The Effects of Attentional Focus Strategies on The Performance and Learning of Soccer-Dribbling Task in Children and Adolescences

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Abstract
The aim of this study was determine the effects of internal versus external attentional focus strategies on the performance and learning in novice children and adolescences. At the practice phase, participants (76 men; 8-9; 10-11; 13-14 years, & right-foot dominant) without prior experience were required to dribble a colorful soccer ball quickly and accurately through a slalom course on the grass field. Participants were randomly assigned to two groups. They asked to recall which part of the foot (internal) was touching the ball or which color of the ball (external) is facing up at 3 random points during the trial. Retention and transfer (external evaluation) performed without instructions or reminder on day 2. Movement time (MT) and errors data were analyzed in analysis of variance with repeated measures on the trials. The internal focus condition had lower errors during practice, but the external focus showed faster MT during transfer.

Keywords: motor learning, soccer, children, adolescence, attetnional focus

Introduction

Numerous anecdotal (e.g., Kimble & Perlmuter, 1970; Klatzky, 1984; Masters, 1992; Schmidt, 1988) and experimental (Baumeister, 1984; Wulf & Weigelt, 1997) studies have shown that the learning of motor skills can be degraded if the learners pay too much attention to their performance. For example, Wulf and Weigelt (1997, Experiment 1) found that providing participants with instructions about how to best perform the ski simulator task hampered learning in beginners. These findings are quite worrisome if one considers that the instructions and feedback provided to learners in an attempt to guide them to the correct movement form - for example, in sport settings - typically refer to the spatiotemporal coordination of various movement components. Also, at the initial stages of novel skills acquisition, the instructions and feedback almost necessarily direct the learner's attention to their performance and hence, attention is committed to controlling task performance (Nissen & Bullemer, 1987; Cohen, Ivry, & Keele, 1990). In recent years, for optimizing the instructions or feedback provided for motor skills learning, Wulf et al. (for a review see Wulf & Prinz, 2001; Wulf, 2007), suggested that directing the performer's attention to the effects of their movements on the environment, such as the apparatus or implement (external focus), leads to more effective learning than directing attention on their body movements (internal focus). The advantage of external than internal focus of attention is revealed in skill acquisition (e.g., McNevin, & Wulf, 2002; Wulf, Mercer, McNevin, & Guadagnoli, 2004), retention or transfer (e.g., Wulf, Höß, & Prinz, 1998, Experiment 2; McNevin, Shea, & Wulf, 2003; Wulf, Shea & Park, 2001), and mostly both skill acquisition and learning conditions (e.g., Wulf, Höß, & Prinz, 1998, Experiment 2; Totsika & Wulf, 2003; Wulf, Lauterbach, & Toole, 1999; Shea, & Wulf, 1999; Liu, Lee &

Sheila, in review). Recently, this advantage is generalized to the balance performance and learning of 9-10 and 11-12 years old children on a Biodex Dynamic Balance System (Thorn, 2006). Wulf, McNevin, & Shea, (2001) proposed "constrained action hypothesis" for these results. According to this hypothesis, attempts to control ones own movements consciously (internal focus) disrupt functioning of the motor system by interfering with automatic control processes. In contrast, focusing on the effects of ones movements promotes the use of automatic control processes, allowing the motor system to self-organize more naturally.

On the other hand, a number of other studies have demonstrated the differences in the attentional mechanisms of novice performers using manipulations check at the initial stages of skill acquisition (e.g. Beilock, Carr, MacMahon, & Starkes, 2002, experiment 2; Beilock, Bertenhal, McCoy, & Carr, 2004, experiment 1; Ford, Hodges, & Williams, 2005). For example, Beilock, et al. (2002, experiment 2) found these differences in a soccer dribbling task through a series of pylons in less skilled soccer players (college). Authors reported that participants performance was poorer while listening to a series of words and speaking the target word out loud when detected (dual-task condition), in comparison to those performers who focused on the side of their foot which was in contact with the ball and, upon hearing the tone, individuals verbally indicate whether they had just touched the ball with the outside or inside of their foot (skill-focused condition). In sequence, Beilock, et al. (experiment 1, 2004) showed novices golfers (college) performed better under monitoring their swing and attempt to keep their club head straight as it traveled toward the target during their swing and saying the word ***straight*** out loud at ball contact (skill-focused) rather than the individuals who putted while simultaneously listening to a series of tape recorded tones and monitoring the tones, and each time they heard a specified target tone, they were to say the word ***tone*** out loud (dual-task condition). Also, Ford, Hodges, and Williams (2005) reported that for low-skilled performers (college), instructions that induced an internal, skill-relevant attentional focus do not degrade performance, while irrelevant instructions (arm) are detrimental to performance through a soccer dribbling task. These studies have shown that focus on the relevant aspects of task is more beneficial for novice participants. Authors linked their results to the theories of skill acquisition. On the basis of these theories, early in learning, skill execution is supported by a set of unintegrated control structures that are held in working memory and attended to one-by-one in a step-by-step fashion (Anderson, 1983, 1993; Fitts & Posner, 1967).

Recently, Castaneda and Gray (2007) explored the effects of attentional focus in a baseball batting simulation on Less-skilled baseball players (college) at the acquisition stage. The results of the mean temporal swing error (MTE) showed that there was no significant difference between the MTEs of those participants focusing on the movement of the hands (skill/internal) and those focusing on the bat while they were asked to judge whether the direction of their hands (internal group) or the bat (external group) was moving upward or downward at the instant in time that an auditory tone was presented.

There is an important difference between experimental methodology of verbal instructions and manipulation check conditions (Castaneda & Gray, 2007), and there are some experimental differences between these two series of studies as well. Considering these differences will be helpful for a better understanding of attentional focus strategies which are involved in the motor skills learning. First, on the basis of "constrained action hypothesis", a direct focus of attention is defined as external attentional focus while in a number of other studies; they are recognized as internal or self-focused conditions (Beilock et al. 2004; Perkins-Cecctto et al. 2003). Second, the information of dual-task (as external focus) conditions versus self-focused condition (Beilock et al. 2002, experiment 2; Beilock et al. 2004) were unrelated to task. Also, in these studies external sources did not provide any information about task performance in contrast to internal or self-focused sources; thus, it might be an unfair comparison. Third, in the manipulation check or dual-task studies, the authors have only reported the results of practice phase (e.g., Beilock et al. 2002, 2004; Perkins-Ceccato et al. 2003; Reeves 2005; Castaneda & Gray, 2007), while mostly attentional focus studies have shown the advantages of an external focus versus an internal focus in delayed retention tests without instructions or reminders to assess learning effects (e.g., Wulf, Höß, & Prinz, 1998, Experiment 2; McNevin, Shea, & Wulf, 2003; Wulf, Shea & Park, 2001; Shea, & Wulf, 1999).

This study was designed to determine whether the advantages of an external versus internal focus would also be found in novice children and adolescences. On the basis of Wulf et al. findings on novice participants, we assumed that an external focused condition would have a similar role on the performance and learning of children and adolescences. Also, significant age differences have been found to be associated with many motor tests (Garcia, 1994; Thomas & French, 1985; Nelson, Thomas, & Nelson, 1991). Young children process the information more slowly and with more errors than older children and adults (Burton, 1987; Chi, 1976; Kail, 1991; Sugden, 1980; Thomas, 1980; Yan, Thomas, Stelmach, & Thomas, 2000) because children are generally less proficient in the movement tasks in comparison to adults. Additionally, we were interested in examining the role of attentional focus strategies in childhood and adolescence as the teachers can have an important role on the children's motor skills during the early school years and they should provide instruction, motivation, and encouragement, for the children's movement behaviors and practice opportunities (Rink, 2002). Hence, we chose a dribbling task that is a fundamental skill in soccer and is used a lot by the children and adolescences during physical education classes. In the game of soccer, the primary skill that will satisfy the players is the ability to dribble a soccer ball with their feet and it is supposed that all the players must be able to keep the ball within their control while moving, standing, preparing to pass or shooting (Mielke, 2003).

Moreover, we wanted to determine whether the differential effects of attentional focus have only an immediate effect on performance (i.e., only present when the individual adopts the respective focus), or whether they represent a relatively permanent learning effect on children and adolescences. That is we asked whether the committed attention to the control of task performance (applied at the acquisition stage by the external and internal focus) have a similar role on task performance and learning. Also, we asked whether an external focus would be advantageous over an internal focus when the motor task is performed in the presence of others. According to Zajonc's theory (1965), mere presence of others produces the drive-like effect while other studies have demonstrated the similar evidence that the mere presence of others is not sufficient to produce the drive effect (e.g., Cottrell, Wack, Sekerak, & Rittle, 1968; Hency & Glass, 1968; Klinger, 1969; Martens & Landers, 1972; Sanders, Baron, & Moore, 1978). A number of other studies have suggested that the perception of evaluation apprehension, or the awareness of the fact that others are observing their performance causes performers to focus on the process of the skill, therefore it interferes with its automaticity, and ultimately results in a diminished performance (e.g., Cottrell, 1972; Baumeister, 1984). Masters (1992) argued that performance pressure is detrimental only for complex, multi-step skills, and it does not cause choking in simple tasks. Therefore, in order to provide a pressure situation we used evaluators who were the participants©fellow classmates and the coach. Participants were told that their coach and teammates would be evaluating their performance (see Reeves, 2005). As a result, we supposed that this would be a significant pressure condition for participants and team athletes (Baumeister, 1984; Paulus, Shannon, Wilson, & Boone, 1972). We also assumed that the external focus would be more beneficial than the internal focus, because focusing on the effects of one© movements promotes the use of automatic control processes (Wulf et al., 2001). Therefore, controlled structures that are instructed under relevant-external focus cues may relatively be in more harmony with external distraction stimulus when compared to relevant-internal focus cues.

In summery, we examined the effects of given attentional focus conditions on the performance and learning of novice children and adolescences on two groups of the participants that were practicing the soccer-dribbling task. One group of the participants was provided with internal focus manipulation check and the other group was given external manipulation check during each trial. Learning was assessed one day after the practice session via retention and transfer (external evaluation) tests without any reminders.

Method

Participants

Seventy-six elementary ***(8-9 years, N=24, Mage=8.7, SD=0.94; 10-11 years, N=26, Mage=10.9, SD=0.91)*** and middle ***(13-14 years, N=26, Mage=13.8, SD=0.94)*** students of Arak city participated in this experiment. Participants were boy and right-foot dominant***.*** Participants were novice and they had no prior experience with the experimental task and were not aware of the study purpose. Informed consent was obtained from each participant before beginning the experiment.

Task and Apparatus

Participants were required to dribble a soccer ball through a slalom course, consisted of five cones of 40 cm high, 1.5 m apart for a total of 7.5 m, and back for a total distance of 15 m from the start to the finish line. This was considered one trial. The size of ball was 4 and the experiment was conducted on an outdoor grass field. Participants started on the line, moved between the cones, circled the final cone and then moved back through the cones to cross the finish line. A stopwatch was used to record the time in seconds that took a participant to complete one trial. Participants performed 15 trials for the practice phase and 5 trials in each of the retention and transfer tests.

Procedure

Participants filled in a questionnaire which involved questions regarding players© health and demographic information, and also their preference foot identification. In this study only individuals with right-foot preference were tested. Before starting the trials on the first day, the participants were told that their aim in the task was to dribble a soccer ball quickly and accurately through the slalom course. The Participants were randomly divided into two attentional conditions in each of the age groups: internal relevant manipulations check group versus external relevant manipulations check group. In this experiment participants used a special ball that was painted in different colors on its 3 sides (i.e., red, blue, and black). A similar dribbling task was used by Reeves, (2005). In each group the performance task was demonstrated and the errors were explained. A special form was used to record the time and the errors of each trial. The following data were considered as errors: hitting a cone (HC), missing a cone completely (MC), using the other foot (UF) at any time during the trial, and reporting any incorrect responses (IR). Participants completed an average of 3 to 4 warm-up trials, until they felt comfortable with the task. After the warm-up trials, all participants performed 15 trials under respective condition. Before each trial, the experimenter instructed the participants to the requirements of each condition. In the ***Internal, relevant attentional manipulation checks*** the participants were told to focus on the part of their dribbling foot that is in contact with the ball while dribbling through the slalom course on the grass field. They were told that it is important to focus on the dribbling foot because they will be asked to recall which part of the foot (i.e., inside, outside, instep) was touching the ball at 3 random points during the trial. The ability to recall which part of the foot was in contact with the ball ensured that the participants were attending to the dribbling foot. The reported information by the participants was recorded and checked for the accuracy, and then any errors in their ability to recall were marked. In the ***External, relevant attentional manipulation checks*** the participants were told to focus on the ball while dribbling through the slalom course on the grass field. They were told that it is important to focus on the ball because, they will be asked to recall which color of the ball was facing up at 3 random points during the trial. Being able to recall which part of the ball was facing up ensured that the participants were attending to the ball. The information reported by the participant were recorded and checked for the accuracy, and then any errors in their ability to recall were marked.

To assess the learning effects of the differential attentional focus conditions, retention and transfer tests were used on the second day. Tests were consisted of five trials and they were without any instructions or reminders. At First, retention test was performed. Ten minutes after retention trials, the participants performed transfer test under the pressure condition. In order to provide a pressure situation, we used external evaluation consisted of a participant's fellow classmates and the coach judging performance on a scale from 1 to 5, with 1being a poor performance, and 5 being a great performance. Before starting the evaluation trials, participants were told that their coach and teammates would be evaluating their performance on a scale from 1 to 5 (A similar dribbling task was used by Reeves, 2005). Additionally, they were told that the best performers will be selected to participate in a higher practice level.

Data Analysis

The main dependent variable was the time that measured by the total time in seconds. It took a participant to complete one trial. When participants passed the start line, the stopwatch began timing, and when they passed finish line, stopped timing. Accuracy data were also collected, corresponding to hitting a cone, missing a cone completely, using the other foot at any time during the trial, and reporting any incorrect respond (in practice phase). For errors in execution, we calculated differences scores between each error separately. The practice data were analyzed in a 2 (attentional focus) * 3 (age group) * 15 (trials) analysis of variance (ANOVA) with repeated measures on the last factor. Data for each retention and transfer test were analyzed in 2 (attentional focus) * 3 (age group) * 5 (trials) ANOVAs, repeated measures on the last factor. Greenhouse-Geisser epsilon values were used to adjust the degrees of freedom in all the ANOVAs to compensate for deviations from the assumption of sphericity.

Results

Practice

Movement time

Both groups showed considerable reductions in MT across trials, (see left panel of Figure 1), with the 13-14 years had fastest MT, whereas the 8-9 years showed the smallest MT, and the 10-11 years demonstrated intermediate performance time.

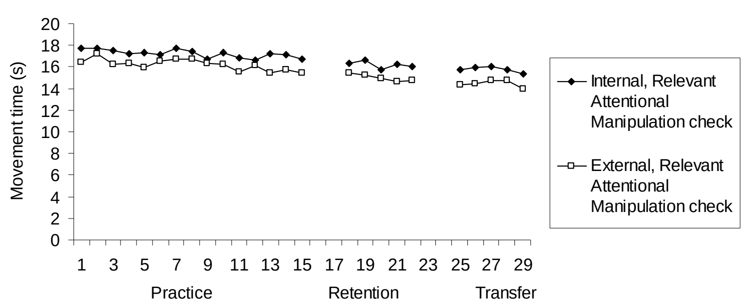


Figure 1. Average movement time (MT) of internal, and external relevant attentional manipulation check groups during the practice trials, retention, and transfer tests in soccer-dribbling task of children and adolescences.

The main effects of trials, ***F***(10.39, 727.70) = 3.70, ***p*** < 0.001, and age groups, ***F***(2, 70) = 60.52, ***p*** < 0.001, were significant (left panel of Figure 2). In addition, the interaction of age groups, groups and trials was significant, ***F***(10.39, 727.70) = 1.70, ***p*** < 0.05, while, the groups main effects, F(1, 70) = 2.29, ***p*** > 0.05, the age groups * trials interaction, ***F***(10.39, 727.70) = 1.39, ***p*** > 0.05, and the other main or interaction effects were not significant, all ***Fs < 1.***

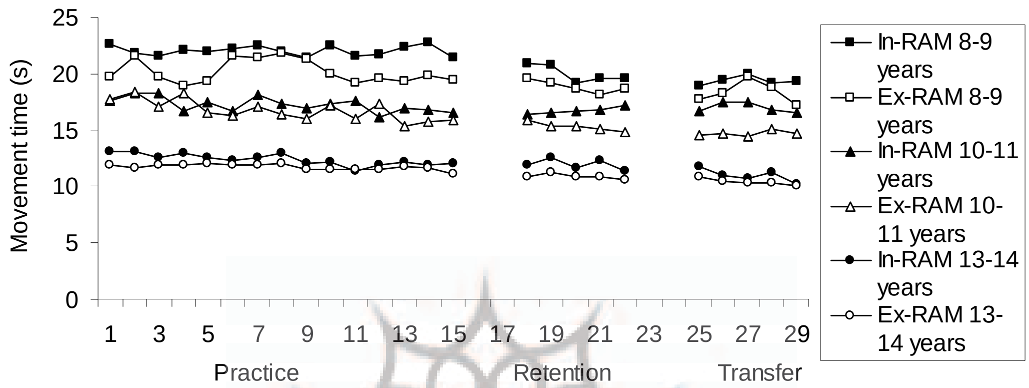
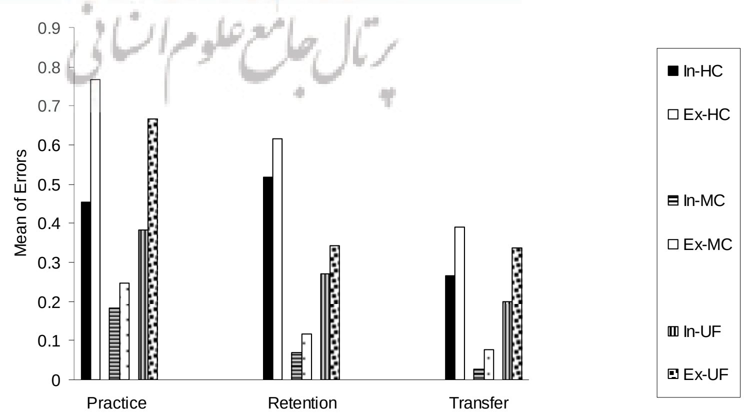


Figure 2. Average movement time (MT) of age groups of internal, relevant attentional manipulation check (In-RAM) and external, relevant attentional manipulation check (Ex-RAM) during the practice trials, retention, and transfer tests in soccer-dribbling task of children and adolescences.

Performance Errors

For errors in execution, we analyzed differences scores between each error separately. The mean of each error for both groups during practice trials can be seen in Figure 3 (left panel). For ***HC error,*** the errors decreased across practice trials, with the internal focus group and older children showing lower errors than the external focus group and smaller children. The main effects of trials, ***F***(10.96, 767.30) = 2.64, ***p*** < 0.01, group, ***F***(1, 70) = 21.62, ***p*** < 0.001, age groups, ***F***(2, 70) = 10.55, p < 0.001, and the groups * age groups interaction, ***F***(2, 70) = 5.59, ***p*** < 0.01, were significant. None of the other main or interaction effects were significant, all ***Fs < 2.***

Figure 3. Mean of errors of groups separately, internal-hitting a cone (In-HC), external-hitting a cone (Ex-HC), internal-missing a cone (In-MC), external-missing a cone (Ex-MC), internal-using other foot (In-UF), external-using other foot (Ex-UF), during practice trials, and retention and transfer tests in soccer-dribbling task of children and adolescences.



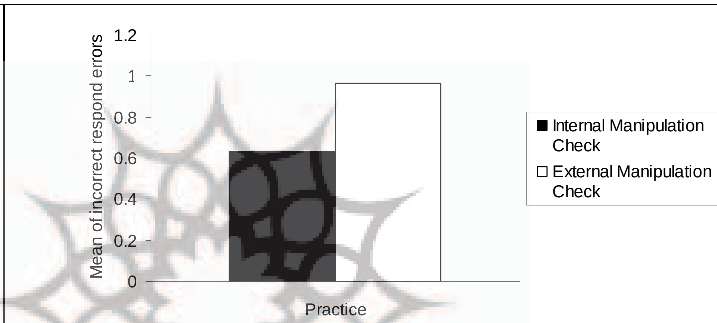
For ***MC error,*** the age groups main effect was significant, F (2, 70) = 4.61, p < 0.05, reflecting the fact that the 13-14 years had lowest errors, whereas the 8-9 years showed the largest errors, and the 10-11 years demonstrated intermediate performance errors. The main effects of trials * age group, ***F***(10.04, 703.16) = 1.53, ***p*** =

0.06, failed to reach significant. None of the other main or interaction effects were significant, all ***Fs* < 2.**

For ***UF error*,** the main effects of group, ***F***(1, 70) = 6.44, ***p*** < 0.05, age groups, ***F***(2, 70) = 6.18, p < 0.01, and the groups * age groups interaction, ***F***(2, 70) = 11.94, ***p*** < 0.001, were significant, showing that the 13-14 years had lower errors, whereas the 8-9 years were the highest errors, and the 10-11 years demonstrated intermediate errors**.** None of the other main or interaction effects were significant, all ***Fs* < 2.**

For ***IR error*,** as can be seen from Figure 4, the errors decreased across practice trials, with the internal focus group and older children showing lower errors than external focus group and smaller children. The main effects of trials, ***F***(11.09, 776.47) = 2.40, ***p*** < 0.01, group, ***F***(1, 70) = 12.68, p < 0.01, and age groups, ***F***(2, 70) = 38.10, p < 0.001, were significant. None of the other main or interaction effects were significant, all ***Fs* < 2.**

Figure 4. Mean of incorrect respond (IR) errors of internal, and external relevant attentional manipulation check groups during the practice trials, retention, and transfer tests in soccer-dribbling task of children and adolescences.



Retention
Movement Time

The MTs for both groups during retention trials can be seen in Figure 1 (middle panel). The age groups main effect was significant, ***F***(2, 70) = 49.99, ***p*** < 0.001, showing that the 13-14 years had fastest MTs, whereas the 8-9 years were the slowest MTs, and the 10-11 years demonstrated intermediate MTs (Figure 2, middle panel). The main effects of trials, ***F***(3.39, 237.80) = 2.39, ***p*** = 0.06, and group, ***F***(1, 70) = 3.27, ***p*** = 0.07, just failed to reach significance. The age groups * trials interaction F (3.39, 237.80) = 1.43, p > 0.05, and the other main or interaction effects were not significant, all ***Fs* < 1.**

Performance Errors

The mean of performance errors for both groups during retention test can be seen in Figure 3 (middle panel). The main effects of age group * trials interaction, ***F***(7.46, 261.23) = 1.73, ***p*** = 0.09, for ***HC error***, and age group, ***F***(2, 70) = 2.03, ***p*** = 0.1, for ***UF error*,** failed to reach significant. None of the other main or interaction effects were significant, all ***Fs* < 2.**

Transfer
Movement Time

The MTs for both groups decreased across transfer trials (see right panel Figure 1), with the external focus group and older children showing faster MTs than the internal focus group and smaller children. The main effects of trials, ***F***(3.78, 265.11) = 3.612, ***p*** < 0.01, groups, ***F***(1, 70) = 4.62, ***p*** < 0.01, and age groups, ***F***(2, 70) = 62.87, ***p*** < 0.001, were significant (Figure 2, right panel). Also, the age groups * trials interaction was significant, ***F***(3.78, 265.11) = 2.92, ***p*** < 0.01. Post hoc tests indicated that the older children had significantly faster MTs than smaller children during all transfer trials. The groups * age groups * trials interaction, ***F***(3.78, 265.11) = 1.56, ***p*** = 0.1, failed to reach significance***.*** The other main or interaction effects were not significant, all ***Fs < 1.***

Performance Errors

The mean of each error for both groups during transfer test can be seen in Figure 3 (right panel). ***UF error*** decreased during transfer test with the 13-14 years had lowest errors, whereas the 8-9 years showed the highest errors, and the 10-11 years demonstrated intermediate performance errors. The main effects of trials, ***F***(3.90, 273.48) = 2.96, ***p*** < 0.05, age groups, ***F***(2, 70) = 9.65, p < 0.01, were significant. Also, the main effects of group, ***F***(1,70) = 2.81, ***p*** = 0.09, for ***HC error***, group, ***F***(1, 70) = 3.02, ***p*** = 0.08, age group, ***F***(2, 70) = 2.35, ***p*** = 0.1, and group * age group interaction, ***F***(2, 70) = 2.50, ***p*** = 0.08, for ***MC error***, group, ***F***(1, 70) = 2.90, ***p*** = 0.09, and group * age group, ***F***(2, 70) = 2.57, ***p*** = 0.08, for ***UF error,*** failed to reach significant. None of the other main or interaction effects were significant, all ***Fs < 2.***

Discussion

The main goal of this study was to determine the effects of internal versus external attentional focus on the performance and learning of novice children and adolescences. The results of the present study has extended the previous findings as it shows the benefits of an external versus an internal focus of attention (e.g., McNevin, & Wulf, 2002; Wulf et al., 2004; Thorn, 2006) in the learning of a soccer-dribbling task in children and adolescences. The results demonstrated that although there was no difference between the MTs of the practice phase and the retention, the external attentional focus group was faster than the internal attentional focus group when the participants had to perform the practiced task (soccer-dribbling) under a stressful condition. This result was in line with the other studies that have shown the advantageous of the external versus internal focus of attention under a psychological pressure (Totsika & Wulf, 2003; Liu, Lee & Sheila, in review). According to the researches pressure incites the athletes to focus on the process of the skill which interferes with its automaticity, and results in an outcome that is suboptimal (Baumeister, 1984; Beilock & Carr, 2001, Lewis & Linder, 1997; Reeves, Acharya, Lidor, & Tenenbaum, in review). The results of the present study demonstrated that the external focus group would be more beneficial than the internal focus, because an external attentional focus promotes the use of more automatic control processes (Wulf et al., 2001). Consequently, controlled structures that are instructed under relevant-external focus cues may relatively be in more harmony with external distraction stimulus when compared to relevant-internal focus cues.

The results of this study at the practice phase showed that the internal focus group had fewer errors than external focus group. The fact that judgment errors are smaller for the internal group could perhaps be explained by the fact that participants could feel which part of the foot was touching the ball (even when they did not look at it). But in the external condition, participants had to look at the ball – while they probably do not do it all the time.

Also, there were no group differences during the practice and retention based on MTs. A possible explanation for that difference might be related to task demands. Soccer-dribbling task seems to be more motor in nature and may not be affected by cognitive intervention strategies, such as those imposed by instructions, until a certain skill level is reached (Wulf et al., 1998).

Conclusion

In summary, we would conclude that directing the participants©attention to the external aspect of skill execution (e.g., ball) in comparison to the internal aspect (foot) will be more useful for novice children and adolescences in a pressure condition, however, the results of the acquisition phase must be treated with caution. Consistent with the "constrained action hypothesis" (Wulf et al., 2001), our results showed that focusing on the effects of ones movements (external) in comparison to ones own movements (internal) promotes the use of automatic control processes which allows the motor system to self-organize more naturally. The results of the present study can be used to enable teachers and coaches in helping the athletes to reach their highest potential. However, future studies are necessary.

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