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The Effects of External and Internal Focus of Attention on Learning a Static Balance Skill in Children with Mild Mental Retardation

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Abstract

Background: This study examines the effects of adopting external and internal focus of attention on learning a static balance skill in children with mild mental retardation.

Methods: The participants included 45 children with mild mental retardation in three groups: external focus, internal focus, and control. Motor tasks were used for the static balance, and the time children performed the skills without error was considered as the dependent variable. The students performed the pretest, the acquisition phase (including five 3-minute practice blocks), and posttest. In each exercise block, the children in the external focus group were instructed to focus on a red marker on the ground, while children in the internal focus group focused on their feet.

Results: Descriptive findings showed that the age means of the participants in external focus, internal focus, and control groups were 14.29, 14.62, and 13.84 years, respectively. And the means of their BMI were 21.27, 23.52, and 23.51 kg/m2, respectively. The results showed that external focus could improve motor learning. However, there was no significant difference between mean scores of the internal focus and control groups. Furthermore, children in the external focus group reported that they focused more on the external sign (red marker) rather than the internal sign (body part) when performing the skills, while the opposite was true for those in the internal focus group.

Conclusion: The results show that children with mental retardation benefited from adopting an external focus of attention to learn a static balance. This finding may indicate that these children have mechanisms such as goal-action coupling, which are needed to learn new motor skills through external focus of attention.

Key Words: Focus of attention, Goal-action, Mental retardation, Static balance.

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1- INTRODUCTION

The external focus of attention is an essential factor in the optimal (Optimizing Performance through Intrinsic Motivation and Attention for Learning) theory of motor learning (1). Wulf and Lewthwaite (1) posed the optimal theory of motor learning which demonstrates important roles for motivation and attentional focus in motor performance and learning. The optimal theory proposes that factors affecting motor performance and learning are practice conditions that (a) *enhance expectancies* for future performance, (b) support learners' *autonomy* and (c) promote an *external focus of attention*. The first two factors are considered as motivational and the last factor is considered as an attentional factor which optimizes the performance and learning of new motor skills (1). Numerous studies have examined the effect of external and internal focus of attention on learning motor skills (2-12). These studies generally compared the effect of external focus versus internal focus on motor skills learning. External focus of attention refers to focusing on the intended movement, such as the dartboard or dart path in dart-throwing, while internal attention focuses on the body, such as the hand when throwing the dart (1). A common finding in previous research has been that adopting an external focus of attention improves motor learning better than internal focus (2-12). For example, Wulf and Sue (2007) asked beginners to hit the golf ball toward a circular target and found that the participants in the external focus group had higher accuracy scores on the retention test than the internal focus group (13). In addition, Wulf et al. (2010) repeated these results using a soccer shooting task for children. Also, Abdollahipour et al. (2015, 2017, 2019) found that children who adopted external focus were more accurate on bowling rolling than internal focus (4-6). Wulf and Lewthwaite (1) suggested that adopting an external relative to an internal focus plays a dual role by (a) directing attention to the task goal and (b) reducing a focus on the self. Thus, an external focus is an important contributor to goal-action coupling (22). Wulf and Lewthwaite (1) assumed that adopting an external focus complements the goal-action couple as an underlying mechanism for motor learning following. Salehian et al. (3, 12) showed that a far external focus had better effects than a near external focus on the body center of mass displacement.

Most studies that have examined the effect of focus on one's performance and motor skills learning have found this component in healthy individuals, and a small number of researchers have sought to examine the effect of these components on motor learning in exceptional individuals. (14). For example, Saemi et al. (2013) examined the effect of using external focus (as opposed to internal focus) on learning and performance of throwing a tennis ball at a target in a group of children with ADHD (15). The results showed that adopting an external focus of attention leads to better accuracy scores than internal focus. However, few studies have examined the effect of external and internal focus of attention on motor learning in children with mental retardation. Children with severe, moderate, and mild mental retardation generally have lower levels of intelligence and cognitive functions than healthy children; and exhibit different social behaviors (16, 17). Also, some research has shown that healthy children can perform motor skills better than those with mental retardation (14).

Therefore, due to the lack of research on the effect of external and internal focus of attention on motor learning in children with mental retardation, this study investigates the effect of external and internal focus of attention on learning a balance skill in children with mental

retardation. Balance skills are among children's most important motor skills (18-21). Based on the results of previous research on the effect of external and internal focus of attention, this study hypothesizes that adopting an external focus of attention compared to an internal focus of attention and control leads to better learning of balance skills in children with mild mental retardation.

2- METHODS & MATERIALS

2-1. Sampling

The present study is descriptive and causal-comparative. The subjects consist of 45 12-16-year-old girls with mild mental retardation. Children with mild mental retardation were selected from special schools and randomly and equally divided into three groups: 1) External Focus of attention (EFA), 2) Internal Focus of attention (IFA), and 3) Control (CO). After referring to the special schools, children with an IQ of 50-70 and mild mental retardation were selected according to the information provided by the relevant schools.

2-2. Motor Task

In this study, a static balance skill (Warrior III Pose) was selected as the motor task. This task requires the participant to balance on the right foot while lifting the left foot off the ground and holding the hands above the head. The purpose of this exercise is to maintain balance as much as possible. In this study, we measured the balance time of each child with a digital stopwatch. The stopwatch started in a balanced position and stopped when an error occurred, such as when the left hand or foot hit the ground.

2-3. Procedure

First, a demographic information sheet was completed for each child by referring to the child record at school. The children were tested separately in a room set up for the study in the respective schools. As soon as they entered the particular room, demographic information such as age, height, and weight was obtained. Then, the details of the method and movement were provided to the child. To familiarize children with the protocol, implementation environment and motor task, they were asked to perform static balance skills in a designated area once. Then, in the pretest, the children performed the static balance skill once without any feedback or instructions. Then, they participated in the acquisition phase in five training blocks, each of which consisted of three minutes of static balance tasks. The participants were given a two-minute break between each exercise block. One day after the acquisition test, the children took a memorization test that performed static balance skills. In the pretest and retention test, children were asked to continue performing static balance skills as much as possible. Here, the length of time that each child could perform the skill without error was calculated along with her score in performing the static balance skill.

Regarding the external focus of attention, the children in the external focus group were instructed to "focus on the red marker" two meters ahead of them on the floor while performing the static balance skill. The children in the internal focus of attention group were instructed to "focus on their feet" while performing the static balance skill. There was no focus of attention instructions in the pretest and retention test and no marker on the ground. To ensure that children follow the concentration instructions, we reminded the children how to concentrate at 10-second intervals during the exercise blocks. In order to measure the type and intensity of the participants' focus, we asked all children to take the manipulation test after the acquisition phase. In the manipulation test, we asked the children "What are you focusing on?" to determine the type, and "How much did you focus on it?" on a Likert scale from 1 (not at all) to

7 (very much) to measure the focus intensity. The children in the control group did not receive any instructions on the focus of attention during the training period.

2-4. Data Analysis

In the present study, the dependent variable was the balance time (in minutes) in the pretest and retention test. One-way analysis of variance was used to analyze the balance time in the pretest and retention test. Tukey's post hoc test was used as a post hoc test. The level of statistical significance was considered at $P < 0.05$.

3- RESULTS

The demographic characteristics of the participants are given in **Table 1**. Demographic results include age, height, weight, and BMI of children in different groups.

Table 2 and **Fig. 1** show the performance time of healthy children and children with mental retardation in the pretest and retention test.

Table-1: The participants' demographic characteristics

Group	Age	Height	Weight	BMI
External focus of attention	41.1 ± 29.14	18.16 ± 29.161	61.20 ± 71.55	02.2 ± 27.21
Internal focus of attention	60.1 ± 62.14	95.15 ± 66.157	71.19 ± 51.58	65.3 ± 52.23
Control	93.1 ± 84.13	26.17 ± 87.160	86.17 ± 79.59	60.2 ± 51.23

Table-2: The mean and standard deviation of performance scores of research groups in the pretest and retention test

		External focus of attention	Internal focus of attention	Control
Pretest	Mean	51.1	45.1	69.1
	Std.	12.1	41.1	59.1
Posttest	Mean	59.3	49.2	86.2
	Std.	47.2	20.2	51.2

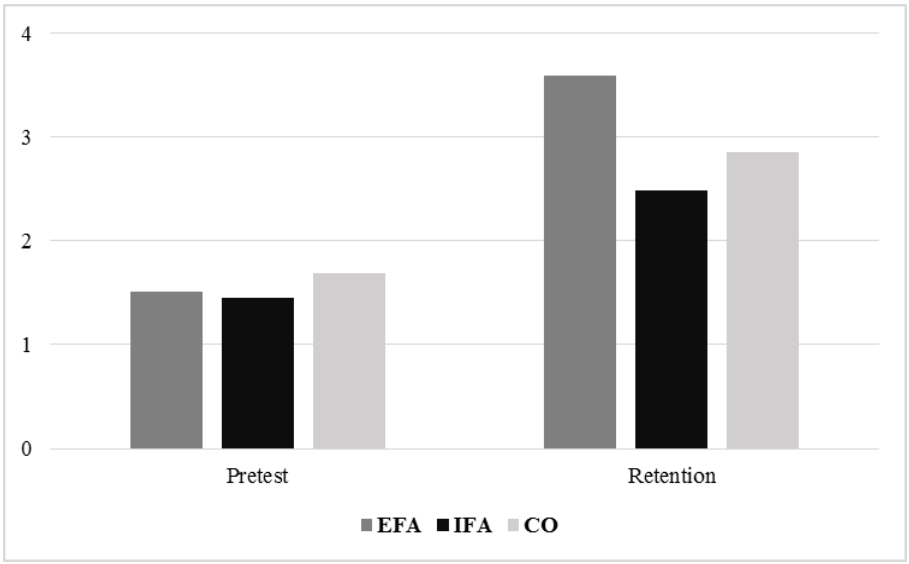

Fig. 1: Children's performance in the pretest and retention test; EFA: External Focus of Attention Group; IFA: Internal Focus of Attention Group; CO: Control group.

The results of the analysis of variance in the pretest and retention test are given in **Table 3**.

The analysis of variance showed no significant difference in performance time between the groups in the pretest (F = 0.82, p = 0.54). These results indicate that all children in different groups had the same conditions at the beginning of the exercise. However, in the retention test, the analysis of variance showed a significant difference between the groups in performance time (F = 12.01, p <0.001). Tukey post hoc test results showed that children in the external focus of attention group performed better than those in the internal focus of attention and control groups (p <0.001). However, no significant difference was observed between the internal focus of attention and control groups (p> 0.05).

Table-3: Results of analysis of variance in the pretest and retention test

Parameter		Sum of Squares	df	Mean Square	F	Sig.
Pretest	Between Groups	63.48	2	31.24	82.0	547.0
	Within Groups	86.48	43	42.59		
	Total	135.11	45			
Retention	Between Groups	54.186	2	27.93	01.12	000.0
	Within Groups	386.94	43	183.69		
	Total	573.48	45			

Table-4: Subjects' answers to the manipulation test

Group	Parameter	External focus of attention (red marker)	Internal focus of attention (limbs)
External focus of attention	What	7.90	3.9
	Intensity	5.4	6.4
Internal focus of attention	What	2.30	8.69
	Intensity	8.4	9.3
Control	What	6.45	4.54
	Intensity	2.4	9.4

4- DISCUSSION

This study compared a static balance skill learning by the external and internal focus of attention on children with mild mental retardation. Based on the results of previous research on the acquisition of external and internal focus of attention, this study hypothesized that external focus of attention compared to an internal focus of attention leads to better learning of static balance skills in children with mental retardation. The results of the research indicate that the research hypothesis is confirmed. The results showed that children with mental retardation who adopted an external focus of attention were significantly more likely to perform better during the retention test than children in the internal focus of attention or control groups. This finding is consistent with the results of previous research, which shows that taking the external focus of attention on learning new motor skills is more effective than internal focus of attention in both healthy children and specific groups such as ADHD (2-13). In addition, this finding supports the optimal theory (1), which suggests the advantage of an external focus of attention when learning new motor skills.

Another important finding is that those who adopted the External focus of attention focused more on an external cue (red marker) than an internal cue when performing motor skills (limb). At the same time, the opposite is true for children who have adopted an internal focus of attention. According to the optimal theory, adopting the external focus of attention facilitates motor learning by directing attention to the skill purpose and reducing self-focus (1). The findings support the hypothesis of the optimal theory by showing that adopting the external focus of attention increases the focus on the skill purpose and decreases the self-focus. Therefore, the external focus of attention is an essential factor in the goal-action coupling. This may be especially important for children with mental retardation exposed to cognitive deficits in motor skills.

Wulf and Lewthwaite (1) suggested that adopting an external focus of attention results in promoting the learners' focus on the task goal and this directly connects the goals and actions, enhancing goal-action coupling. Adopting an external focus of attention facilitates efficient switching from the default mode network to relevant motor networks, whereas an internal attentional focus impedes this process (1). In the optimal theory, performing under external attentional focus conditions is presumed to facilitate functional connectivity, i.e., the task-specific neural connections across distinct brain regions that are seen in skilled performers. Lack of a clear task focus (e.g., internal focus) would impede switching to task related functional networks or goal-action coupling.

4-1. Limitations of the Study

One limitation is that we used only girls as participants, thereby limiting the generalizability of research results to boys. Similarly, the age range of the participants was restricted to 12-16 years, limiting the generalizability of the results to younger children. Also, we examined the effects of focus of attention on balance time, and the motor coordination components were not measured. Future studies should examine the effect of focus of attention on motor coordination in children with mental retardation, emphasizing kinematic analysis (21).

5- CONCLUSION

In summary, the results show that children with mental retardation benefit from the external focus of attention in learning a static balance skill. This result may indicate that these children have the mechanisms to learn new skills through the external focus of attention (such as goal-action coupling). Based on the optimal theory, adopting an external focus of attention reduces a self-focus, directs attention to the task goals, and connects goals and actions, e.g., goal-action coupling. Generally, the results of this study confirm these propositions. The present findings have some practical implications. These results suggest that coaches, trainers and physical educators could optimize learning new motor skills in children with mental retardation by adopting an external focus of attention during practice. Future studies might examine the effects of external focus of attention on learning new motor skills in other special populations.

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8- CONFLICTS OF INTEREST

None.

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