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Original Article

Influence of attentional instructions on football juggling performance in children

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Abstract:
Success in football requires skilled control of the ball. Juggling is a fundamental skill that improves leg-eye coordination. The purpose of this study was to examine the influence of adopting an external, internal, and neutral focus of attention while football juggling is performed. Twenty-two young male football players (age 10.6 ± 0.5 years) were asked to perform juggling with their dominant foot. Each participant completed three trials under the following conditions: under an external focus (the ball), under an internal focus (foot), and a control (no attentional instruction). Three sessions were conducted in a limited zone (3×3 meters), and three sessions were conducted in an unlimited zone. The use of external and internal foci resulted in a greater number of touches compared with the control condition in the unlimited zone. In turn, only the external instruction produced advantages for juggling compared with the internal and control conditions. These results show that instructions to adopt external and internal foci promoted football-specific skills. When the findings are taken as a whole, it is clear that directing attention externally should be prioritized for motor learning and performance in children.
Key Words: focus of attention, motor performance, soccer, young players

Introduction

To be effective during the match, football players have to skilfully control the ball with their feet. For children, juggling the ball with the foot is a fundamental exercise for the football-specific skills such as dribbling or reception of the ball. Thus, juggling is frequently used in training programmes and for testing of football skills, especially in young players (Weigelt, Williams, Wingrove, & Scott, 2000; Bozkurt, & Kucuk, 2018). In general, this exercise involves rhythmic kicking of the ball with one foot (as many times as possible or as many times as possible within a given time) while standing on the contralateral leg. In addition, juggling improves perceptual-motor skills such as visual anticipation (the spin and direction of the flight of the ball), balance and intra- and interlimb coordination (Tlili, Mottet, Dupuy, & Pavis, 2004).

Movements are performed fluently and efficiently when a group of muscles are well coordinated. From a motor learning perspective, the key point for the early stages of learning is to acquire a new skill by producing a correct movement pattern. Because this process requires attention of the learners (Sullivan, Kantak, & Burtner 2008), it is a common practice to facilitate learning of a novel motor skill by directing the learners' attention to the parts of their body or body movement's coordination (Beilock, Carr, MacMahon, & Starkes, 2002). These types of instruction promote a greater awareness of the movements and make this process more conscious. This may result in developing an automatic execution of the movement (Abdollahipour, Psotta, Palomo, & Wulf, 2017). A large body of research have shown that directing an athlete's focus towards the movement of their own body during the motor skill performance (internal focus of attention) disrupts motor learning and performance. Whereas paying attention to the environmental effects of the movements (external focus) led to better performance (Wulf, 2013). Providing the external focus instruction has been demonstrated to improve the performance of specific sports skills such as basketball free throw (Zachry, Wulf, Mercer, & Bezodis, 2005), football kick, and volleyball serve (Wulf, McConnel, Gärtner, & Schwarz, 2002). For example, Zachry (2005) found an increase in accuracy in American football kick during the external focus condition compared with the internal focus condition. In addition, a study by Ford, Hodges, Huys, and Williams (2009) suggested that in skilled and novice football players, focusing on the ball trajectory (external) during football-specific exercises was more beneficial for motor performance (movement kinematics) compared with focusing on the body. Several other studies have shown gains in balance and greater whole-body coordination patterns (Flores, Schild,

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& Chiviacowsky, 2015; Porter, Makaruk, & Starzak, 2016) when an external focus of attention is adopted rather than an internal focus.

The constrained action hypothesis is proposed to explain these motor learning and performance benefits (Wulf, McNevin, & Shea, 2001). This hypothesis suggests that direction of attention towards the movement disrupts automatic (i.e., non-conscious) processes of motor behaviour. This interruption in automatic control processes degrades motor performance. In contrast, focusing on the results of the movements promotes automatic processing and, thereby, improves motor performance by more naturally self-organizing the motor control system (Bernstein, 1996).

However, there are a few studies that do not report positive benefits of adopting an external focus (Uehara, Button, & Davids, 2008; Zentgraf, & Munzert, 2009). Some researchers claim that when the instruction involves the main object of the motor task, external cues may be redundant in the task where the instruction refers to the task-relevant feature (e.g., hand juggling the balls) (Zentgraf, & Munzert, 2009). Moreover, other researchers believe that an internal focus is necessary and beneficial in early learning because it may provide additional information for the learners (Beilock et al., 2004; Uehara et al., 2008). According to the studies of football skills conducted by Bailock et al. (2004) and Uehara et al. (2008), the influence of attentional focus instructions may depend on the level of skill proficiency.

In the field of attentional foci, there are several studies that incorporated a control condition consisting of neutral stimuli. For example, Porter, Nolan, Ostrowski, and Wulf (2010) have reported that when participants were given neutral instructions or when they accomplished the task without an instruction, the participants achieved similar results to the trials completed under the internal condition.

Tlili et al. (2004) suggested that attention is shared across two main tasks during football juggling. The first is dynamic stabilization segments of the body, and the second is dynamic stabilization of the ball. This dual-task condition requires that attentional control is constantly maintained and effectively used to execute the task. Therefore, we assume that identification of the key attentional strategies for keeping the ball under control is an efficient way to adopt an established movement pattern for football juggling in children. Thus, the aim of this study was to examine the effects of attentional focus instructions on the performance of juggling task in young football players.

Materials and Methods

Participants

Twenty-two young male players from a football academy, with a mean age of 10.6 ± 0.5 years and 3.1 years of sport experience, participated in this study. Before participating in the experiment, all of them read and signed an informed consent. The research was approved by the Ethics Committee at the Josef Pilsudski University of Physical Education in Warsaw.

Apparatus and task

All of the tests were performed at a football field with players wearing football shoes. The limited zone (3×3 m) was marked with a 5-cm-wide white tape, which was clearly visible by the participant while he performed juggling. The ball (size 4) was used in accordance with the FIFA rules.

The task required the participant to bounce the ball with his dominant leg (foot) while standing on the other leg. The ball was picked up with the hands to start it bouncing. Then, the participant started to kick the ball up as many times as possible within 30 s with one leg, using only the instep of the other leg to keep it in the air (Raastad, Aune, & van den Tillaar, 2016). The task was completed when the ball touched the ground or when the participant touched the ball with another part of his body (no instep), or when the participant left the marked zone. Each participant had three attempts. The best scores (the highest number of touches) was used for further analysis.

Procedure

During the standardized warm-up (20 minutes), each participant had several familiarization trials. Then, each participant performed three testing trials in each of six testing sessions. Three sessions were conducted in a limited zone, and the remaining three sessions were conducted in an unlimited zone. Each session involved only one type of instruction. Using a within-participant design, the participants performed each of the three focus of attention conditions: external focus (EXF), internal focus (INF), and the control (CON) in a random and counterbalanced order (across participants) to avoid learning effects. There were three sequences of treatment (e.g., EXF-INF-CON, INF-EXF-CON, and CON-INF-EXF). Testing sessions were separated by three or four days. After the general instruction, the participant received a specific instruction for the condition. The instruction given prior to the EXF condition was: "When you are juggling, focus on the ball." The instruction for the INF condition was: "When you are juggling, focus on your foot". When the participants were under the CON condition, they were simply told: "Perform the task to the best of your abilities." This instruction was designed to be neutral and to not promote a specific focus of attention.

Statistical analysis

A computer program (Statistica version 13.1, StatSoft Poland) was used for all statistical calculations. Descriptive statistics are presented as the mean and standard deviation (M ± SD). The Shapiro-Wilk test of normality was applied to check whether the data were normally distributed. A one-way ANOVA was performed

to examine whether there were significant differences among the three conditions (i.e., INF, EXF, and CON). Tukey's *post-hoc* tests were applied when significant effects were observed. In the test, $p<.05$ was used as the level of significant differences. Cohen's effect-size statistics (ES) were calculated to determine the magnitude of observed differences between conditions using the following thresholds: >.5=large, .2-.5=moderate, <.2=small (Cohen, 1988).

Results

The unlimited zone

One-way repeated measures ANOVAs indicated a significant main effect on football juggling in the unlimited zone ($F_{2,42}=8.85$, $p<0.001$, $\eta_p^2=0.30$) – Fig. 1. The results of the *post-hoc* analysis showed that both the external and internal foci of attention resulted in a greater number of touches compared with the no attentional (control) condition ($p<0.001$, ES=0.43; $p<0.05$, ES=0.27, respectively).

The limited zone

The results of ANOVA also revealed a significant main effect on football juggling in the limited zone ($F_{2,42}=7.68$, $p<0.01$, $\eta_p^2=0.27$) – Fig. 2. Follow up analysis demonstrated that the number of touches under the external focus condition was higher compared with the internal and control conditions ($p<0.01$, ES=0.39; $p<0.01$, ES=0.45, respectively).

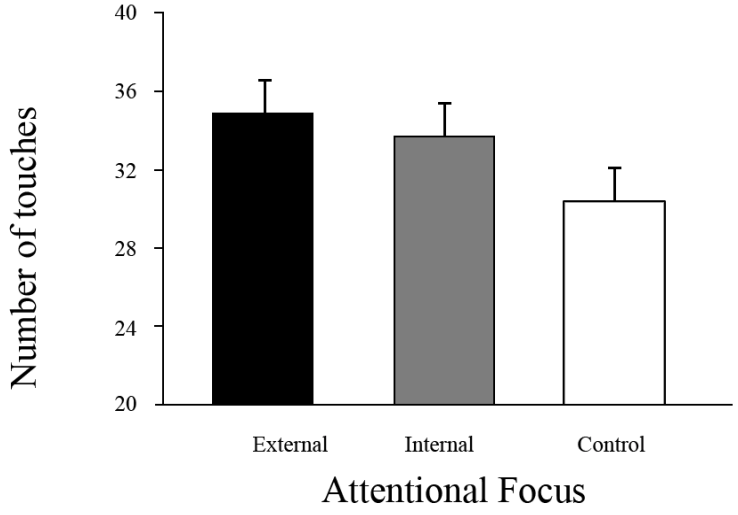

Figure 1. Mean (±SD) of the football juggling touches (or repetitions) in the experimental and control conditions in the unlimited zone

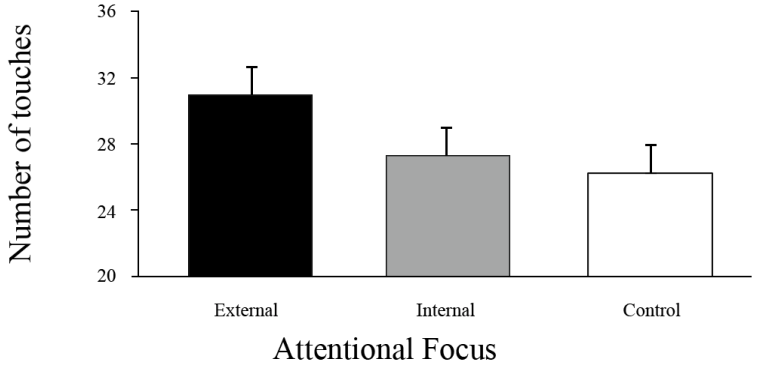

Figure 2. Mean (±SD) of the football juggling touches (or repetitions) under the experimental and control conditions in the limited zone

Discussion

The findings of this study partially confirmed the constrained action hypothesis, showing that in young football players, an external focus of attention produced a higher number of touches in football juggling in a limited zone compared with both internal and control conditions. There were no differences in the number of touches between the external and internal foci in an unlimited zone. In addition, the players performed juggling more effectively while using an internal focus of attention compared with no attentional focus (control condition).

Our results suggest that adoption of external focus of attention may be the preferred type of instruction to immediately increase movement effectiveness of football-specific tasks. Regardless of the conditions of task performance (type of zone), external focus showed the highest gains in motor performance. This suggests that instructions that direct an individual's attention to the movement effect produce the desired movement patterns. Based in this, we assume that the external focus of attention should be incorporated into motor learning programs in children. These observations do not support the suggestions of Zentgraf and Munzert (2009) that external focus cues are redundant when the instruction is related to the object representing the main goal.

In accordance with previous studies (Wulf, 2013), we found that external focus of attention resulted in better performance compared with internal focus when players performed juggling in the unlimited zone. However, the juggling outcomes were similar for external and internal conditions in the limited zone. These results are not consistent with the assumption of the constrained action hypothesis (Wulf et al., 2001), but they are in agreement with those of Uehara et al. (2008), who demonstrated that both attentional foci were beneficial for developing football skills during the early stages of motor learning. In addition, these researchers suggested that early learners may not rely on single attentional source during skill execution. Rather, they switch their attention interchangeably between both foci (external and internal) depending on the learning needs (e.g., additional information). It is also plausible that the instruction that induced internal focus ("focus on your foot") facilitated control of the ball due to more optimal movements (or position) of the foot than under the no attentional condition. During motor skill learning, the main difficulties faced by the learner are how to become proficient in mastering various degrees of freedom of single joints and muscles. It has been proposed that learners utilize freezing and freeing degrees of freedom (Bernstein, 1996). They initially freeze degrees of freedom in their limb to short the kinetic chains to simplify motor control during the early learning stages. It is plausible that directing attention to the foot helps the participants of this study to adjust their movements to the task. These results suggest that advanced beginners may benefit from instructions that direct attention toward movement performance in familiar or non-complex conditions.

The fact that the internal focus of attention resulted in better motor performance in an unlimited zone, and did not enhance performance in a limited zone compared with the control condition, may be caused by the amount of space for the performance of the task. Advanced beginners find it difficult to perform routine tasks when environmental conditions are changed (Castaneda, & Gray, 2007; Uehara et al., 2008). It is plausible that the spatial restriction of the task caused by the limited zone introduced additional task demands or increased complexity of the task (Lopes, Araújo, Duarte, Davids, & Fernandes, 2012). It has been found that internal focus imposed a greater load on working memory than external focus, and that when working memory is overloaded by new information, performance may decrease (Poolton, Maxwell, Masters, & Raab, 2006). It is possible that the internal cue was not effective compared with the external cue due to the overloading of working memory during the execution of the task. These finding are in agreement with the study by Kal, Van der Kamp, and Houdijk (2013) who found that the external focus instruction more effectively decreased attentional load.

There are two main limitations of this study. First, it is possible that the adherence to instructions was different due to the young age of the study participants. Future research should report the degree of adherence of participants to the focus instructions. Second, we only examined the immediate effects of motor performance. Therefore, future studies need to involve a motor learning approach.

Conclusions

Our results extend the previous studies (Wulf et al., 2002; Zachry, 2005) by showing that external focus instructions increase movement effectiveness in football-specific task and by demonstrating that internal focus may have positive contributions to motor performance in children. Taken together, our findings demonstrate that it is more effective to explicitly instruct young players to focus their attention externally or on the movement of their own body during the motor skill performance rather than only providing no attentional instructions. Coaches, instructors, and teachers, who work with young athletes should pay considerable attention to the content of instructions provided during training sessions because this directly influences how players direct their conscious attention.

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