



Differences in children's thinking and learning during attentional focus instruction



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ABSTRACT

Considerable evidence supports the motor learning advantage associated with an external focus of attention; however, very few studies have investigated attentional focus effects with children despite individual functional constraints that have the potential to impact use of instructional content. Thus, the purpose of this study was to determine the effect of attentional focus instruction on motor learning in children. Participants ($n = 42$) aged 9–11 years were randomly assigned to one of three gender-stratified groups: (1) control, (2) internal focus, or (3) external focus. Following initial instructions and task demonstration, participants performed 100 modified free throws over two days while receiving additional cues respective to their attentional focus condition and returned approximately 48 h later to perform 20 additional free throws. Results revealed no significant learning differences between groups. However, responses to retrospective verbal reports suggest that the use of external focus content during practice may have contributed to some participants' superior performance in retention. Future research should continue to examine attentional focus effects across a variety of ages and incorporate retrospective verbal reports in order to examine children's thoughts during attentional focus instruction.

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1. Differences in children's thinking and learning during attentional focus instruction

Physical education teachers and sport coaches often pair verbal instructions with a visual demonstration when introducing a new motor skill to learners. These instructions serve to orient learners to the new skill, draw attention to the critical elements of skill execution, and highlight common errors they may encounter (Schmidt & Lee, 2011). Instructions are often reduced to a few concise words or phrases referred to in the pedagogy literature as verbal cues. According to Rink (2010), good cues are accurate, critical to the intended task, limited in number, and age and skill level appropriate. One reason verbal cues are thought to be effective for motor learning is because they reduce the cognitive load needed to process information relevant to skill execution (Landin, 1994). This is especially important given the limits on attentional resources early in learning. Another reason they are thought to be effective is that they draw attention to appropriate sensory information. Given the abundance of sensory information available during motor skill learning, it is imperative that researchers determine the types of attentional foci that have the most influential effect on learning.

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In the motor learning literature, there has been a prolific line of research examining the effect of attentional focus on motor skill learning and performance (for a review, see [Wulf, 2013](#)). Although originally based on her own anecdotal experience, Wulf and others have produced empirical evidence supporting the use of an external focus of attention, whereby one directs attention to the effects of the movement, over an internal focus of attention, whereby one directs attention to body movements. These findings are explained using the constrained action hypothesis (e.g., [McNevin, Shea, & Wulf, 2003](#); [Wulf, McNevin, & Shea, 2001](#)). According to this hypothesis, focusing on the effects of one's movements (external focus) allows unconscious, reflexive control processes to govern the action. In contrast, focusing on one's body movements (internal focus) disrupts this automatic control by constraining the motor system.

Instructions and/or verbal cues can be used to evoke either an internal or external focus of attention. For example, students learning a golf putt could be instructed to focus on the swing of their hands (internal) or the swing of the putter head (external). Previous research has consistently demonstrated a learning and performance advantage for participants using instruction with an external focus across a variety of motor skills. For example, participants instructed to keep markers horizontal (external focus) while learning to balance on a stabilometer performed better on a retention test than those instructed to keep their feet horizontal (internal focus) ([Wulf et al., 2001](#)). In addition to balance tasks, the advantage of an external focus has been replicated for learning golf pitches ([Wulf & Su, 2007](#)), basketball free throws ([Zachry, Wulf, Mercer, & Bezodis, 2005](#)), dart throws ([Marchant, Clough, Crawshaw, & Levy, 2009](#)), and volleyball serves and soccer passes ([Wulf, McConnel, Gärtner, & Schwarz, 2002](#)). An external focus has also proved advantageous for improving vertical jump height ([Wulf & Dufek, 2009](#)), swimming speed ([Stoate & Wulf, 2011](#)), agility running speed ([Porter, Nolan, Ostrowski, & Wulf, 2010](#)), and muscular endurance ([Marchant, Greig, Bullough, & Hitchen, 2011](#)).

Despite the extensive literature and robust finding that an external attentional focus facilitates motor learning across a variety of skills, one major limitation still exists. An overwhelming majority of these studies have been limited to adult populations; thus, there is a lack of full understanding concerning the effective application of attentional focus instructional content to children. In fact, only three published studies have used normally developing children to examine attentional focus effects ([Emanuel, Jarus, & Bart, 2008](#); [Perreault & French, 2015](#); [Wulf, Chiviawsky, Schiller, & Avila, 2010](#)), one of which having several problems as pointed out by [Wulf \(2013\)](#). Additionally, these studies produced varied findings and most failed to provide an adequate measure of treatment adherence. Since children tend to utilize control processes in working memory (e.g., encoding, rehearsal) less effectively than adults (for a review, see [Thomas, 1980](#)), their ability to use instructional content during the learning process may be limited. Thus, it is vital that motor learning researchers replicate findings in relevant populations in order to effectively inform practice in elementary physical education and youth sport settings. Therefore, the purpose of this study was to determine the effect of attentional focus instruction on motor learning in children and examine children's thoughts during attentional focus instruction to ensure treatment adherence. Based on the previous attentional focus literature, it was hypothesized that an external focus group would have significantly better performance scores in retention than an internal focus group and a control group.

2. Method

2.1. Participants

Forty-two children (28 boys, 28 girls) aged 9–11 years with no prior organized basketball experience (e.g., recreational leagues) from an afterschool program at elementary schools in the southeastern United States volunteered for this study. In compliance with the university's Institutional Review Board, informed consent was obtained from legal guardians and assent was obtained from participants prior to the study.

2.2. Task, equipment, and scoring

The task consisted of a modified basketball free throw in an indoor gymnasium or multipurpose room at the school. Modifications from a standard free throw included a 12 ft free throw line and a basketball goal height of 9.5 ft. These modifications were selected based on pilot testing in which the majority of participants' could not generate enough force when shooting a free throw to reach a regulation height basketball goal (10 ft) from a regulation free throw line (15 ft). Participants performed the free throw using a 28.5" circumference basketball chosen in accordance with AAU youth basketball guidelines ([Amateur Athletic Union, 2012](#)). Free throw performance was scored using a 3-point scale ([Price, Gill, Etnier, & Kornatz, 2009](#)) wherein a score of 2 was given for a make, 1 for a near miss (i.e., ball hits rim), and 0 for a complete miss.

2.3. Procedure

Participants were randomly assigned to one of three gender stratified groups of equal size: (1) control, (2) internal focus, or (3) external focus. Each participant took part in three individual sessions over three days consisting of two identical practice sessions and a retention session approximately 48 h later. Each practice session began with some initial instruction on how to perform a free throw that included the following: (1) viewing a video model of an adult using correct free throw technique from three angles, (2) receiving verbal instructions on correct free throw technique (adapted from [Zachry et al., 2005](#)),

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