonism and Related Disorders*, **2005**, 11, 95-9.
[26] G Wulf; M Landers; R Lewthwaite; T Töllner. *Physical Therapy*, **2009**, 89, *2*, 162-73.
[27] SE Fasoli; CA Tromblu; L Tickle-Degnen; MH Verfaellie. *The American Journal of Occupational Therapy*, **2002**, 56, *4*, 380-90.
[28] G Wulf. Attention and Motor Learning, Human Kinetics, Illinoise, **2007**.
[29] N Perkins-Ceccato; SR Passmore; T Lee. *Journal of Sport Sciences*, **2003**, 21,593-600.
[30] SL Beilock; TH Carr; C MacMahon; JL Starkes. *Journal of Experimental Psychology: Applied*, **2002**, 8, *1*, 6-16.
[31] SL Beilock; BL Bertenthal; A McCoy; T Carr. *Psychonomic Bulletin & Review*, **2004**,11, *2*, 373-9.
[32] R Gray. *Journal of Experimental Psychology: Applied*, 2004,10, *1*, 42-54.
[33] B Castaneda; R Gray.*Journal of Sport & Exercise Psychology*. **2007**, 29, *1*, 60-77.
[34] R Lidor. *Movement [Be'tnua]*. **1993**, b, 104-24.
[35] R Lidor; RN Singer. Performance routines in self-paced tasks: developmental and educational considerations. Fitness Information Technology, Morgantown, **2003**; pp. 68-98.
[36] S Cohen-Nachman; A Madkar. *Journal of Occupational Therapy*, **2001**, 10, 23–41.
[37] NL Eoff. PhD thesis, Arizona State University(Tempe, USA, **1985)**.