



## Attentional focus on learning fundamental movement skills in children

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### Abstract

Several researchers studying focus of attention have concluded that the external focus is superior to the internal in learning motor skills in adults. However, there is limited research concerning the effect of different focus of attention on learning fundamental movement skills in kindergarten children. The present study aimed to compare the effectiveness of internal and external focus of attention on learning and transfer of a throwing skill in kindergarten children. Participants were 51 children (5-6 years), boys and girls, who were randomly selected and assigned into three groups: two experimental (internal and external focus respectively) and one control group. The movement form and the outcome of a throwing task were evaluated. It was found that both experimental groups improved over time, in both movement form and outcome. During the transfer test, the external focus group was better than the internal focus group in movement form; however, there were no differences in movement outcome. It is concluded that both the external or internal focus of attention improved over time the movement outcome and form of the throwing skill. Since the acquisition of sports skills requires the acquisition of fundamental motor skills, further research is needed to investigate the effect of the external or internal focus of attention on fundamental movement skills in kindergarten children.

**Keywords:** focus of attention, fundamental motor skills, kindergarten children, external/internal instructions.

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## INTRODUCTION

The choice of the learner's focus of attention, guided by the instructors before or after the execution of the sports skills, seems to play an important role in learning motor skills [1-4]. Learners can focus their attention either internally (on their body movements) or externally (on the outcome of their movements), and the direction of their focus may have a different effect on their performance [5].

In sports, the superiority of external focus of attention is supported by a significant body of research (for a review, see [6]) and the results show the superiority of the external focus of attention over the internal on the result of the movement in balance task [7], in serve task in volleyball [8], in basketball free-throw [9], in golf [10] or darts [11]. Besides, there are shreds of evidence that the benefits of the external method are retained over time [8,12,13].

Most of the studies examining the effect of external versus the internal focus of attention have mainly adults as participants [14-16]. However, few researchers have supported the superiority of external over the internal focus of attention in children in gymnastics for 12-year-old experienced gymnasts [1], in balance skill for 10-year-old children [17], in a throwing task for children aged 9-11 years [18], and in balance on a moving platform for 9 to 12 years of age [19]. Even if the acquisition and learning of fundamental motor skills are important for the learning of sports skills, few studies examined the effect of the focus of attention in fundamental motor skills in kindergarten children.

Wulf et al. [7] explained their results via the "constrained action hypothesis", which postulates that an external focus enables an unconscious, reflexive control mechanism to regulate the action (i.e. automatic processing), while an internal focus interrupts this automatic control by restricting the motor system. They further explained that an internal focus "*constrains the motor system by interfering with automatic motor control processes that would normally regulate the movement conversely, an external focus allows the motor system to more naturally self-organize, unconstrained by the interference caused by conscious control attempts*" (p. 1144). Chua et al. [20] also explained that training via external focus leads to automatic control processes and frees up that system to engage flexible, reflexive movement control processes, while Wulf and Lewthwaite [21] added that the external focus may enhance functional connectivity of task-relevant brain areas.

As mentioned above, many researchers have examined the effect of an internal or external focus of attention in adults (see [6] for review), fewer in children [1,17,18,22], and very few, in kindergarten children. Since the acquisition of sports skills requires the acquisition of fundamental motor skills [23], it is crucial to investigate the way the movement form and outcome of fundamental movement skills develop effectively in kindergarten children, a rather understudied population. Previous researchers primarily measured only outcome scores; studies examining the effects of focus of attention on both movement outcome and movement form are limited [22,24]. Finally, most of the researchers examined retention scores [25-28], while few examined the effectiveness of training methods with a transfer test [12,22,26], which is more appropriate in open skills. The present study investigated the effects of an internal and external focus of attention on the acquisition and transfer of fundamental motor skills (throwing), measuring movement outcome and movement form in kindergarten children.

## MATERIAL AND METHODS

### *Participants*

A private kindergarten was chosen as a sample of convenience. 51 children out of 112, aged 5-6 (M=5.4 years) of both sexes, were selected by lot to participate in the research in order to ensure the randomness of the sample. In the same way, 15 other children were selected as alternates, in case one or more children did not want to continue the research. They were randomly selected and assigned into an external focus of the attention group (n=17), an internal focus of the attention group (n=17), and a control group (n=17). Participants had no vision problems, motor impairment, or injury, which could affect the results of the study, and they were all right-handed. The children's parents signed an informed consent form.

### *Measures*

A target was placed on the floor at a distance of 2.8 m. Each child was asked to throw a beanbag at the target. General instructions were given to the participants, but without directing the children's attention to specific key points of the movement: "Stand here and throw the bag on the mat with the target, always with the same hand." The child was encouraged to throw with one hand. Before the first attempt, there was a demonstration of the execution. The first five attempts were practice trials followed by, 10 measured attempts. The same procedure was followed for the pre-test, post-test, retention test, and transfer test.

The movement outcome performance of the throwing task was evaluated via the Movement Assessment Battery for Children (MABC) [29]. The instrument was used the Greek version [30]. The movement outcome scoring was based on the number of successful throws (out of 10), with the child throwing the beanbag at a target on the mat. Ten throws were performed by each participant during each test (pre-test, post-test, retention test, and transfer test). The participants' score was calculated as the number of successful throws.

The movement form was evaluated by subjective rating by two independent raters (the independent raters were experienced on the tests and the processes). In a separate test, the internal consistency (inter reliability) of the two raters was evaluated, as well as their reliability the next day (intra reliability) through the re-evaluation and they were found to be within the acceptable limits. The evaluation criteria of movement form were: a) position – posture, b) keeping an eye on the target, c) swing of the hand, d) synchronization of body movements, e) push with the body, f) hand power control. Form score was calculated as follows: the participants were evaluated regarding their throwing form according to the six criteria for each throwing effort. For each criterion they achieved, they received one point so the final score for each effort ranged from zero to six. The sum of their scores in the 10 throws was their total form score, ranging from 0 to 60. Before testing, the researchers described the test, the purpose and then one of them executed the task as a demonstration.

In the transfer test, the distance to the target increased to 3.5 m and 30 degrees to the right. At the end of the effort, the children were asked to answer the question "What were you thinking about while you were executing the task?", in order to make it clear whether the child retained their attention in terms of the focus point (internally or externally), depending on the instructions received during the practice phase [19]. Correct answers were considered those which agreed with the focusing point instruction.

### *Procedure*

On the first day, a pre-test measurement of the throwing skill was conducted. On the second day, the experimental groups participated in the intervention program. On the third day, the final measurement (post-test) was performed to evaluate the performance. One week later the retention test was performed to evaluate the acquisition of learning, and one day after the transfer test was implemented to determine if the transfer of learning to different parameters was achieved.

### *Intervention program*

In the practice phase, each child was asked to throw a beanbag at the target. The children executed five sets of 18 attempts. Each group was instructed internally or externally on how to execute the motor task. One instruction was given after every three attempts. The control group did not participate in the intervention program, only in the measurements. The participants were instructed to "do their best by sending the beanbag to the target". After each instruction, we asked the child if he/she understood and if necessary we repeated the instruction. A brief description of the instructions given to the internal and external focus groups is provided in Table 1.

### *Analysis*

Independent variables were: a) the "group", consisting of three (3) levels: i) internal focus, ii) external focus and iii) the control group, and b) the "measurement", consisting of four (4) levels: i) the pre-test, ii) the post-test and iii) retention test, and iv) the transfer test. The dependent variables were the scores of the movement outcome and the movement form. A two-way factorial analysis of variance (3 group x 4 measurements) with repeated measurement of the last factor was conducted, and a post hoc Bonferroni test was used to analyze significant differences ( $p < 0.05$ ).

Table 1. Focus group instructions.

For internal focusing of attention	For external focusing of attention
<ul style="list-style-type: none"> <li>• When throwing the bean bag tilt your body from the back foot to the front</li> <li>• Put one foot forward and the other next to it and a little further back</li> <li>• Bring your hand behind your body, bend your elbow slightly</li> <li>• Stretch your elbow when you throw the beanbag</li> <li>• Move forward with your shoulder and open the palm as soon as your hand comes in front of you</li> <li>• Follow through the movement made by the bean bag with your hand by stretching it forward</li> </ul>	<ul style="list-style-type: none"> <li>• Focus on the target</li> <li>• Swing your body like a hammock towards the trajectory of the bean bag</li> <li>• Tilt your body towards the trajectory of the bean bag</li> <li>• Look carefully at the target before dropping your bean bag</li> <li>• Think about the trajectory of the bean bag to reach the target</li> <li>• Try to measure the distance to the target</li> </ul>

## RESULTS

### Assessment of movement outcome

a) There was a statistically significant main effect ( $F_{(2.15, 102.95)} = 17.59, p < 0.001$ ) between the four measurement periods for all groups. The post hoc Bonferonni analysis showed that, only for the experimental groups, mean performance improved from the pre-test to the post-test. No statistically significant difference was found from the post-test to the retention and then to the transfer test. The control group showed no significant improvement, b) There was a statistically significant main effect ( $F_{(2.48)} = 3.97, p = 0.025$ ) between the three groups, c) There wasn't a statistically significant interaction ( $F_{(2.22, 4.01)} = 0.55, p = 0.71$ ) between the four measurement periods and the three groups. The results are summarized in Table 2.

Table 2. Post hoc analysis of differences in movement outcome among groups and measurements.

Test	External (E)		Internal (I)		Control (C)		Post hoc test
	Mean	SD	Mean	SD	Mean	SD	
Pre-test (pre)	4.41	2.21	4.41	4.04	3.35	2.32	E=I=C
Post-test (post)	6.65	1.57	6.12	2.71	5.24	1.95	E=I>C
Retention test (ret)	5.94	1.81	5.59	2.55	4.65	1.73	E=I>C
Transfer test (tran)	5.18	1.70	4.59	2.03	3.82	1.42	E=I>C
Post hoc test	pre<post, post=ret, ret=tran		pre<post, post=ret, ret=tran		pre<post, post=ret, ret>tran		

SD – standard deviation

### Assessment of the movement form of the skill

a) There was a statistically significant main effect ( $F_{(2.12, 101.56)} = 387.46, p < 0.001$ ) between the four measurement periods. The post hoc Bonferonni analysis showed that for both experimental groups the average performance improved from the pre-test to the post-test and the transfer test, b) There was a statistically significant main effect ( $F_{(2.48)} = 10.95, p < 0.001$ ) between the three groups on the movement form. From the post hoc Bonferonni analysis it appeared that in the pre-test there were no statistically significant differences between the three groups. In the post-test, both the internal and the external focus groups were better than the control group. In the transfer test, the external focus group was better than the internal focus group, c) There was a statistically significant interaction ( $F_{(4.23, 101.56)} = 5.20, p = 0.001$ ) between the four measurement periods and the four groups in the movement form of the throwing. The results are summarized in Table 3.

Table 3. Post hoc analysis of differences in movement form among groups and measurements

Test	External (E)		Internal (I)		Control (C)		Post hoc test
	Mean	SD	Mean	Mean	SD	Mean	
Pre-test (pre)	3.88	2.20	5.76	3.52	3.82	2.29	E=I=C
Post-test (post)	15.88	1.40	15.06	2.92	11.71	2.39	E=I>C
Retention test (ret)	15.41	2.03	15.00	2.00	13.18	1.18	E=I>C
Transfer test (tran)	16.35	1.90	14.82	1.94	11.09	1.07	E>I>C
Post hoc test	pre<post, post=ret, ret=tran		pre<post, post=ret, ret=tran		pre<post, post=ret, ret>tran		

SD – standard deviation

## DISCUSSION

The present study aimed to investigate the effect of different focusing of attention (internal/external) on the acquisition and transfer of fundamental motor skill (throwing) in kindergarten children, a rather understudied population. Based on the previous literature, it was hypothesized that the group following the external focus of attention instructions would outperform the movement form and outcome of the internal focus of the attention group. Summarizing the results of the present study, according to the movement form, both the internal and external focus of attention groups improved their scores over time (from pre- to post-test) and maintained their improved performance on the retention test. The internal group maintained its improved performance during the transfer test, however, the external focus group had better scores than the internal focus group during the transfer test. According to the movement outcome: the internal and external focus of attention groups improved their movement outcome over time (from pre- to post-test and maintained their improved performance to the retention test). There was no difference between them during the retention or the transfer test.

According to movement form as evaluation criterion and as mentioned above, the results of the present study show an improvement in the movement form of both groups from pre- to post-test, and the improved performance was retained to the transfer condition. Trying to explain the results of the present study, on movement form, we found out that the results are partially supported by previous research that has shown that external focus may be more beneficial than internal focus in enhancing movement form [31]. The internal focus group may have reaped significant benefits from the kinesthetic feedback about the movement of the body, and therefore the technical (qualitative) characteristics of the execution were improved. Porter, Wu, and Partridge [32] showed that adopting internal focus strategies improves movement form. The improvement of the external attention focus group regarding the movement form can be explained since it seems that the task was not difficult, and the external focus of attention increased automaticity in movement control and was performed with greater efficiency [7,33].

As mentioned above, in the present study the external focus group had better movement form scores than the internal focus group during the transfer test. The external focus plays a dual role because it reduces the focus on the self and directs attention to the task goal [1]. According to the constrained action hypothesis [7,33], attention to the task goal increases automaticity in movement control, and movements are performed with greater efficiency. Lohse and Sherwood [37] asserted that external focus recalls less cognitive information, thus allowing automated control of the movement and maintenance of the quality of the execution. Perreault and French [18] mentioned that goal-related thoughts are developed in the external focus condition and self-related thoughts are developed in the internal focus condition. By reducing self-focus and ensuring a focus on the task goal, an external focus directly connects goals and actions, termed “goal-action coupling” by Wulf and Lewthwaite [21]. On the other hand, however, an internal focus results in conscious control of the movements and interferes with automatic control processes [3,35]. Thus, during the transfer test, the participants in the internal focus group of attention continued to focus their attention on the movement of their body parts rather than allowing automated control of the movement, creating complex models of rules.

Regarding the movement outcome, the results of the present study showed that both experimental groups improved over time, and also there was no difference between them during the

transfer test. The external and internal focus of attention groups improved the movement outcome over time for different reasons. The external focus of attention group directed their attention towards the trajectory of the throwing or to the target, leaving the automatic motor control mechanism to operate without restriction and improving the movement outcome scores. Since the skill was considered rather easy and automatically controlled, the internal focus group probably switched their focus of attention between the movement or the target [35], and this resulted in the improvement of the outcome scores. Furthermore, this group received internal visual feedback, and this information might have led to a successful result [32]. The current results are in line with those of other relative studies that show an improvement in the outcome scores of the group that received instructions to focus attention on their body internally [36,37]. Similar results were found by other researchers who examined the effects of the external focus of attention when learning different skills [33], at a different level of difficulty [35], and with participants of different levels (experts and novices) [36,38,39]. However, none of the aforementioned studies involved kindergarten children.

The researchers of the present study had hypothesized that the external group would exhibit better scores than the internal group, and there are some explanations about the different results. Wulf et al. [40] asserted that the benefits of the external training method over the internal focus of attention can be found when the skill to be learned is challenging. According to the “constrained action hypothesis” [33], when the participant is practicing a difficult skill, he/she tends to control his/her movement by altering the focus of attention to his/her body. When the movement outcome of the skill is easy or well-learned and automatically controlled, then the participant turns his/her attention to either the movement (internally) or its result (externally) and thus it will not make any difference [35]. It is possible that the movement outcome of the throwing skill was not difficult or challenging for the children, so the execution may have been automated for both experimental groups. Similar results were found by Landers, Wulf, Wallman, and Guadagnoli [41], who explained that the skill must be a challenge for the participants if significant differences are to be found [35].

Another possible explanation could rely on the type of instructions received by the external focus group. Half of the instructions of the external focus group focused on the target, a distal focus, and half of them on the trajectory of the ball. A more distal external focus has often been found to be more advantageous than a proximal external focus, such as the path of the ball [33,42]. This may be why the movement outcome of the external focus of the attention group was no better than that of the internal focus group.

Finally, the advantages of adopting an external rather than an internal focus, due to the increased automaticity in movement control, were probably limited since extrinsic information about movement outcome was available through visual feedback of all participants. Thus, adjustments could easily be made based on visual outcome information, resulting in similar accuracy scores for both groups [33,35,43].

## **CONCLUSIONS**

The present study showed that both the external or internal focus of attention improves over time the movement outcome and form of the throwing skill, for children aged 5 to 6 years. However, the external focus method was more effective than the internal focus of attention in movement form. The results of this study will be useful to Physical Education and Preschool Teachers and/or Coaches dealing with kindergarten children, who want to contribute to the motor development of fundamental movement skills of their children. Wulf, Chiviawosky et al. [4] and Porter, Nolan et al. [44] stated that coaches usually give instructions to focus attention internally. Thus, there certainly seems to be the potential to improve performance in various fields through their education.

This study is limited to the young participants 5-6 years of age and the throwing skill. Even if an effort was made to motivate the participants during the tests, it was not measured whether the children put in their maximum effort. Also, the fact that the specific kindergarten includes only indoor activities in the daily schedule maybe is an extra limitation on the children's movement skills and also on their enthusiasm for participating in physical activities [45]. It is suggested that future research could examine the effect of the two training methods on kindergarten children with other fundamental

motor skills (reception, movement, balance), or novice skills, altering the level of difficulty, to determine whether the results of the present study are generalizable.

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