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Are internal focuses really useful? A replication study in Basketball

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Abstract: To evaluate the external vs. internal focus during free basketball shots in non-basketball players. For this analysis 49 subjects participated in one baseline and one experimental session. During the baseline session all the participants performed 20 free basketball shots without instructions (Non-Instructions). During the experimental session participants were randomly allocated to one group: Dominant-Group, which performed the free basketball shots with the dominant hand; or a Non-dominant Group, which performed the shots with the non-dominant hand. Both groups performed 20 throws under internal and external focus of attention conditions. In the Dominant-Group internal focus of attention resulted in a higher number of successful shots compared with the external focus condition. Our study does not support previous findings and shows that external focus of attention impairs the performance of free basketball shots with the dominant hand in comparison with internal focus and ¨no instructions¨ conditions, in non-basketball players.

Key Words: Motor Learning, Sport Skills, Motor training, Internal focus

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Introduction

It is well known that the performance of motor skills can be shaped by the individual's focus of attention. Recent studies have explored whether the type of instructions or feedback that is provided can enhance the motor performance of an individual. For example, it has been reported that both experts and novels can benefit from external focus instructions in order to improve the performance in a variety of sports, such as volleyball [1], golf [2], and soccer [1]. However, others have shown this not to be the case [3]. Instructions of external focus of attention refer to the movement effect on the environment (e.g. an apparatus or an instrument) while internal instructions focus on the performer's body movements [4].

Many studies have reported that external focus of attention instructions are more beneficial to performance and learning compared with internal focus [5, 6]. However, only a small number of studies have examined this in relation to basketball skills [4, 7, 8]. These studies have focused on the free basketball shot, probably since shooting efficacy is a determinant factor in winning a game [9]. Weiss et al., (2008) evaluated the performance of free basketball shots in 100 non-basketball players and showed an advantage for external focus, although such an effect may interact with the individual´s focus of attention preference [10]. The authors noted that in certain instances, internal focus may benefit the performer. Another study showed that the performance of basketball players was better under familiar than unfamiliar focus conditions, irrespective of the focus of attention (internal vs. external) [8].

The studies of Zachry et al. (2007) and Zhedi et al. (2011) are of particular interest [4, 7]. Both studies used exactly the same focus of attention instructions, but found opposite results. The former study was the first to evaluate the external focus in the performance of basketball shots and showed that the accuracy was greater when participants adopted and external compared to an internal focus [4]. However, in the latter study subjects with higher levels of skill performance performed better with an internal focus of attention than with an external one [7]. Both studies also used the identical procedure to score the throw accuracy. This procedure assigns a 5-scale point to each shot according to the surface ball contact on the backboard (i.e. 5 points for a successful shot, 3 points for the ball touching the hoop). However, to our knowledge this scale has not been validated nor has its reliability been tested. In addition, the studies do not report the total number of successful shots and thus it is difficult to reach definite conclusions based on the reported results.

In summary, the effects of internal versus external focus of attention in free basketball shots remain inconclusive. The objective of the current study was to replicate the original study of Zachry and colleagues (2007), in order to test the reliability of their findings [4]. We used the same 5-scale scores, but unlike the former study we have also evaluated the total number of successful shots. In addition, we also explored the role of the focus of attention when subjects performed the same skill using the non-dominant hand. The use of the non-dominant hand is more difficult and requires a greater level of motor control, thus allowing us to evaluate the magnitude of the enhanced effect that is attributed to the focus of attention. This is of relevance for novel players, in order to determine whether focus of attention is beneficial to the initial learning phases of the skill.

Method

Participants

A total of 49 university students from the Institute of Physical Education and Sport of Galicia, Spain, participated in this study (6 females and 43 males; age 21 ± 4 years; height 1.75 ± 11 cm; weight 75 ± 6 kg). Subjects had at least 1 year experience in

playing basketball in a physical education class. All subjects gave their written informed consent after being informed of the protocol of the study. The experimental procedures conformed to the Declaration of Helsinki and were approved by the local ethics committee of University of A Coruña.

Procedure

The subjects took part in two sessions, a baseline and a second (experimental) session. The baseline session evaluated the level of performance of free basketball shots. After the baseline session, participants were randomly distributed in to two groups: a dominant or a non-dominant group. One month after the baseline session, the experimental session was conducted in order to evaluate the effect of focus of attention instructions on the performance of free basketball shots. All the procedures regarding the performance of free shots and focus of attention instructions have been replicated according to the methodology used in Zachry et al., (2007) [4].

Free basketball shots

The free basketball shots were performed in an official basketball indoor facility. Males and females used the basketball ball according to their gender. At the beginning of each session participants were provided with instructions of the correct free throw technique as previously described in Zachry et al. (2007) (table 1) [4]. Participants were also informed that accuracy of their shots would be scored as follows: 1 point for the ball touching the board, 2 points for the ball touching the board and hoop, 3 points for the ball touching the hoop, 5 points if the ball went through the hoop (successful shot) and 0 point for a missed shot.

Participants were positioned behind the free throw line and were asked to remain in a still position ready to shoot. The participants were instructed to perform the shot the moment that they heard the instruction "go" from the examiner. The examiner stood behind the participant and took note of the performance using the 5-points scale described above.

Table 1 General Free throw instructions given to participants [4]

Stance	
(1)	Square yourself to the basket—your shoulders and torso face the basket.
(2)	Place your feet about shoulder-width apart.
(3)	Bend the knees and waist slightly.
Grip	
(4)	Place your shooting hand (dominant) behind the ball, fingers spread almost to maximum.
(5)	Use the other (non-dominant) hand to stabilize the ball from the side
(6)	The ball should rest on the pads of the fingers and hand, not the palm.
Shot	
(7)	Get set by ensuring the knees and waist are slightly bent.
(8)	Shoot the ball by releasing the guide hand (non-dominant) and extending the knees and arms together.
(9)	Follow through with the shot by fully extending the elbow and letting the ball roll off the fingers—the wrist should snap toward the basket and the hand should hang when complete.

Baseline session

Participants performed a total of 20 free basketball shots with their dominant hand, divided in to two sets, with one minute rest periods between each set and 30 seconds rest periods between each shot. With the exception of the general instructions regarding the correct free throw technique no other information, feedback or any kind of instructions were provide before, during and after the performance of the shots. The performance during this session was defined as the ¨no instructions¨ condition.

Experimental session

The participants of the Dominant Group (n = 24), performed all the free shots with their dominant hand and the participants of Non-dominant Group (n

= 25) performed all the free shots with their non-dominant hand. The Dominant hand was assigned according to the shooting hand that was freely chosen by each participant in the baseline session. All participants performed free basketball shots under both external and internal focus conditions. For the external focus condition, subjects were instructed to concentrate on the center of the rear of the basketball hoop. For the internal focus condition, participants were instructed to concentrate on the "snapping" motion of their wrist during the follow-through of the free throw shot. The participants were reminded of the focus of attention instructions after every trial for the first three trials of each condition, and after every other trial after that. Participants performed a total of 40 trials of free shots distributed in two sets of 10 trials in each condition. Between each set and each trial there were rest periods of 1 minute and 30 seconds, respectively. The order of the conditions was counterbalanced between participants.

Statistical Analysis

Accuracy Scores were evaluated and defined as the sum of the points achieved by a subject, using the 5-points scale. The number of Successful Shots was also evaluated and analyzed separately.

Shapiro-Wilk tests were used to test the data normality. Accuracy Scores followed a normal distribution. On the other hand, the number of Successful Shots violated the normality assumption ($p < 0.05$), and non-parametric tests were performed in the analysis of this variable.

To explore group differences in the control condition, *independentt-tests* and U Mann-Whitney tests were used to compare the Accuracy Score and number of Successful Shots, respectively.

To compare the efficacy of the focus of attention instructions, two-way ANOVA was used for Accuracy Score values with "Focus" (external vs internal) as the within subject factor and "Group" (Dominant vs Non-dominant) as the between subject factor. Post hoc analyses were conducted using paired t-tests when a significant interaction was detected. In addition, nonparametric ANOVA-type statistics (Focus × Group) was conducted for the number of Successful Shots by using the nparLD R software package. If a significant interaction was detected, paired comparison was performed using the Wilcoxon signed-rank test.

To compare the effect of the focus of attention instructions versus ¨no instructions¨ in the Dominant Group a repeated-measures analysis of variance (ANOVA) was performed for the Accuracy Scores and a Friedman test for the number of Successful Shots, with Condition as the intra-subject factor (internal focus, external focus, no instructions). Post hoc analysis was performed using paired t-tests and Wilcoxon signed-rank test for Accuracy Scores and Successful Shots, respectively.

Effect sizes were computed using Eta squared (η^2) for variables with normal distribution (Accuracy Scores) and Cliff´s delta (CD) for variables for which normality could not be assumed (Successful Shots). All statistical analysis was performed using PASW Statistics 18 and the nparLD R software package.

Results

The baseline session showed no significant differences between the groups for the Accuracy Score and number of Successful Shots. In the Dominant group the mean Accuracy Score was 3.37 ± 0.47 and the mean number of Successful Shots was 7.91 ± 2.66 ($t = 0.16$ $P = 0.86$). In the Non-dominant Group the mean Accuracy Score was 3.4 ± 0.47 and the mean number of Successful Shots was 8.12 ± 2.61 ($Z = 0.21$ $P = 0.83$).

We compared the Accuracy Score using a two-way ANOVA (Group, Focus). There was a significant effect of Group ($F = 30.87$ $P < 0.001$, $\eta^2 = 0.39$, observed power = 100%) but no significant main effect for Focus nor a significant Group*Focus interaction. As expected, performance of the Dominant Group was significantly better than the Non-dominant Group ($P < 0.001$). The nonparametric ANOVA analysis of the Successful Shots revealed a

significant effect of group (χ^2 = 22.43 P < 0.001) and a significant Group*Focus interaction (χ^2 = 4.89 P < 0.05),but no significant effect for Focus (figure 1).

Post-hoc analysis showed a higher number of Successful Shots for the internal focus condition compared to external focus in the Dominant Group (Z = 2.75 P < 0.01 CD = 0.58). Eighteen subjects (75% of the total sample) achieved more Successful Shots under the internal focus condition in comparison with 4 subjects that performed better under the external focus condition. There were no significant differences between the focus of attention conditions in the Non-dominant Group.

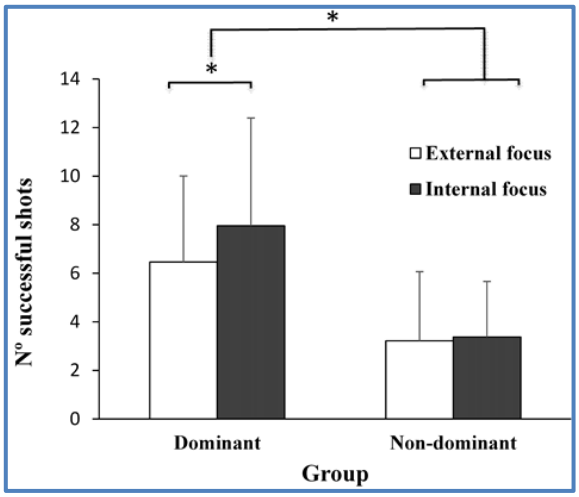

Figure 1 Comparison of the number of successful shots between Dominant and Non-dominant Groups. * p< 0.05.

The analysis of the Accuracy Score between focus of attention instructions and no instructions for the Dominant Group did not show any significant differences (figure 2a). However, the Friedmann test analysis of the number of Successful Shots showed a main effect of Condition (χ^2 = 8.09 P < 0.05). The post-hoc analysis showed that the number of Successful Shots achieved with ¨no instructions¨ was higher than in the external focus condition (Z = 2. 09 P < 0.05 CD = 0.59) but no differences were found between the ¨no instructions¨ and internal focus conditions (figure 2b).

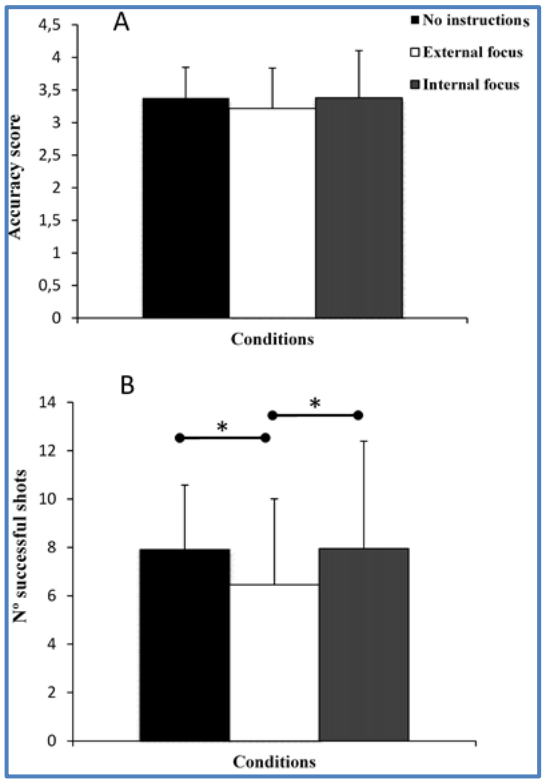

Figure 2 A) Accuracy Scores based in the 5-point scale; and **B)** Number of Successful Shots, for the Dominant Group in the ¨no instructions¨, internal, and external focus of attention conditions. * p< 0.05.

Discussion

The current study evaluated the effectiveness of the instructions related to the focus of attention during free basketball shots performed with either the dominant or the non-dominant hand. Our study fails to replicate previous findings that support the use of external focus instructions to enhance free basketball shot performance. We found that internal focus of attention instructions resulted in a higher number of successful shots compared with external focus when the shots were performed with the dominant hand. The performance with the internal focus instructions was not superior to that of free basketball shots in which no instructions were provided. Unexpectedly, external focus instructions impaired the performance in comparison with internal focus and the ¨no instructions¨ conditions.

In our study, movement accuracy was scored using the same previously described method (Zachry et al.,

2007), using a 5-point scale where 0 to 5 points are attributed to each shot [4]. Using this scale, we did not find differences in the performance of free basketball shots between external and internal focus conditions. This is in contrast with the findings previously reported by Zachry et al., (2007), where greater movement accuracy was observed in free basketball throw shooting under the external relative to the internal focus condition [4]. This inconsistence between the results of Zachry and colleagues (2007) and the current results is difficult to explain since the procedures in both studies were identical. We provided our participants with the same general free throw, internal and external focus instructions that were used in the study. The number of trials for each focus of attention condition was also identical and the participants in both studies were university students with at least 1 year of basketball experience. It should be pointed out that in our study, participants performed a control session of 20 trials of the free throws without verbal instructions, one month before the experimental session. However, it is unlikely that this control session could account for the difference in the results between the studies. We can speculate that the procedure used to measure the movement accuracy (the 5-point scale) may be unreliable since it has not been validated. The method attributes different scores according to the impact zone of the ball during a free basketball shot and the values obtained by this procedure provide, in the best of cases, a gross estimate regarding the accuracy of a free basketball shot.

The analysis of the number of successful shots provides us with more relevant information regarding the movement accuracy score, since a successful shot is the ultimate goal in basketball in terms of performance. Our study clearly shows that with internal focus instructions, participants that performed with the dominant hand were able to achieve a higher number of successful shots relative to external focus instructions. This effect was consistent across subjects, since 18 out of a total of 24 subjects performed better with the internal focus instructions. The subjects reported at the end of the experimental session that it was easier for them to direct the throw towards the hoop under the internal focus condition compared to the external focus condition. This observation is in line with the suggestion that external focus is more common in experts compared with novices [11-13]. Our results are not in line with an important number of studies that have reported a higher efficacy of the external relative to internal focus instructions during the performance of motor skills [14]. However, only two studies have explored the effect of internal vs. external focus instructions during basketball shots, using identical focus instructions. These studies showed inconsistent results, one showing enhanced performance with external compared with internal focus instructions, while opposite results were found in a later study that evaluated the efficiency of the focus of attention in free shots under psychological pressure.

Our current results showed that although the internal focus instructions enhanced performance compared with the external focus of attention, there were no differences in the performance between internal focus of attention and the ¨no instructions¨ condition. This is in line with a previous study that evaluated the performance in a soccer kicking task and reported no differences between a ¨no instructions¨ condition and either external or internal instructions [12]. However, most of the studies that include a control condition (without attention focus instructions) seem to support the effectiveness of the external focus condition [2, 15, 16]. We could speculate that in our study, the subjects tend to adopt an internal focus in absence of instructions, which could explain the similar performance observed when the internal focus instructions were provided. Therefore, external focus instructions could act as impairment rather than an enhanced performance factor during the free basketball shots. This is supported by our findings of the impaired performance that was observed during the external focus condition in comparison with the baseline ¨no instruction¨ condition.

While our results strongly point out to the advantage of using internal rather than external focus instructions for a free basketball shot, at least in non-basketball players, we must be cautions in applying this finding in a real sport life context. First, it seems that the effect of internal focus instructions used in our experiment is futile since the absence of instructions lead to same level of performance. In addition, the performance using the non-dominant hand was similar under both the external and internal focus of attention conditions, suggesting that the difficulty of the task can influence the effectiveness of the focus of attention instructions. Second, we should not infer that the focus of attention instructions induce the same cognitive strategies across all the subjects. Several factors, such as the individual preference for an internal or external focus [10], familiarity with the instructions [8], level of anxiety (Mullen and Hardy) and level of performance [7] may modulate the effect of the focus of attention instructions on individual performance. This may be another factor contributing to the inconsistencies between our findings and those of Zachry et al. (2007) [4].

The current study has several limitations. First, the nature of the focus of attention instructions that were used may not be the most logical or ecological approach to explore the role of the focus of attention. The internal focus was constrained to the wrist movement and the external focus to the center of the rear of the basketball hoop rather than providing a more informative and individual feedback. Second, the awareness of the participants of the performance score method may have affected the subjects´ strategy of the free shot instead of just achieving a successful shot. In addition, the instructions provide regarding the correct free throw technique, although identical to the previous study, may have modulated the individual effect of the subsequent focus of attention instructions [4]. If this is the case the instructions of the internal and external focus of attention may be futile.

Conclusion

In summary, the main finding of our study shows that external focus of attention impairs the performance of free basketball shots with the dominant hand in comparison with internal focus and ¨no instructions¨ conditions, in non-basketball players.

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Competing Interests

The authors declare that they have no competing interests.

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