EFFECTS OF ATTENTIONAL FOCUS ON AN UNDERHAND TOSSING TASK AMONG YOUNG CHILDREN

by

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ABSTRACT

Research has shown that externally focused instruction and feedback has positive effects on skill acquisition and performance outcomes among adults (Wulf, 2007, 2013). However, in children, there are mixed findings as to whether an external or internal focus of attention is most effective (Chiviacowsky, Wulf, & Ávila, 2013; Emanuel, Jarus, & Bart, 2008; Perreault, 2013; Thorn, 2006; Wulf, Chiviacowsky, Schiller, & Ávila, 2010). Currently, there is a gap in the attentional focus literature and a need to research young children, under the age of eight, whose cognitive development is not as matured as older children or adults (Gallagher & Thomas, 1980, 1984, 1986). The purpose of this study was to examine the effects of attentional focused instruction and feedback on the performance outcome of an underhand tossing task among first graders. It was hypothesized the external focused group would perform with better outcome scores compared to the internal focused group. Three intact classes of first graders were recruited from a local elementary school in the Northwest. Within each class participants were quasi-randomly divided into two treatment groups (either external or internal attentional focus), with an equal representation of gender in each group. Twenty-five participants (M = 6.26 yrs, SD = 0.45) engaged in pretest, acquisition, retention and transfer trial blocks, each completing a total of 80 tosses over a three-week period. Performance outcomes were assessed using a circular target similarly used by Chiviacowsky et al. (2013) and Saemi, Porter, Wulf, Ghotbi-Varzaneh, & Bakhtiari

(2013). Outcome scores during acquisition were analyzed using a 2 (Group: Int., Ext.) X 6 (Pretest, Acquisition Trial Blocks) ANOVA with repeated measures on the last factor. Outcome scores during acquisition trial block 5, retention, and transfer was analyzed using a 2 (Group: Int., Ext.) X 3 (Acquisition Block 5, Retention, Transfer) ANOVA with repeated measures on the last factor. No significant differences were found between groups during the pretest and acquisition ($p = 0.56$) or during acquisition trial block 5, retention and transfer ($p = 0.71$). Although non-significant, the internal focus group performed the task with slightly better performance outcome scores during acquisition, retention and transfer trial blocks. There was a significant difference within groups during acquisition trial block 5, retention and transfer trial blocks ($p < 0.005$). Both groups exhibited a decrease in scores during the transfer trial block. The results from this study did not support the hypothesis or previous research (Chiviacowsky et al., 2013; Perreault, 2013, Exp. 2; Saemi et al., 2013; Thorn, 2006; Wulf, Chiviacowsky, et al., 2010). However, these results demonstrated similar findings to Emanuel and colleagues (2008) and Perreault (2013, Exp. 1). Future research should continue to focus on this age population to gain a better understanding of how young children cognitively process and utilize instructions and feedback provided to them for improving motor skills.

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CHAPTER I: INTRODUCTION

In both clinical and sport settings, professionals often provide feedback to learners that teach them to focus their attention on the movements of their body (Chiviacowsky, Wulf, & Wally, 2010). In adults, there is a consistent finding that an external focus of attention leads to better learning and performance outcomes. However, in children, there is an inconsistency in the findings as to which type of attentional focus is most beneficial (Chiviacowsky, Wulf, & Avíla, 2013; Chiviacowsky et al., 2010; Emanuel, Jarus, & Bart, 2008; Perreault, 2013; Saemi, Porter, Wulf, Ghotbi-Varzaneh, & Bakhtiari, 2013; Shea & Wulf, 1999; Thorn, 2006; Wulf, Chiviacowsky, Schiller, & Avíla, 2010; Wulf, Höß, & Prinz, 1998). Young children do not have the ability to utilize mature cognitive strategies and are therefore unable to process feedback as quickly and efficiently as adults, causing them to perform motor skills less effectively (Gallagher & Thomas, 1980, 1984,1986; Thomas, Solomon, & Mitchell, 1979). The differences in cognitive maturity and inconsistencies in the findings make it important to understand how young children process and utilize feedback provided to them, as this is a time when they are being introduced to many fundamental motor skills.

Attentional focus explains where one directs their attention during a variety of tasks and settings. This concept has been studied in many different perspectives, and can be classified as either associative (focusing attention on sensations of the body) or dissociative (focusing attention outside the body; Morgan, 1978; Weinberg, Smith,

Jackson, & Gould, 1984; Wulf, 2013). Further, attentional focus can also be classified in terms of direction (external vs. internal) and width (narrow vs. broad; Moran, 1996; Nideffer & Sagal, 1998; Wulf, 2013). In motor learning, the direction classification has shown to be an important factor in influencing both the learning process and performance outcomes (Wulf, 2013). Used instructionally or through feedback, an external focus of attention guides the participant to focus on the effects or outcomes of their actions, whereas an internal focus guides participants to focus on their body movements or limb segments (Peh, Chow, & Davids, 2011; Wulf, 2007). Previous research suggests that adopting an external focus of attention guides the participant to higher performance levels at a faster rate compared to an internal focus of attention (Peh et al., 2011; Wulf, 2007). Although research suggests that an external focus of attention may be more beneficial, it is common for clinicians and coaches to provide internally focused feedback to their learners, causing them to focus on their bodily movements (Chiviacowsky et al., 2013; Peh et al., 2011; Wulf, 2007). The current literature available suggests that this may not be the most effective form of delivering instruction and feedback to learners.

Efficiency and effectiveness are key factors in measuring skill levels in motor learning; a field encompassing the learning or re-learning of new skills and the enhancement of already learned skills (Magill & Anderson, 2014). Attentional focused cues and feedback are a means by which both efficiency and effectiveness of a motor skill can be altered. Effectiveness is viewed in motor learning as the demonstration of consistent, reliable and accurate movements; efficiency is classified by the use of less physical and mental effort to carry out a movement pattern with increased economy and automaticity (Magill & Anderson, 2014; Wulf, 2007, 2013). A large body of research has

supported the adoption of an external focus of attention, which aides in decreasing the time one needs to learn a new skill for a variety of tasks. These tasks include balancing (Chiviacowsky et al., 2010; Shea & Wulf, 1999; Wulf et al., 1998, Exp. 2), postural control (McNevin & Wulf, 2002; Wulf, McNevin, & Shea, 2001), and a variety of sport skills (An, Wulf, & Kim, 2013; Bell & Hardy, 2009; Land, Frank, & Shack, 2014; Marchant, Clough, Crawshaw, & Levy, 2009; Stoate & Wulf, 2011). Retention and transfer tests have been used as a means to support the idea that an external focus of attention is not only influential in improving both the efficiency and effectiveness of a movement pattern throughout acquisition but also has a positive effect on the learning process (Wulf, 2013).

Historically, three primary theories have been used to explain how attentional focus effects performance. The constrained action hypothesis, the most commonly cited theory and primary framework in the attentional focus research, has extended concepts and ideas from the common coding theory (Prinz, 1997; Wulf & Prinz 2001), and the action identification theory (Vallacher & Wegner, 1987). The constrained action hypothesis posits that when a learner adopts an internal focus of attention, they consciously evaluate and regulate their movements, disrupting their automatic control processes and thus decreasing performance (Wulf, 2013; Wulf, McNevin & Shea, 2001; Wulf, Shea, & Park, 2001). In contrast, when a learner adopts an external focus of attention, the system is able to self-organize more naturally creating a fluid and efficient movement pattern (Wulf, 2013; Wulf, McNevin, et al., 2001; Wulf, Shea, et al., 2001).

Instruction and feedback provide information to the learner about how to correctly perform a motor task. Where a person chooses to focus their attention when learning a

new skill can greatly effect how well they are able to learn and perform (Wulf, 2013). When studied in adults, a majority of the current research on attentional focus has reported findings in support of external focus instructions and feedback for improving performance and enhancing learning (Chiviacowsky et al., 2010; Land et al., 2014; McNevin & Wulf, 2002; Shea & Wulf, 1999; Wulf, McNevin, et al., 2001; Wulf, 2013). In accordance with the constrained action hypothesis, these researchers have found that learning is facilitated when the participant's attention is directed away from bodily movement (Chiviacowsky et al., 2010; Land et al., 2014; McNevin and Wulf, 2002). External focus also enhances movement accuracy by reducing memory demands and brain and muscle activity, deterioration of performance under pressure, and leads to an overall improvement in performance outcomes (Wulf, McNevin, et al., 2001).

Although few in number, the effect of attentional focus on learning and performance has been studied in younger populations. In children, findings in the attentional focus literature are mixed. Some research supports the findings among adults that an external focus of attention is beneficial in facilitating successful learning and performance outcomes (Chiviacowsky et al., 2013; Saemi et al., 2013; Perrault, 2013, Exp. 2; Thorn, 2006). In contrast, a limited amount of research suggests that internally focused instructions lead to better performance outcomes in children (Emanuel et al., 2008; Perrault, 2013, Exp. 1). The mixed findings and limited research available make it difficult to discern which type of attentional focused feedback is best for skill learning in children. One possible explanation for the mixed finding is the limited cognitive capacity children have when compared to adults (Emanual et al., 2008; Perreault, 2013).

Until the age of 11, children are unable to regularly utilize information processing techniques as quickly and efficiently as adults (Gallagher & Thomas, 1980). Immature information processing abilities cause children to take longer time to absorb and recall information in the manner in which it is presented to them (Gallagher & Thomas, 1980). In addition to their limited ability to process information, children do not possess mature recall strategies and are unable to group and recode new information provided to them (Gallagher & Thomas, 1984). Mature learning strategies are important in motor learning because they allow participants to commit new information to their existing base of knowledge; when this ability is not fully developed (like in children) participants are unable to perform new tasks in an efficient manner (Gallagher & Thomas, 1984). Before age 10, children are able to encode new information in an immature manner, but have not developed their cognitive abilities enough to be able to organize and process this information (Gallagher & Thomas, 1986). It has also been suggested this lack of organization could be a contributor to the poorer performance seen in children when compared to adults (Gallagher & Thomas, 1986).

Need of Study

Currently, the body of research on attentional focus in children is very limited. Of the research available, few focus on the performance effects of attentional focused feedback among children (Perreault, 2013, Exp. 2; Wulf, Chivicowsky, et al., 2010). In addition, this research has focused on children between the ages of 8–11 (Perreault, 2013, Exp. 2; Wulf, Chiviacowsky, et al., 2010). A gap in the research lies in examining how younger children, specifically six and seven year olds, respond to attentional focus based instruction and feedback. Studying attentional focus in a younger population is important

because research has shown that their cognitive development is not as mature as older children and adults; which could significantly impact how they interpret and utilize attentional focus instruction and feedback (Gallagher & Thomas 1980, 1984, 1986). Additionally, at this age, children are being exposed to fundamental motor skills, making it important to understand how to best teach them these skills. The available literature on children indicates mixed findings making it unclear whether external or internal based instruction and feedback is most beneficial (Chiviacowsky et al., 2013; Emanuel et al., 2008; Perrault, 2013; Saemi et al., 2013; Thorn, 2006; Wulf, Chiviacowsky, et al., 2010). The inconsistency in the findings makes it difficult to inform professionals of how to best promote learning in an applied setting. By studying the effects of attentional focused instruction and feedback on skill acquisition in children, this research will help determine the type of instruction and feedback that is most beneficial for younger age populations.

Purpose of the Study and Hypothesis

The purpose of this study was to examine the effects of attentional focus based instruction and feedback on skill accuracy among young children. Specifically, this study aimed to examine whether external focused instruction and feedback would improve learning and performance of an underhand tossing task among first graders (ages 6−7). Despite the mixed findings in the attentional focus literature among children, a majority of studies provide support for the constrained action hypothesis, demonstrating favorable results for external attentional focus (Chiviacowsky et al., 2013; Saemi et al., 2013; Perrault, 2013 Exp. 2; Thorn, 2006). Therefore, in accordance with the constrained action hypothesis, it was hypothesized that the external attentional focused group would perform better in the underhand tossing task compared to the internal attentional focused group.

Operational Definitions

For the purposes of this study, externally focused instruction and feedback related to statements that direct the participant's attention towards the effects of their actions. An example of this type of feedback is "Swing the beanbag forward towards the target." Internally focused instruction and feedback were defined as any feedback given to the participant that caused them to focus on their actions. This type of feedback directed the participant's attention towards their body segments and how they moved during an action. An example of an internal focus statement is "Swing your hand forward towards the target."

Limitations and Delimitations

Due to the natural setting of this research, the principal investigator was unable to control for unpredictable events, such as absences of participants and distractions resulting from a shared gym space. Another limitation the principal investigator was unable to control for were the scheduled meeting times of the physical education classes. Each class met twice a week, on a rotating schedule. This resulted in varying retention intervals; some participants had to wait longer than others in order to complete acquisition, retention, and transfer trial blocks.

Delimitations of this study included the time of day participants completed all trials, the number of practice attempts, and the frequency of the feedback provided. Data was collected at the same time of day, immediately following recess. Further, each participant was asked to complete the same number of trials over the same number of days of practice. Due to the novelty of the task, participants could not easily practice outside, thus minimizing opportunity to practice outside of class. Lastly, each intact class

was quasi-randomly divided into two experimental groups, with an equal representation of gender, while frequency of feedback remained the same for both treatment groups.

Significance of Study

Previous research examining attentional focus and the effects it has on motor learning and performance outcomes has reported mixed findings among children (Chiviacowsky et al., 2013; Emanuel et al., 2008; Perreault, 2013; Saemi et al., 2013; Thorn, 2006). This study contributes to the existing literature by providing insight as to which type of attentional focused based instruction and feedback was more beneficial for children. In doing so, results from this study may help provide information to both coaches and clinicians working with young children about effective content provided via instruction and feedback when learning a new skill.

CHAPTER II: LITERATURE REVIEW

Attentional focus, thought to be an influential factor on motor performance, has been a popular topic among researchers, and has implications for practitioners (Wulf, 2013). It can be studied from a variety of perspectives: dissociative, associative, width and direction (Moran, 1996; Morgan, 1978; Nideffer & Sagal, 1998; Weinberg et al., 1984; Wulf, 2013). However, direction (external versus internal) has proven to be influential on the learning process and motor performance (Wulf, 2013). An external focus of attention directs the participant's attention to the effects of their movement on the environment, which previous research has shown to be more beneficial compared to an internal focus of attention in promoting learning and performance improvement (Peh et al., 2011; Wulf, 2007). The purpose of the current research study was to determine how attentional focused based instruction and feedback effects the acquisition and performance outcome of a motor skill among young children. This research will contribute to the current body of literature by including young children, a population less studied. In addition, coaches and clinicians may be able to utilize this information to provide feedback that enhances learning in a young population.

This review will identify information on the current body of attentional focus literature, specifically, its effects on instruction and feedback for both adults and children. First, the theoretical framework will be discussed; followed by existing literature on both adult and youth populations, a large portion of which examines the effects of attentional

focused instruction and feedback among adults. Lastly, this review will discuss the cognitive differences between adults and children offering an explanation for differences seen in the attentional focus literature.

Theoretical Framework

An early attempt at understanding how the adoption of external or internal attentional focus influenced performance was explained by the action identification theory. This theory proposed the idea that naturally, people tend to focus their attention on the effects of their actions rather than the action, or movement, itself. The action identification theory suggests that there is a hierarchical order of action identities that an individual relies upon during skill performance (Vallacher & Wegner, 1987; Wulf & Shea, 2002). Lower levels of action identity refer to the specific movements of an action, similar to an internal focus. An example might be running, where the learner would just focus on the task. Higher levels of action identity refer to the effects of the action, similar to external focus. An example would be that rather than focusing on running, the learner would be focusing on the idea of them getting exercise (Vallacher & Wegner, 1987; Wulf & Shea, 2002). When the learner selects a lower action identity (e.g., focusing on self), performance is disrupted due to the pressure of performing well. When the learner selects a higher action identity (e.g., focusing on the environment), performance is often enhanced due to the automaticity displayed (Vallacher & Wegner, 1987; Wulf & Shea, 2002).

A slightly different, yet similar theory, Prinz's common-coding theory posits that there is a common code for both perceptual and motor representations within the brain (Prinz, 1997; Wulf & Prinz, 2001). The theory also suggests that this common code can

only be achieved in “distal events” or situations that are not directly related to the body. This theoretical framework helped researchers to better understand attentional focus; when movements were planned based upon their effects on the environment, a common code could be used, thereby promoting positive performance outcomes (Prinz, 1997; Wulf & Prinz, 2001; Wulf, 2013). However, this early theory does not specifically address how adopting an external or internal focus of attention effects either learning or performance outcomes, and was only used to speculate how an external focus of attention might be more beneficial (Wulf, 2013).

Combining concepts from both the action identification theory and the common-coding theory, the constrained action hypothesis was proposed to provide an explanation of how adopting a specific type of focus can either enhance or constrain performance of a motor skill. The constrained action hypothesis, proposed by Wulf, McNevin, and Shea (2001), explains the effect of adopting either an internal or external focus of attention on the execution of movement patterns. This hypothesis posits that adopting an internal focus of attention causes the learner to disrupt the automatic control processes, placing a constraint on the motor system that results in a less fluid movement pattern (Wulf, McNevin, et al., 2001; Wulf, Shea, et al., 2001; Wulf, 2013). It is further proposed that by adopting an external focus of attention, learners are able to focus less on their own movements, promoting the use of unconscious and reflexive control processes that represent a more automatic control of movement (Wulf, McNevin, et al., 2001; Wulf, 2013). Early in skill acquisition, when the learner is too focused on controlling the multiple aspects of a skill, performance is often deteriorated (Wulf & Shea, 2002). Conscious control of movement occurs when the learner adopts an internal focus of

attention, thus causing a disruption in the automatic control processes (Wulf & Shea, 2002). Consequently, when a learner focuses externally, the motor system is able to naturally self-organize and is able to continue the automatic control process, unconstrained (Wulf & Shea, 2002). Previous research has found positive benefits of external focus of attention in a variety of capacities including: reduced attentional capacity, high frequency movement adjustments (i.e. smaller, quicker corrections to a movement pattern), and reduced pre-movement times (i.e. completing the task faster), all of which represent efficient motor planning strategies (Wulf, McNevin et al., 2001; Wulf, Shea et al., 2001; Wulf, 2013).

Wulf, Chiviacowsky, and colleagues (2010) further explained the constrained action hypothesis suggesting that an internal focus of attention causes a self-invoking trigger that forces the learner to rely upon the neural representation of the "self". This focus on the "self" promotes more self-evaluative and self-regulatory processing of movement patterns (Wulf, 2013, p. 15). This form of processing causes the learner to evaluate and regulate thoughts, actions, and behavior creating "micro-choking" episodes that cause a decrease in performance outcomes (Wulf, 2013, p. 15). The extension of this hypothesis provides evidence supporting the adoption of an external focus of attention. As research has grown in attentional focus, the theories proposed have become more complex, encompassing all of the effects of attentional focus on motor performance. Although these theoretical frameworks have been used to research attentional focused instruction and feedback across both adults and children, the constrained action hypothesis is the most commonly cited framework within this literature.

Attentional Focus Instruction Among Adults

Instructions are provided to a learner as a means of providing them with information about how to complete a motor skill. Additionally, feedback is provided to the learner throughout the practice of a new motor skill and can be administered in a variety of manners (i.e., high and low frequency, information about the process or product of the task, via internal methods or an external source). Both instruction and feedback can be attentional focused in nature, which research has shown can have an effect on performance in a variety of activities including balance, postural control, and sport skills (Chiviacowsky et al., 2010; Land et al., 2014; McNevin & Wulf, 2002; Shea & Wulf, 1999; Wulf et al., 1998; Wulf et al., 2001; Zentgraf & Munzert, 2009). Early studies on the effectiveness of attentional focused instruction was researched using balancing tasks where participants were instructed to keep markers on a stabilometer (a device to assess balance) horizontal (externally focused) or feet horizontal (internally focused) (Chiviacowsky et al., 2010; Shea & Wulf, 1999; Wulf et al., 1998, Exp. 2). Results of these stability tasks confirmed that the external focused instruction groups outperformed both the internal focused and control groups during retention tests. The external focus group was able to maintain balance for longer time periods across all trials (Chiviacowsky et al., 2010; Shea & Wulf, 1999; Wulf et al., 1998, Exp. 2). When balance was tested on different surfaces (e.g. stabilometer, solid surface, and foam mat), Wulf, Tollner, and Shea (2007) discovered that in order for the effects of attentional focus to be present, a certain degree of instability and difficulty needed to be present. Consistent with research on balancing using the stabilometer, the external focused groups produced less

postural sway when attempting to maintain balance on foam mats and overall more stable balance in comparison to both internal focus and control groups (Wulf et al., 2007).

In an internal focused condition, research has shown that focusing on one's own movements within such balancing tasks causes participants to adopt a conscious control of body movement (Chiviacowsky et al., 2010). This conscious control constrains the motor system thereby disrupting the automatic control processing necessary for success. This greater consciousness on body movement has a detrimental effect on overall performance (Chiviacowsky et al., 2010; Shea & Wulf, 1999). Conversely, adopting an external focus of attention allows for the promotion of unconscious, fast and reflexive control, resulting in enhanced motor learning and an overall greater fluidity of movement (Chiviacowsky et al., 2010; Shea & Wulf, 1999). In balancing tasks, the type of attentional focus adopted by the subject has an effect on the reflexive control mechanisms used to maintain stability. An external focus of attention allows for the use of more automatic control processes that allow for corrections of movement patterns to occur at a quicker rate causing an improvement in overall performance (Shea & Wulf, 1999).

Similar to studying balance, researchers have also examined the effects on postural sway among adults using the same stabilometer apparatus and attentional focus cues from the balancing research (McNevin & Wulf, 2002; Wulf et al., 2001). Although participants demonstrated improvement across all practice trials, the external focused instructional group had lower root mean squared errors (RMSE) in comparison to the internal focus group throughout the acquisition phase (Wulf, McNevin, et al., 2001). In a follow up task, Wulf, McNevin, and colleagues (2001) analyzed how quickly participants were able to respond to postural sway by measuring their reaction time, the time between

an unexpected stimulus and the participants' response. In their study, the external and internal focused instructional groups remained consistent with previous studies using the stabilometer (McNevin & Wulf, 2002; Wulf, McNevin et al., 2001). Throughout practice, all groups were able to reduce their reaction time; however, the external focused group resulted in lower reaction times, reacting faster in comparison to the internal focused group (Wulf, McNevin, et al., 2001). The external focus group was able to make more frequent and smaller adjustments to movement of the stabilometer, which was associated with an improvement in balance and an overall greater performance outcome (Wulf, McNevin, et al., 2001).

With the introduction of a supra-postural task, postural sway is greatly influenced due to the adaptations one must make in order to successfully complete the task (McNevin & Wulf, 2002). During baseline collection, McNevin and Wulf asked participants to stand on a force plate with their eyes closed; no attentional focused instruction was administered (McNevin & Wulf, 2002). All participants completed a total of three 30-second trials, their baseline trial, and then a trial under both external and internal focus, along with a secondary task. The additional task required participants to touch the edge of a cloth sheet hanging on a coat rack. When externally focused, participants were instructed to "minimize the movement of the sheet over the duration of the trial" (McNevin & Wulf, 2002, p. 6). Internal focus instructions prompted participants to "minimize the movement of their index finger over the duration of the trial" (McNevin & Wulf, 2002, p. 6). Adding an additional task caused an increase in postural sway in both external and internal focused groups when compared to baseline conditions. The external focused group had greater success in correcting this postural sway at a higher

frequency, making smaller movement adjustments whereas the internal focus group responded at a lower frequency creating larger postural sway deviations (McNevin & Wulf, 2002). Findings from this study demonstrate the implications of an individual's attentional focus and its impact on postural stability. There is a combination of both conscious and automatic processing that plays a role in successful postural stability. With the addition of attentional focus demands (e.g., "focus on keeping your feet horizontal" versus "focus on keeping the markers on the stabilometer horizontal") these processes can be interrupted; however, this interruption occurs to a lesser extent under external focused conditions (Wulf, McNevin, et al. 2001). When focused externally, individuals demonstrate a greater stability in addition to a quicker response to sway; consequently, an internal focus of attention causes less stability and a slower response to postural sway (McNevin & Wulf, 2002; Wulf, McNevin, et al., 2001).

In addition to its effects on balance and postural sway, attentional focused instruction also has implications on acquisition and accuracy in a variety of sport skills, both discrete and continuous in nature. Of the discrete skills studied, many have supported the adoption of an external focus of attention including: golfing, dart throwing, jumping, soccer skills, volleyball skills, and basketball skills (Al-Abood, Bennett, Hernandez, Ashford, & Davids, 2002; An et al., 2013; Lohse, Sherwood, & Healy, 2010; Marchant et al., 2009; Wulf & Dufek, 2009; Wulf, McConnel, Gärtner, & Schwarz, 2002). The type of instruction given to learners prior to task execution not only has an impact on motor skill learning, but also the long-term effects on motor behavior (Zentgraf & Munzert, 2009). In a variety of golf tasks, researchers have found that an external focus of attention produces better performance outcomes when compared to an internal

focus of attention (An et al., 2013; Bell & Hardy, 2009; Land et al., 2014). For example, participants with no prior experience to golf putting were placed into two groups; the external focus group received instruction to focus on the speed of the ball and the internal focus group received instruction to focus on their arm swing (Land et al., 2014). The external focus group demonstrated greater accuracy and consistency throughout the acquisition period and retention test when compared to those who were instructed to internally focus their attention (Land et al., 2014). In addition, the movement patterns adopted by the participants in the external focus group were more representative of the biomechanical demands of the task as demonstrated by expert golfers (Land et al., 2014).

Challenging the results of previous studies, Perkins-Ceccato, Passamore, and Lee (2003) found that in lower skilled golfers, internal focused instructions ("concentrate on the form of the golf swing") resulted in an overall more consistent performance pattern compared to external focus instructions (Perkins-Ceccato et al., 2003, p. 4). Conversely, it was found among higher skilled golfers, the external focused instruction, "concentrate on hitting the ball as close to the target pylon as possible," resulted in better performance indicating that skill level may have an effect on which types of instruction are appropriate (Perkins-Ceccato et al., 2003, p. 4). Results from their study indicate that for a golf pitch shot, learning the task through an internal focus of attention may be more beneficial until the task is learned. However, once learned, focusing on where to hit the shot (external focus) will result in greater accuracy (Perkins-Ceccato et al., 2003). It should be noted, Wulf (2013) questioned these results, arguing that the instructions provided to the participants focused on different aspects of the task, and the internal focus instructions did not mention the participant's body. Wulf further noted ambiguities of the instructions,

making it difficult to determine where participants were truly focusing their attention (Wulf, 2013). The differing instructions and lack of a true internal focus might contribute to the results found by Perkins-Ceccato and colleagues (2003). In a recent review article, Wulf (2013) noted that instructional statements for both attentional focused groups should be similar to one another with the replacement of one or two words to induce either an external or internal focus of attention. Keeping instructional statements consistent with one another insures that participants are being asked to focus on the same element of a task, the only difference between treatment groups should be the direction they are instructed to focus.

The consistent results that an external focus of attention enhances performance can also be extended to dart throwing tasks. For example, participants were assessed on the accuracy of a dart throw to a target (Lohse et al., 2010; Marchant et al., 2009). Participants in the internal focused group were instructed to focus on the movement of the arm as the arm was drawn back and then to focus on releasing the dart at the end of the throw. Participants in the external focused group were instructed to focus on the center of the dartboard and to toss the dart once they achieved that focus (Lohse et al., 2010; Marchant et al., 2009). Participants displayed significantly less error when focused externally compared to those focused internally (Lohse et al., 2010; Marchant et al., 2009). Results from these studies provide support for the need of subtle differences in wording of instruction (external vs. internal) having a significant effect on performance outcomes (Lohse et al., 2010; Marchant et al., 2009).

In addition to dart throwing, vertical jump effectiveness and efficiency of jump height can be positively influenced using externally focused instruction (Wulf & Dufek,

2009; Wulf, Dufek, et al., 2010). In a vertical jump and reach task, Wulf and Dufek (2009) examined jump height and impulse, center of mass displacement, and lower extremity joint moments. Participants who were in the external focus group were instructed to focus on the rungs of the Vertec measurement system and participants in the internal focus group were instructed to focus on the finger they used to touch the rungs of the Vertec (Wulf & Dufek, 2009; Wulf, Dufek, et al., 2010). When externally focused, participants displayed a greater force production and jump height compared to the internal focused group (Wulf & Dufek, 2009; Wulf, Dufek, et al., 2010). In addition, Wulf and colleagues studied the muscle activation during the jump and reach task, finding that muscle activation started at the same time for both groups, however; in the external focused condition electromyography (EMG) activity was lower, suggesting a more efficient movement pattern (Wulf, Dufek, et al., 2010). These results add to the existing body of literature providing evidence for the use of external focus in increased performance efficiency and effectiveness (Wulf & Dufek, 2009; Wulf, Dufek, et al., 2010).

In addition to discrete sport skills, many continuous sport skills also provide support for the adoption of an external focus of attention, including: ski simulation, juggling, swimming, running, and rowing (Parr & Button, 2009; Schücker, Hagemann, Strauss, & Völker, 2009; Stoate & Wulf, 2011; Wulf, Höß, & Prinz, 1998; Zentgraf & Munzert, 2009,). In a slalom task using a ski simulator, Wulf and colleagues (1998) used attentional focused based instruction to research force exertion. Internal focus instructions required participants to focus on their feet during the task, while external focused instructions required participants to focus on the platform beneath their feet

(Wulf et al., 1998). After acquisition, participants completed a retention test where all forms of instruction were removed. Participants from the external focus group performed significantly better than the internal focus group, signifying a learning effect (Wulf et al., 1998).

Zentgraf and Munzert (2009) used the observational learning paradigm as a framework to research attentional focus instruction on the long-term biomechanical effects of learning a juggling task. The external focus group showed less discrepancy in peak ball height in comparison to the internal focus group; however, the internal focus group demonstrated less elbow displacement compared to the external focus group (Zentgraf & Munzert, 2009). The results of this study indicate that directing one's attention to something specific (i.e. focusing on the trajectory of the ball versus the movement of the arms) does have an impact on performance. Further, initial verbal instruction related to attentional focus can have a strong influence on skill acquisition (Zentgraf & Munzert, 2009). In addition, the external focused instructions do not have negative effects on movement patterns but they are redundant in an observational learning setting where the participant can observe what they are being instructed to do. Researchers concluded that attentional focused instructions are not always applicable to all types of motor skills and settings (Zentgraf & Munzert, 2009). Results from this juggling task also provide evidence that in an observational learning setting, participants can gather their own externally focused information and that providing internally focused instructions may unnecessarily increase task difficulty.

Lastly, swimming is another continuous sport skill in which researchers have found positive benefits for externally focused instruction (Stoate & Wulf, 2011). In a

swimming task Stoate and Wulf (2011) examined the effectiveness of attentional focused instruction in highly skilled swimmers. All participants completed a total of three trials; one to serve as a control, an external focus trial and an internal focus trial. When asked to focus internally, instructions directed the participants towards focusing on pulling their hands backwards and when focused externally instructions directed the participants to focus on pushing the water back (Stoate & Wulf, 2011). Results indicated that the external focus and control groups had significantly faster times than the internal focus group, providing support for externally focused instruction (Stoate & Wulf, 2011). In addition, this study provided support for an external focus of attention in enhancing performance of highly skilled participants in a complex task (Stoate & Wulf, 2011).

Attentional Focus Feedback Among Adults

The advantage found for using an external focus of attention in instruction is shown to have similar, positive implications on the type of feedback provided to learners practicing new motor skills (Shea & Wulf, 1999; Wulf et al., 2002). Since feedback is provided at a higher rate and volume than instruction, it is hypothesized that attentional focused feedback will be more effective at directing the participant's attention either externally or internally compared to attentional focused instruction (Wulf et al., 2002). Skill acquisition is promoted when feedback that is given to the learner focuses on the effects of their movements (external focus) versus the movements themselves (internal focus). Due to this, it is expected that externally focused feedback will enhance skill acquisition compared to internally focused feedback (Wulf et al., 2002).

Shea and Wulf (1999) used a stabilometer to assess the effects of attentional focused feedback on the accuracy of maintaining balance. Feedback was provided to

participants via a video screen where they could see movement deviations from the desired position. The external group was told to think of these deviations as the movement of the stabilometer and the internal group was told to think of these deviations as the movement of their feet (Shea & Wulf, 1999). When feedback was provided, regardless of its attentional focus, performance was enhanced; however, greater improvements were observed in externally focused feedback conditions (Shea & Wulf, 1999). At the retention test, when all feedback was removed, participants who received external focused feedback during acquisition outperformed other treatment groups, indicating that externally focused feedback has an effect on learning in addition to performance (Shea & Wulf, 1999).

In an applied setting, Wulf and colleagues (2002) conducted two experiments examining the effectiveness of type and frequency of feedback among participants learning a volleyball skill and soccer kick. In their first experiment, they aimed to test their hypothesis that externally focused feedback would be more effective in skill acquisition. Both novice and expert participants were divided into external and internal feedback groups. Although all groups increased their accuracy during practice, the experts scored higher than the novices, and the external feedback groups demonstrated greater accuracy and higher movement form scores compared to the internal focus groups for both novices and experts (Wulf et al., 2002). Surprisingly, at the retention test, the positive effects of external based feedback on performance were no longer seen, indicating that once feedback was removed, participants in the internal focus group were able to demonstrate performance comparable to those in the external focused group (Wulf et al. 2002). The results from this first experiment indicate that when learning a new skill,

directly referencing one's body movements via feedback does not have any long-term disadvantages or advantages on performance outcomes.

In their second experiment, Wulf and colleagues (2002) manipulated the frequency, in addition to the type, of feedback provided to learners to see the effects on skill performance. They hypothesized that under internal conditions, a lower frequency of feedback (33%) would be more effective than a higher frequency (100%), but that under external focus conditions the higher frequency would be better or equally as effective as the lower frequency (Wulf et al., 2002). Results from this study indicated that when feedback was internally focused, the lower frequency group performed better during acquisition, retention, and transfer tests. These results provide evidence that the lower frequency of feedback lessens the negative effects of internally focused feedback (Wulf et al., 2002). During the retention test, the participants that were part of the external feedback group performed better than those in the internal focus group with the most accurate being those who received high frequency externally focused feedback (Wulf et al., 2002).

In summary, a majority of the attentional focused research conducted among adults concludes that adopting an external focus yields better results in both skill acquisition and accuracy, for a variety of tasks (e.g., balance, postural sway, golf, dart-throwing, and juggling; Chiviacowsky et al., 2010; Land et al., 2014; McNevin & Wulf, 2002; Shea & Wulf, 1999; Wulf et al., 2002; Wulf et al., 2001; Wulf, Tollner, & Shea, 2007; Zentgraf & Munzert, 2009). These findings also provide support for the constrained action hypothesis, which posits that an external focus of attention facilitates enhanced performance of motor skills. Though a majority of the findings do support

adopting an external focus of attention, one study found support for an internal focus of attention (Perkins-Ceccato et al., 2003). However, flaws within the instructional statements may be the primary reason for these inconsistent findings (Wulf, 2013). The majority of studies reviewed focus on the effects of attentional focused instruction, with very few studies examining the effects of attentional focused feedback (Shea & Wulf, 1999; Wulf et al., 2002). Currently, in the literature, there is a lack of research examining the effects of attentional focused feedback on skill acquisition and performance. Extending the available literature on the effects of attentional focused based feedback may be beneficial since feedback is a primary avenue by which participants learn new skills.

Attentional Focus Instruction Among Children

Similar to the research focusing on the effects of attentional focus among adults, researchers have also studied this topic among a younger age population. Using a Biodex Balance System, Thorn (2006) included children between the ages of 9−12 years; those in the internal focus group were instructed to keep their feet still while trying to stand as still as possible. The external focus group was instructed to keep the platform still while trying to stand as still as possible, and the control group was not given any specific instructions (Thorn, 2006). In agreement with the constrained action hypothesis, results from this balancing task indicated that, similar to adults, children perform and learn the task better when prompted with instructions having an external focus of attention. Interestingly, the 9−10 year olds in the study generally performed the task with less variance than the 11−12 year old participants (Thorn, 2006).

Similar to the research studied in adults, there are fewer studies focusing on sport in children. Perreault (2013, Exp. 1) used basketball free throws to assess the effectiveness of externally focused instruction among children ages 9−11. The internal focus group was given the instruction "focus on making an L-shape with your arm and rest the ball on your finger pads," which provoked the learner to focus their attention towards their body (Perreault, 2013, Exp. 1, p. 41). The external focus group was instructed to "focus on balancing the ball on your hand like a waiter balances a tray," which provoked the learner to focus their attention towards the effects of their movement, rather than on the movement itself (Perreault, 2013, Exp. 1, p. 42). In contrast to previous research, results from this study found that the control group and internal focus group performed better than the external focused group during the retention test (Perreault, 2013, Exp. 1). These results are similar to those of Emanuel and colleagues (2008) who also found learning benefits with an internal focus of attention rather than an external focus of attention (Perreault 2013, Exp.1).

In a dart throwing task, Emanuel and colleagues (2008) hypothesized that children ages 8−10 years old would benefit more from an internal focus of attention due to their less mature cognitive capabilities compared to adults. The internal focus group was instructed to focus on the movements of the shoulder, arm and fingers, whereas the external focus group was instructed to focus on the target, the dart, and the path of the dart (Emanuel et al., 2008). Throughout acquisition, there was no consistent pattern of improvement in either group of children; however, during the transfer phase, children in the internal focus group performed the task with greater accuracy compared to the external group (Emanuel et al., 2008). Due to the slower rate at which children are able to

process new information and collect relevant visual cues, Emanuel and colleagues (2008) concluded that directing their attention to specifics in the visual field such as the darts and dart path hindered their performance. The results from this study suggest that the benefits of attentional focused instruction and feedback may not be as influential in children as in adults. However, in a recent review paper, Wulf (2013) argues these results may be due to the large number of instructional statements used in the study design, which can overwhelm the learner causing the instructions to be less effective. Additionally, Wulf mentions that there was only an interaction effect between age (adults and children) and focus (external and internal), and that the results are not as significant as the researchers reported (Wulf, 2013).

Some of the attentional focus literature has included children with minor disabilities. In children ages 10−14 with intellectual disabilities classified as mild (IQ = 51-69), motor performance varies with the severity of their disability (Chiviacowsky et al., 2013). Chiviacowsky and colleagues (2013) used an overhead beanbag toss to assess motor learning patterns in children. Although both the external and internal attentional focused instructional groups showed improvements throughout the acquisition phase, the external focused group consistently presented higher scores. During the transfer test, where the target distance was changed, a positive learning effect was noted when externally focused instructions were provided (Chiviacowsky, et al., 2013).

Attention deficit hyperactivity disorder (ADHD) is another disability that effects the cognitive, emotional and social functioning in children. Children who have been diagnosed with ADHD generally find it more difficult to learn and perform new skills (Saemi et al., 2013). Saemi and colleagues (2013) studied the effects of attentional

focused instructions in children ages 8−11 diagnosed with ADHD that was not severe enough for medication. Results suggest that during the acquisition phase, though results were not significant, the external focused group performed better than the internal focused group. Differences were also seen during the retention test, where the external focused group outperformed the internal focused group (Saemi et al., 2013). Additionally, researchers suggest that adopting an external focus of attention helps to speed up the delayed learning process in children with this disability (Chiviacowsky et al., 2013; Saemi et al., 2013). Findings from the research on children with mild disabilities provides evidence that children with lower cognitive functioning can still benefit from instructional cues that induce an external focus of attention (Chiviacowsky et al., 2013; Saemi et al., 2013).

Attentional Focus Feedback Among Children

Similar to the adult population, there is very little research that has been conducted on the effects of attentional focused based feedback on performance and learning in children. Based on the constrained action hypothesis, it is expected that because internally focused feedback causes the learner to focus on their own movements, interrupting the automatic control process, that a lower frequency of feedback would be more effective than a higher frequency (Wulf, Chiviacowsky, et al., 2010). Wulf and colleagues provided feedback at a high frequency to participants ages 10−12 after every practice trial, and at a low frequency approximately 30% of the time (Wulf, Chiviacowsky, et al., 2010). Conversely, because externally focused feedback promotes the use of the automatic control process, it is expected that a higher frequency of externally focused feedback would be more beneficial to learning and performance

(Wulf, Chiviacowsky, et al., 2010). Using a soccer throw-in task, Wulf, Chiviacowsky and colleagues (2010) examined the effects of this feedback type and frequency among children between the ages of 10−12. Results indicated that those participants in the high frequency external focused group demonstrated greater accuracy and movement form compared to all other treatment groups (Wulf, Chiviacowsky, et al., 2010).

In a basketball free throw task, Perreault (2013, Exp. 2) studied the effects of attentional focused feedback among children ages 9-11 who had no previous experience with the skill. Feedback was given to participants every third trial (low frequency) based upon the aspect of the skill that needed most improvement, and emphasis was placed on the learner using the type of focus being induced by the feedback (Perreault, 2013). Results from this study provide support for the use of external focused feedback in aiding performance and learning in children, similar to that of the adult populations (Perreault, 2013).

In summary, there are mixed findings as to which type of attentional focus instruction is most beneficial in the younger population. However, a greater portion of the literature available suggests that external attentional focus seems to promote learning and performance in children (Chiviacowsky et al., 2013; Perreault, 2013, Exp. 2; Saemi et al., 2013; Thorn, 2006). Though there is more research to support the use of external focus among children, the mixed findings and overall lack of research make it difficult to determine which type of instruction and feedback actually promote learning and enhanced performance in children. It has been suggested in previous research that one potential explanation of the differences in the findings of adults and children is the cognitive differences between these age populations (Emanual et al., 2008; Perreault,

2013). During the younger years of life, children are changing at a rapid rate and cognitive abilities improve throughout the years. Because of this, it is also important to bridge the gap in this literature and study the effects of attentional focus in a younger child population. Currently, there is no literature available examining the effects of attentional focus cues or feedback on children under the age of eight.

Cognitive Differences between Adults and Children

There are three primary ways by which children differ cognitively from adults: rehearsal, recall and recoding. Rehearsal strategies use repetition as a means to learning a new skill (Gallagher & Thomas, 1980). Recall strategies require the learner to call upon already learned mechanisms to help them connect previously learned skills from memory to a new skill or learning environment (Gallagher & Thomas, 1984). Recoding strategies require learners to organize, even reorganize, newly learned information or skills with previously learned information or skills (Gallagher & Thomas, 1986). Children lack the ability to utilize mature memory processes in order to generalize learning strategies to a novel situation. It is because of this that children are unable to process information as quickly and efficiently as adults (Gallagher & Thomas, 1980). Although children begin to utilize rehearsal strategies by age five, it is not until seven that they are able to employ them spontaneously, yet even at this stage they are still less efficient than adults. By age 11, children begin to display more mature rehearsal patterns, similar to adults (Gallagher & Thomas, 1980). Gallagher and Thomas (1980) studied how varying processing times in children would affect their performance of a ballistic, linear positioning task. They predicted that children and adults would perform similarly under conditions where children were given adequate processing time, yet when processing time decreased,

children's performance would also decrease (Gallagher & Thomas, 1980). Participants were assigned to three different treatment groups: mature strategy, child-like strategy, and self-determined strategy. Participants in the mature strategy group were taught active rehearsal techniques, which were accompanied by the use of grouping and recoding strategies (Gallagher & Thomas, 1980, 1984). The child-like strategy group used a passive (rote) rehearsal strategy, absent of any mature techniques. The self-determined strategy group served as a control and was allowed to use whichever rehearsal strategy they chose (Gallagher & Thomas, 1980, 1984). When placed in a group where participants were instructed to use child-like rehearsal strategies, the 5, 7, and 11 year olds were less likely to recall movements in the correct order compared to matched ages in the self-determined and mature groups (Gallagher & Thomas, 1980). Results from this study indicated that when children were instructed to rehearse using more mature strategies, their performance was greatly improved (Gallagher & Thomas, 1980).

Following their study on differences in rehearsal strategies between adults and children, Gallagher and Thomas (1984) researched the developmental differences in recall strategies between adults and children using the same linear positioning task and the same treatment groups. One of the major developmental differences between adults and children in processing information is that children often are unable use mature rehearsal strategies and are therefore unable to group and recode new information (Gallagher & Thomas, 1984). Mature rehearsal strategies are used in motor learning to commit information to memory and add the novel information to one's existing base of knowledge. Those in the child-like strategy group displayed greater variability on recall tasks than those in the mature and self-determined strategy groups (Gallagher & Thomas,

1984). The children (between the ages of 5−11) in the child-like strategy group were unable to recall movements in the correct order as frequently as age-matched subjects in the mature group (Gallaher & Thomas, 1984). These results indicate that children are able to perform better when they are instructed to use more mature processing strategies but when left to process information on their own, will revert to a child-like strategy. Children need help with utilizing more mature recall and recoding strategies because they are unable to complete these cognitive skills on their own.

Gallagher and Thomas (1986) conducted a third research study, examining the grouping and recoding strategies when learning a movement series, using the same linear slide task as the first two studies. In this study, there were three groups experimenter presented organization (EPO), subject organization (SO) and a training group (TO). The EPO group was presented movements in order from shortest to longest and the SO and TO groups were presented movements at random with no two consecutive lengths next to one another. Results from this study suggested that five year olds were not able to use the organizational cues provided to them via researchers. Additionally, results also indicated that adults are able to reach their maximal level of organization and decrease errors more quickly than children. While children were able to reach higher levels of organization, they did not decrease their error. The lack of ability of the children to use mature cognitive strategies affected their reaction times, causing them to perform slower. However, when taught to use a more mature cognitive strategy, children's reaction times were not significantly different from the adults (Gallagher & Thomas, 1986). Organization, comprised of grouping and recoding, is a key part of mature cognitive strategies that reduce task demands (Gallagher & Thomas, 1986). Grouping is a cognitive

strategy that is used to combine new information into larger units of information, after this process, recoding combines several groups of information and stores them in the long term memory for later use (Gallagher & Thomas, 1986). Results from this study indicate that before age ten, children are able to encode new information but do not use mature cognitive organizational skills to process this information. This lack of organization contributes to the decreased performance outcomes seen in children compared to adults (Gallagher & Thomas, 1986).

In addition to memory functions (rehearsal, recall, and recoding), perceptual development is also less mature in children when compared to adults. At age five, children are unable to perceive the same level of information as adults (Thomas & Thomas, 1987). Additionally children need a greater amount of time to be able to differentiate between an already learned movement sequence and a novel movement sequence. This immature perceptual development causes children to perceive their actions as correct although, often times, they are not (Thomas & Thomas, 1987). At approximately six to seven years of age, children have over-inclusive attentional capacities. This means that the environment can often overwhelm young children because they are unable to accurately recognize relevant from irrelevant information and try to attend to numerous features (Thomas & Thomas, 1987). In relation to attentional focused instruction and feedback, because children are unable to spontaneously select attention strategies until early adolescence, it is possible that these younger children are unable to utilize the attentional focused cues and feedback being provided to them in the same manner as older children or adults do. Additionally, as a result of their immature perceptual development and over-inclusive attentional capacities, children may often

focus on the irrelevant information being provided to them via instruction and feedback rather than what is relevant.

Due to the developmental differences between adults and children, motor performance in children tends to be less accurate, slower, and less adaptive to the visual changes in the environment, therefore demanding more attention (Goh, Kantak, & Sullivan, 2012). Children benefit from higher frequencies of cues and feedback that specifically direct their attention towards a component of the skill as a result of their need for higher levels of attention (Sullivan, Kantak, & Burtner, 2008). As discovered through the series of research studies conducted by Gallagher and Thomas (1980, 1984, 1986), children use different information processing strategies, which tend to be less efficient than adults. These differences in motor processing strategies cause children to benefit more from high frequency feedback during skill acquisition. Children practicing a skill under high frequency feedback were more successful during retention compared to children who received reduced feedback (Goh et al., 2012; Sullivan et al., 2008). These studies demonstrate that children process and utilize feedback differently than adults and that optimization of learning and successful performance can be achieved through the use of high frequency feedback (Sullivan et al., 2008). By providing children with lower frequency rates (approximately 30%) of feedback, the task demands exceed their capacity to learn new skills causing a decrease in performance; however, when high frequency feedback rates are provided, children are able to learn new skills almost as effectively as adults (Goh et al., 2012).

Additionally, Thomas and colleagues (1979) suggest that young children tend to not adhere to feedback being provided to them, and only improve performance when they

are instructed to utilize mature cognitive strategies (Gallagher & Thomas, 1980). In addition to not adhering to the feedback, young children also need more time to process feedback, and even with more time, are still unable to process feedback as accurately as older children and adults (Thomas et al., 1979). The difference in feedback processing between young children and adults is a contributing factor to differences in motor performance skill.

In summary, this section outlined the cognitive differences that contribute to learning and performance differences between adults and children. Children do not employ mature processing strategies and because of this have a difficult time learning and organizing new information from novel skills (Gallagher & Thomas, 1980, 1984, 1986). Due to these cognitive differences, children benefit from a higher frequency of feedback. Consistent with previous literature in attentional focus, a high frequency of feedback consists of providing feedback to young learners after every practice trial completed, versus a low frequency where learners are provided with feedback after approximately every three practice trials (Wulf, Chiviacowsky, et al., 2010). The increase in feedback children receive provides more opportunities for them to hear this new information and helps to reinforce the use of rehearsal strategies that they might not spontaneously engage in on their own. As a result of this reinforcement, young learners are able to perform the task more effectively (Goh et al., 2012).

Conclusion

In conclusion, this review has discussed the theoretical framework that has evolved in attentional focus literature. Current literature grounded in the constrained action hypothesis postulates an internal focus of attention causes learners to constrain the

automatic movement processes, causing a hindrance to performance (Wulf, McNevin, et al., 2001; Wulf, Shea, et al., 2001; Wulf, 2013). The available research on attentional focus instruction and feedback in adults was reviewed in a variety of tasks, including balance, postural stability, and sport skills. Research available on adults provides a general agreement that an external focus of attention is more successful in promoting learning and increased performance outcomes (Chiviacowsky et al., 2010; Land et al., 2014; McNevin & Wulf, 2001; Shea & Wulf, 1999; Wulf et al., 2002; Wulf, McNevin, et al., 2001; Zentgraf & Munzert, 2009). Research has provided evidence for the difference between adults and children's memory processing strategies. The differences in cognitive strategies, and less mature strategies commonly used by children are the primary reason why children benefit from higher feedback frequency, and also help to explain the inconsistent findings (Goh et al., 2012; Sullivan et al., 2008). The effects of attentional focus instructions in children have reported mix findings with some studies reporting the benefits of an internal focus of attention (Emanuel et al., 2008; Perreault, 2013, Exp. 1). Some studies have reported findings consistent with the literature in adults providing support for adopting an external focus of attention (Chiviacowsky et al., 2013; Perreault, 2013, Exp. 2; Saemi et al., 2013; Thorn, 2006; Wulf, Chiviacowsky, et al., 2010). Due to the minimal research available and the discrepancy in results, the aim of this study was to determine the effects of attentional focused instruction and feedback on performance outcomes of an underhand tossing task among young children. Children at this age have less mature cognitive abilities compared to the children ages 8 and above that have been previously studied in attentional focus literature.

CHAPTER III: METHODS

The purpose of this study was to determine the effectiveness of external attentional focused instruction and feedback on the performance of an underhand tossing task among first graders. It was hypothesized that, in agreement with the constrained action hypothesis and previous research, the external focused group would perform the task with higher performance outcome scores compared to the internal focused group. Data collection for this study was part of a larger study that encompassed the analysis of movement form as well as the adherence to and use of the feedback provided to the participants completing the tossing task. Although this additional data was collected, the primary focus of the current study was to examine and report the performance outcomes of the participants with respect to each treatment group. Results from the movement form and adherence data will be reported in a future manuscript. The following sections include a description of the participants, measures, the task and procedure as well as the data analysis techniques used in the current study.

Pilot Study

Prior to data collection, a pilot study was conducted with a kindergarten class. The participants were between 5−6 years old and part of the university's child daycare center. The pilot data collection took place in the university's main gym on campus. The university's IRB committee approved the consent forms, these were sent home to the parents and/or guardians of the participants. A letter written by the classroom teacher

accompanied the consent form, which indicated approval of the study provided by the center's director and the teacher. In addition, participants were asked to give their verbal assent prior to participating in the study. Signed consent forms and verbal assent were obtained prior to the start of data collection. In order to keep children from feeling left out, everyone participated in the task, however, data was only collected for those who had a signed consent form and agreed to participate.

The pilot served as a method to check the appropriateness of the target, manipulation check questions utilized as part of the larger study, grouping of the participants, positioning of the cameras, and to train the research assistants. The target used in the current study was used in previous studies with older participants (ages 8−12), the principal investigator wanted to confirm that it would also be appropriate to use with younger participants (Chiviacowsky et al., 2013; Saemi et al., 2013). The manipulation check questions were used to determine adherence to and use of feedback provided (data from these question will be presented in another manuscript). Participants were tested both individually and in groups of two and three to determine which grouping was most effective. Additionally, digital video cameras were placed at an angle back and behind the target, as well as at an angle to the side of the target to determine which position was most effective to capture performance scores and movement form. Lastly, to ensure consistency between research assistants, they were trained on the procedures of the study, to identify the elements of the underhand toss, and how to correctly provide feedback to participants. Results from the pilot study indicated that individually testing participants with cameras at an angle back and behind the target were most effective.

Participants

Three first-grade physical education classes from an elementary school in the Northwest were recruited for this study. Participants were between the ages of 6−7 years old. Participation was voluntary and no form of compensation was provided to those who agreed to partake in the study. The university's IRB committee as well as the principal and the physical education teacher of the elementary school approved the study prior to sending out the informed consent packet to the participants' parents or guardians (Appendix A and B). Informed consent was obtained from the parents or guardians of each participant. Further, verbal assent (Appendix C) from each participant was also obtained prior to the start of data collection. Students who did not assent or have a parent's/guardian's consent did not participate in the study, but rather participated in their normal physical education activities.

Task

The task performed was an underhand beanbag toss. This task was selected because it has been identified as developmentally appropriate for first graders (National Association for Sport and Physical Education [NASPE], 2010), and as part of the first grade curriculum in the school district. At the time of data collection the participants had not yet received formal instruction on underhand tossing. Similar to Chiviacowsky et al. (2013), participants stood 2 meters from a target affixed to the wall during the pretest, acquisition, and retention trial blocks. The target's center was 1.5 meters high from the floor. The target consisted of 10 concentric circles with radii of 10 to 100 centimeters in 10-centimeter increments (Chiviacowsky et al., 2013; Saemi et al. 2013). The same target was used for the pretest, acquisition, retention, and transfer trial blocks. During the

transfer trial block, participants completed the same underhand tossing task from a distance of 3 meters instead of 2 meters.

Procedure

Data collection took place in the gymnasium of the elementary school. The children that participated in data collection did so during the time of their regularly scheduled physical education period in four 30-minute sessions over a period of three weeks (See Table 1). The first day of data collection consisted of a pretest and the first acquisition trial block. Days two and three consisted of two trial blocks of acquisition, and the fourth day consisted of a retention and transfer test. The pretest, five trial blocks of acquisition, retention, and transfer tests all consisted of 10 trials each, for a total of 80 tosses. Participants from each intact class were quasi-randomly assigned, based upon gender, into one of two treatment groups: external focus or internal focus.

Table 1:
Data collection schedule

	Monday	Tuesday	Wednesday	Thursday	Friday
Week 1	Class A Pretest – 10 trials Acquisition – 10 trials	Class B Same as A	Class C Same as A	Class A Acquisition – 20 trials	
Week 2		Class B Same as A	Class C Same as A	Class A Acquisition – 20 trials	Class B Same as A
Week 3	Class C Same as A	Class A Retention – 10 trials Transfer – 10 trials	Class B Same as A	Class C Same as A	

Feedback Statements

During the acquisition trial blocks, feedback was provided to the participants after every two tosses. Feedback statements were created using the kindergarten assessment guidelines of the underhand toss determined by NASPE (2010; See Table 2). The three essential elements identified for correct movement form are: a) arm back in preparation, b) opposite foot forward, c) releases ball in forward motion (NASPE, 2010, p. 53). The kindergarten assessment was used so that the movement form elements were developmentally appropriate for participants in both the pilot and primary studies. The feedback statements used in the current study were based upon these elements and were modified to address the intended attentional focus for each treatment group. The principal investigator took into consideration Wulf's (2013) suggestion regarding the similarity of wording and content of the statements. The corresponding statements for each treatment group are the same statement with the replacement of one word to induce that focus of attention. By writing statements like this, the element of the skill that each participant is drawn to is the same and only the attention direction in which they focus changes.

Table 2:
Attentional focused feedback statements, external and internal

External Feedback Statements	Internal Feedback Statements
1. Bring the *beanbag* backwards when you start. 2. Place your opposite *shoe* forward when you begin your toss. 3. Swing the *beanbag* forward towards the target.	1. Bring your *arm* backwards when you start. 2. Place your opposite *foot* forward when you begin your toss. 3. Swing your *hand* forward towards the target.

Acquisition

Participants completed data collection procedures individually and were instructed to participate in regular physical education activities led by their physical education instructor when not participating in data collection. Prior to completing the pretest, participants watched a 15-second general instructional video on how to perform the underhand toss. The general instructional video featured the participants' physical education instructor modeling the task; no specific cues or instructions were provided in the video. The pretest consisted of 10 trials, the participants were instructed to perform the underhand toss towards the target on the wall, and no feedback was provided. Once the pretest was completed, participants watched another 15-second instructional video with a demonstration of the task containing attentional focused information of how to perform the task. The specific instructional videos again featured the participants' physical education instructor modeling the task; however, in these videos, the physical education instructor verbalized the same feedback statements that would be provided to the participants during acquisition (Table 2). Two specific instructional videos were created: one for the external focused group and one for the internal focused group. After watching the specific instructional video, participants completed one block of ten trials of acquisition. All participants watched videos individually with a research assistant on an iPad using a headset. After each viewing of the video, participants were asked to identify the key components of the underhand toss as a check for understanding prior to completing the task (See Appendix D for externally focused daily scripts and Appendix E for internally focused daily scripts). A trained research assistant provided either one

external or internal focused feedback statement after every two trials from a list of three feedback statements during all acquisition trial blocks (Table 2).

On days two and three, participants watched the same specific instructional video, corresponding to their assigned treatment group that was provided on day one during the first acquisition trial block. After watching the video and completing the check for understanding, participants completed another acquisition trial block consisting of 10 tosses. Participants continued to receive one feedback statement, respective to their focus group after every two tosses from a trained research assistant. Once the trial block was completed, participants watched the specific instructional video again and completed another acquisition trial block, receiving a feedback statement after every two tosses. All feedback provided during the five acquisition trial blocks was administered by a trained research assistant, and feedback statements were chosen based upon the essential element of the skill that needed most improvement. If performed correctly, research assistants were instructed to provide a random statement from one of the three provided. Providing feedback in this manner is similar to research done by Perreault (2013) and Wulf, Chiviacowsky, et al. (2010).

Retention and Transfer

After completion of acquisition, participants met on a fourth day to complete retention and transfer trial blocks. During the retention trial block, all participants viewed the general instructions video, similar to the pretest, to remind them of the task. The retention trial block consisted of ten trials, exactly the same as the acquisition period, however no feedback was provided. The transfer trial block took place immediately after the retention trial block with participants standing 3 meters away from the target instead

of 2 meters used in the previous trials. The transfer trial block was similar to the retention trial block; it consisted of 10 trials with no feedback provided to the participants.

Measures

To assess performance outcomes, participants received a score of 10 if the beanbag hit the center target and 1 point was deducted for every concentric circle thereafter. If the beanbag hit a line between two concentric circles, the participant received the higher of the two scores. If participants did not hit the target they received a score of 0. A similar scoring system was used by Chiviacowsky and colleagues (2013). The scores from all 10 trials in each trial block were averaged to obtain one score, a score of 10 being the maximum possible. The averaged scores for each trial block were further used in the data analysis. Digital video cameras (Casio Exilim Ex-ZR100) were placed at an angle back and behind the target so the target and participant were completely seen in the camera view (NASPE, 2010).

Data Analysis

Pretest scores from both treatment groups were tested as a covariate using a t-test to determine if there was a difference between the groups prior to the start of the study. Performance scores during the acquisition phase were analyzed in a 2 (Group: Internal, External) X 6 (Pretest and 5 Acquisition Trial Blocks 1-5) ANOVA with repeated measures on the last factor. Additionally, a second 2 (Group: Internal, External) X 3 (Acquisition Trial Block 5, Retention, and Transfer) ANOVA with repeated measures on the last factor was analyzed. All statistical analyses were conducted through IBM SPSS Statistics (IBM SPSS Statistics for Windows, Version 22.0. Armonk, NY: IBM Corp.), and the significance level for all analyses was set at $\alpha<0.05$.

CHAPTER IV: RESULTS

It was hypothesized that participants in the external focused group would perform the underhand tossing task with better performance outcome scores compared to those in the internal focused group. A t-test was used to determine if the pretest was a covariate prior to running the main statistical analyses. A repeated measures ANOVA was used to test for statistical significance between groups during the pretest and five blocks of acquisition trials. A repeated measures ANOVA was used to test for statistical significance between groups during the last acquisition trial block, retention, and transfer trial blocks.

Participants

Twenty-five participants (M = 6.26 years, SD = 0.45) participated in this study from three separate intact first grade classrooms at a local elementary school in the Northwest. Data were collected on 34 participants, however nine participants were removed from the study because they were absent for at least one of the trial blocks. Table 3 provides a breakdown of participants prior to and with the removal of the 9 absent participants. Prior to removal of participants there was an equal representation of gender across both treatment groups. The principal investigator quasi-randomly assigned participants to groups in this manner to avoid potential gender differences. Additionally, prior to removal of participants, there were an equal number of participants in each treatment group.

Table 3:
Attentional focus group by gender. Participants were removed due to absence of one or more trial blocks

	External		Internal		Total
	Included	Removed	Included	Removed	
Males	5	2	4	4	15
Females	9	1	7	2	19
Total	14	3	11	6	34

Descriptive Statistics

The highest score participants could receive was 10 points. Mean scores, between pretest to transfer, for the externally focused group ranged between 1.6-9.0 points and mean scores for the internally focused group ranged between 2.8-9.0 points. The externally focused group had greater variance within their mean performance outcome scores between the pretest to transfer, and achieved their highest scores during the pretest. Throughout acquisition the scores fluctuated by approximately 0.45 points. The internally focused group scored highest during the first acquisition trial block and scores fluctuated throughout acquisition by approximately 0.70 points. From acquisition trial block five to the retention test, the externally focused group neither improved nor got worse yet the internally focused group performance scores were higher (Table 4). The results from the last acquisition trial block to the retention test indicate that the participants maintained their performance of the skill. Overall, the internally focused group performed the task with slightly higher outcome scores across most trial blocks.

Table 4:
Performance scores for external and internal focus groups

	External		Internal	
	M	*SD*	*M*	*SD*
Pretest	6.71	1.50	6.95	1.18
A1	6.56	1.61	7.00	1.25
A2	6.11	1.81	6.56	1.24
A3	6.31	1.98	6.89	0.96
A4	6.40	1.47	6.30	1.54
A5	6.34	1.50	6.43	1.55
Retention	6.34	1.14	6.47	1.21
Transfer	4.36	1.69	4.75	1.54

Data Analysis

No significant differences were found between groups at the pretest $t(23) = -0.418$, $p = 0.394$, therefore the pretest was included in the main analysis. During the pretest and five acquisition trial blocks, there was no main effect found, $F(5,115) = 1.19$, $p = 0.317$, partial $\eta^2 = 0.05$. This means that there were no significant differences within the groups across the pretest and five acquisition trial blocks. The main effect between groups, $F(1,23) = 0.35$, $p = 0.56$, partial $\eta^2 = 0.02$ was also found to be non-significant. Additionally, the interaction between the acquisition trial blocks and groups, $F(5,115) = 0.39$, $p = 0.85$, partial $\eta^2 = 0.02$ was non-significant. Participants in the internal focus group had higher performance scores at the pretest and during acquisition; however, statistical analyses determined that the differences in scores were not significant.

A main effect within groups was found significant between acquisition trial block five, retention and transfer trial blocks $F(2,46) = 33.93$, $p < 0.0005$, partial $\eta^2 = 0.60$. The partial eta squared value is considered moderate to strong (Ferguson, 2009); 60% of the variance of the participants' performance outcome scores can be attributed to time. It

should also be noted that the task changed from acquisition trial block 5 and retention (participants stood 2 meters from the target) to the transfer trial block (participants stood 3 meters from the target). This change in task could also be considered a confounding factor in the percentage of variance reported in the performance outcome scores. Scores from the fifth acquisition trial block to the retention trial block remained the same for the external focus group and improved for the internal focus group (See Table 4). However, scores from the transfer trial block (M = 4.53, SD = 1.54) were significantly lower compared to both acquisition trial block five (M = 6.38, SD = 1.49), and the retention trial block (M = 6.42, SD = 1.15). There was no significant difference between groups for these three trial blocks $F(1,23) = 0.15$, $p = 0.71$, partial $\eta^2 = 0.01$. The interaction between acquisition trial block five, retention and transfer trial blocks $F(2,46) = 0.21$, $p = 0.81$, partial $\eta^2 = 0.01$ was also not significant.

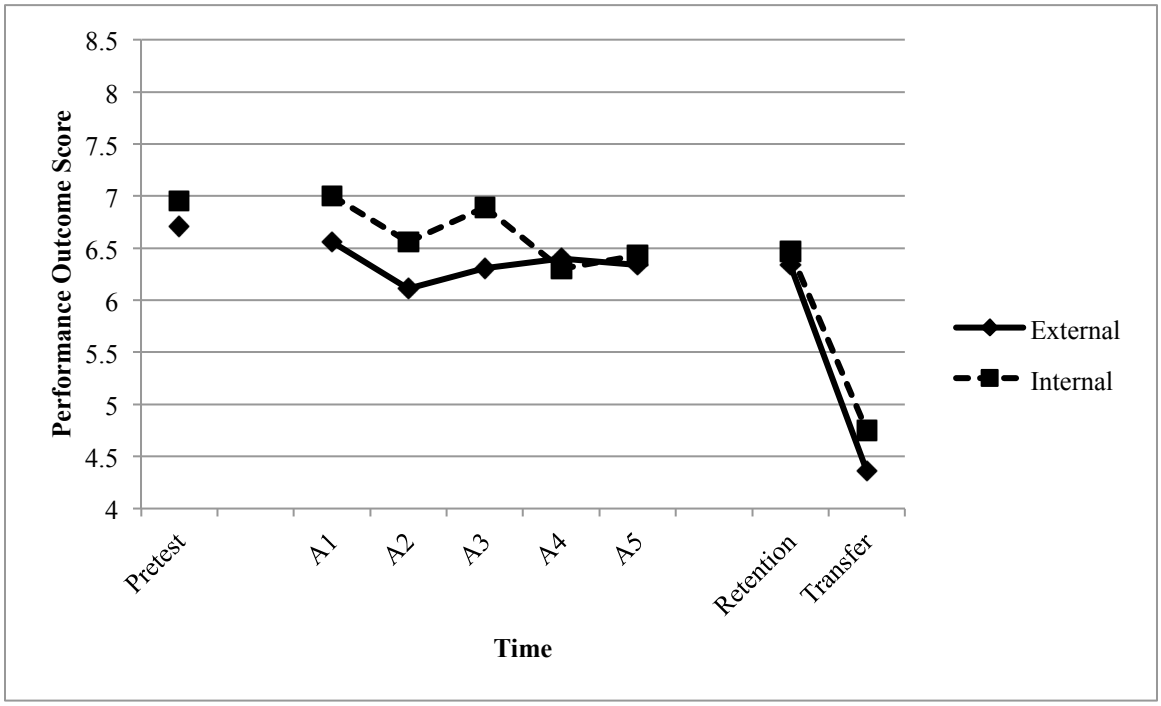

Figure 1: Mean performance scores for the external and internal focus groups for the pretest, acquisition period (A1-A5), retention and transfer tests

The mean performance scores of the underhand toss depict a slight advantage, although non-significant, for the internal focus group at the pretest, throughout acquisition, and during the retention and transfer trial blocks. Although performance scores throughout all five acquisition trial blocks were not statistically significant, there is a slight downward trend for both groups. At the retention trial block, both groups performed similarly to the last acquisition trial block, indicating that retention of the task took place. Additionally, Figure 1 depicts the significant decrease in scores that both groups experienced at the transfer trial block.

CHAPTER V: DISCUSSION

The purpose of this study was to examine the effects of attentional focused based instruction and feedback on performance outcomes among young children. The literature supports the use of an external focus of attention, which improves both performance and learning during acquisition, retention, and transfer (Wulf, McNevin, et al., 2001; Wulf, Shea, et al., 2001; Wulf, 2013). However, among children, there appears to be mixed results (Chiviacowsky et al., 2013; Emanuel et al., 2008; Perreault, 2013; Thorn, 2006; Wulf, Chiviacowsky, et al., 2010). One main hypothesis was tested in the current study, that participants who received externally focused instruction and feedback would perform the underhand toss with higher performance outcome scores compared to those receiving internally focused instruction and feedback. This hypothesis was not supported. Results indicated that there were no significant differences in performance scores during acquisition, retention, or transfer trial blocks between either of the treatment groups.

Neither group significantly improved nor deteriorated throughout the acquisition period; additionally results at the retention test were similar to results during acquisition. While neither group significantly changed between acquisition trial block one and five, there was an average loss of 0.5 points for the internally focused group and 0.3 points for the externally focused group. Although these results were not significant, the internal focus group demonstrated slightly higher mean performance scores compared to the external focus group throughout the acquisition period. These results were similar to

those of Perreault (2013, Exp. 2) and Emanual et al. (2008). The only significant difference reported in the current study was the difference in scores between acquisition trial block five ($M = 6.35$, $SD = 1.53$), the retention trial block ($M = 6.42$, $SD = 1.15$) and the transfer trial block ($M = 4.53$, $SD = 1.54$). Acquisition trial block five and the retention trial block were not significantly different from one another. The slight increase in scores between the last acquisition trial block and the retention trial block indicate that participants from both groups were able to maintain their performance. During the transfer trial block, participants were required to stand further back from the target, which may have been a contributing factor to the significant difference between the transfer trial block and the last acquisition and retention trial blocks. The significantly lower scores during the transfer trial block suggest that any learning that took place during acquisition did not transfer to a task where participants were required to toss from a further distance.

Results from the current study show no significant differences between groups. It is possible that professionals working with young children are not hindering their performance or learning by utilizing internally focused instruction and feedback. There are three major cognitive differences between young children and older children and adults that may help explain the findings from the current study. First, the constrained action hypothesis suggests that when focused internally, participants evaluate and regulate their thoughts, actions, and behaviors when performing a new skill. This evaluation and regulation causes the learner to experience a "micro-choking" episode, which decreases performance outcomes (Wulf, 2013). The ability to evaluate and regulate one's own thoughts, actions, and behaviors may require mature cognitive strategies that young children do not have. Therefore, it is possible that an internal focus

of attention does not cause a hindrance to performance in young children because they are unable to accurately evaluate their own actions and do not experience the "micro-choking" episodes that both older children and adults experience. This is seen in the data when participants in the internally focused group scored higher performance outcome scores during acquisition when participants received feedback (with the exception of trial block 4; see Table 4).

Second, previous research has shown that children require more time to adequately process feedback and even when given this time, do not have the capability to process feedback as effectively as adults (Thomas et al., 1979). Children need longer periods of time to process information due to their less matured abilities to recall, recode and rehearse new information (Gallagher & Thomas, 1980, 1984, 1986). The current study design was set-up in such a manner that during acquisition, participants completed two tosses, received feedback, and then immediately completed two additional tosses. Since it takes children longer to process information, it is possible that the current study design did not allow for adequate processing time before participants were asked to complete the next practice trial. While participants heard and possibly even understood the instructional cues and feedback being provided to them, they might not have been able to recall, recode, or rehearse and accurately utilize this information to improve their performance

Third, Thomas and colleagues (1979) have discovered that with regard to cognition and motor performance, understanding and successfully executing a skill are not the same. Although the participants in the current study were able to repeat back the instruction and feedback provided to them, performed during the check for

understanding, it is possible that their inability to utilize mature cognitive processing disabled them from effectively using the information. In addition to needing more time to recall, recode, and rehearse new information, children are not as efficient or effective as older children and adults are (Gallagher & Thomas, 1980, 1984, 1986). Therefore, because of these less mature cognitive strategies, children are unable to process information as accurately as adults, contributing to their variable and decreased performance outcomes. This is seen in the current data by examining the range of performance outcome scores. The externally focused group received average outcome scores between 1.6-9.0 points while the internally focused group received scores between 2.8-9.0 points. The large variance in scores within both groups demonstrates that participants performed in a variable manner due to their inability to maturely process the feedback being provided to them.

A potential explanation for the difference in results between previous literature and this study could be that the participants in the current study were unable to efficiently process and utilize the specific instruction and feedback provided to them. Previous research has shown that before ten years of age, children are unable to utilize mature organizational and encoding strategies to process newly learned information (Gallagher & Thomas 1984, 1986). Since the children in the current study were all under the age of 10, it is possible that they were not able to organize and encode the information provided to them via instruction and feedback. The children participating in the current study were younger (M=6.26 years) than the children participating in studies conducted by Emanual et al. (2008), Perreault (2013), Thorn (2006) and Wulf, Chiviacowsky, et al. (2010) who ranged in age between 8−12 years. The younger population participating in the current

study makes this explanation more likely since their cognitive strategies are even less efficient than those participating in previous research studies. Additionally, Chiviacowsky et al. (2013) and Saemi et al. (2013) studied special child populations ages 8−14 years (mild intellectual disabilities and ADHD, respectively); it is difficult to compare these participants with those in the current study because of the the differences in both age and diagnosed disabilities. Due to the inability to utilize effective encoding and rehearsal strategies, it is possible that participants in the current study had difficulties understanding and retrieving from memory the attentional focused feedback provided to them when practicing the task. Further, because children require a high frequency of feedback, it is possible that the participants in the current study did not receive an adequate amount of feedback necessary to promote effective encoding and rehearsal strategies.

There was also a discrepancy in the results between the current study and that of Wulf, Chiviacowsky, et al. (2010), one of the few who have provided attentional focused feedback to children. Wulf, Chiviacowsky and colleagues (2010) found a significant benefit for externally focused cues effecting the movement form of a soccer throw-in task; yet found no significant difference between groups when measured on accuracy or distance of throw. A possible explanation for the discrepancy in results to Wulf, Chiviacowsky, et al. (2010) could be due to the aspect of the skill analyzed. Perreault (2013) suggested that instructional cues and feedback provide information to participants about their movement form, yet participants were analyzed based upon performance outcomes. In the current study, feedback statements referred to specific aspects of the underhand toss, however analysis was based on the participant's outcome scores. It may

be possible that although there were no significant differences in the outcome scores of the underhand toss information from movement form might help researchers understand how these young children are responding to attentional focused feedback. Movement form data was collected during the current study, and will be presented in a different manuscript. The constrained action hypothesis, the primary framework from which attentional focus literature emerges, states that there is a benefit for an external focus of attention because it promotes the use of automatic control processes, allowing the system to naturally self-organize, resulting in more effective and fluid movement patterns (Wulf, McNevin, et al., 2001; Wulf, Shea, et al., 2001; Wulf, 2013). This description relates to the analysis of movement form and not accuracy. Including movement form in conjunction with the performance outcome scores, for the current study, may shed light on how these younger participants utilized the instruction and feedback provided to them.

Limitations

A limitation of the current study may have been a lack of motivation and attention of the participants to complete the task, as seen by the decline in outcome scores across time in the current study (Table 4). For example, due to the nature of data collection, participants were tested individually in the same elementary school gymnasium while the rest of their class engaged in regular physical education activities. The decision to test individually was based upon the pilot study as well as previous research that has done the same (Chiviacowsky et al., 2013; Emanual et al., 2008; Perreault, 2013; Wulf, Chiviacowsky, et al., 2010). However, one difference between previous research and the current study is that due to time and space limitations, data collection occurred in the same room as other physical education activities, whereas previous researchers used

isolated settings. It is possible that participants were not motivated to accurately complete the underhand tossing task because they were eager to join the rest of their class in physical education. Additionally, the noise created by those participating in physical education may have caused a distraction to the participants. As stated earlier children between ages six and seven have an over-inclusive attentional capacity, making it difficult for them to discern relevant versus irrelevant information from their environment (Thomas, 1994). It is possible that the children participating in the current study were distracted by their fellow classmates engaging in physical education, which negatively effected their performance. Further, if participants performed badly on one trial, it may have elicited discouragement and caused them to be less motivated to try and perform better on the next trial. Due to the visual nature of the task, participants were able to see their performance scores as they practiced the underhand tossing task, and immediately knew how well they were performing the task, which could have effected their motivation.

Another limitation to the current study was the schedule of data collection, which was dictated by the school. Due to the rotation of physical education classes, participants from each intact class had different time intervals between the four days of testing. For example, Class A had a 2-day break, and Class C had a 4-day break between day one and day two of data collection. See Table 1 for a detailed breakdown of the schedule. The lack of consistency in time between acquisition, retention and transfer trial blocks may contribute to the lack of significant results found in this study. Additionally, data collection took place during participants' regularly scheduled physical education period, which was 30 minutes long. Taking into consideration participants may have arrived late

to physical education and time was needed to split them into groups, there were only 20−24 minutes available for data collection. With this time limitation, the principal investigator controlled for the amount of feedback provided to participants. While previous attentional focus literature supports the delivery of high frequency of feedback provided after every trial, the current study design provided feedback after every other trial (Perreault, 2013; Wulf, Chiviacowsky, et al., 2010). The amount of feedback provided in the current study was administered at a higher rate compared to the low frequency feedback of previous research, which in attentional focused literature is generally given after every three trials (Perreault, 2013; Wulf, Chiviacowsky, et al., 2010). While it is possible that statistical significance may have been found in the current study with more feedback, providing feedback after every practice trial is not practical in an applied setting. The current study better embodies the challenges that a physical education instructor would face when teaching, strengthening its ecological validity. Further, previous research tested participants in a less applied setting, making it difficult to discern if the results favoring an external focus of attention would apply to a real-world setting (Chiviacowsky et al., 2013; Emanual et al., 2008; Perreault, 2013; Thorn, 2006; Wulf, Chiviacowsky, et al., 2010).

Applications and Significance

Young children's less mature cognitive processing abilities are a major contributor to their inability to accurately utilize instruction and feedback. This information is useful for physical educators working with young children. Although children benefit from high frequencies of feedback, in an applied setting, it is not practical for physical educators to individually provide feedback to participants after

every practice trial. However, the time that it takes for a physical educator to individually address students may provide young children the adequate time needed to accurately process this new information for use on future practice trials. Additionally, the strong findings among adults which suggest that an external focus of attention is better for improving both performance and learning has led researchers to believe that an internal focus of attention is detrimental to performance (Wulf, 2013). However, among children, the mixed findings in the literature may suggest that an internal focus of attention is not as detrimental to performance as it is for adults.

Future Research

In conclusion, the current study adds to the literature available on the effects of attentional focused instruction and feedback among children. Despite the lack of statistical significance, this study is one of the first to explore these effects in younger children (ages 6−7), whose cognitive capacities are not as developed as the children previously studied in this literature (Emanual et al., 2008; Gallagher & Thomas, 1980, 1984, 1986; Perreault, 2013; Thorn, 2006; Wulf, Chiviacowsky, et al., 2010). The current study may lend itself to provide future research a place to start when understanding the effects of attentional focus instruction and feedback among young children. As part of a larger study, the data collected on movement form and adherence to the instruction and feedback provided to these participants may shed light on the results of the current study. The manipulation check questions, modified by Perreault (2013) and utilized in the larger study, may help to provide information about the adherence to the instruction and feedback provided. Responses to the manipulation check questions may also provide additional information that would help us understand participants' motivation and what

they focused on while performing the task. Additionally, the informational content may contribute to the understanding of the cognitive processing of these participants', and if they utilized the information that was provided to them via feedback.

Future research should continue to study this younger age population to determine which type of attentional focused instruction and feedback, if any at all, is most beneficial. It may be beneficial to extend the current research and test young children in a more controlled and isolated setting to eliminate distractions from other classmates. Additionally, it may also be beneficial for future researchers to administer feedback to participants at various time intervals. By doing this, it will allow researchers to better understand the amount of time young children need in order to best process and utilize instruction and feedback. Lastly, it may also be beneficial to conduct more research in applied settings so that results can provide more practical information to physical educators and clinicians working with young children.

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APPENDIX A

IRB Approval Letter

BOISE STATE UNIVERSITY
RESEARCH AND ECONOMIC DEVELOPMENT

Date: November 10, 2014 **To:** Amanda Seneri cc: Laura Petranek

From: Social & Behavioral Insitutional Review Board (SB-IRB) c/o Office of Research Compliance (ORC)

Subject: SB-IRB Notification of Approval - Original - 103-SB14-155 *Effects of Attentional Focused Feedback on an Underhand Tossing Task Among Young Children*

The Boise State University IRB has approved your protocol submission. Your protocol is in compliance with this institution's Federal Wide Assurance (#0000097) and the DHHS Regulations for the Protection of Human Subjects (45 CFR 46).

Protocol Number: 103-SB14-155 Received: 11/4/2014 **Expires: 11/9/2015** Approved: 11/10/2014

Review: Expedited Category: 6, 7

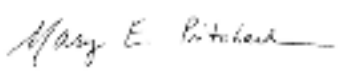
Your approved protocol is effective until 11/9/2015. To remain open, your protocol must be renewed on an annual basis and cannot be renewed beyond 11/9/2017. For the activities to continue beyond 11/9/2017, a new protocol application must be submitted.

ORC will notify you of the protocol's upcoming expiration roughly 30 days prior to 11/9/2015. You, as the PI, have the primary responsibility to ensure any forms are submitted in a timely manner for the approved activities to continue. If the protocol is not renewed before 11/9/2015, the protocol will be closed. If you wish to continue the activities after the protocol is closed, you must submit a new protocol

application for SB-IRB review and approval.

You must notify the SB-IRB of any additions or changes to your approved protocol using a Modification Form. The SB-IRB must review and approve the modifications before they can begin. When your activities are complete or discontinued, please submit a Final Report. An executive summary or other documents with the results of the research may be included.

All forms are available on the ORC website at http://goo.gl/D2FYTV Please direct any questions or concerns to ORC at 426-5401 or humansubjects@boisestate.edu. Thank you and good luck with your research.



Dr. Mary Pritchard

Chair Boise State University Social & Behavioral Insitutional Review Board

1910 University Drive Boise, Idaho 83725-1139
Phone (208) 426-5401 orc@boisestate.edu

APPENDIX B

Consent Form Packet

BOISE STATE UNIVERSITY

INFORMED CONSENT

Study Title: Effects of Attentional Focused Feedback on an Underhand Tossing Task Among Young Children

Principal Investigator: Amanda Seneri

Co-Principal Investigator/Faculty Adviser: Dr. Laura Jones Petranek

Dear Parent/Guardian:

My name is Amanda Seneri and I am a graduate student in the Master's of Science in Kinesiology program at Boise State University. I am asking for your permission to include your child in my research. This consent form will give you the information you will need to understand why this study is being done and why your child is being invited to participate. It will also describe what your child will need to do to participate as well as any known risks, inconveniences or discomforts that your child may have while participating. I encourage you to ask questions at any time. If you decide to allow your child to participate, you will be asked to sign this form and it will be a record of your agreement to participate. You will be given a copy of this form to keep.

➢ PURPOSE AND BACKGROUND

As you may know, the underhand tossing task is part of the curriculum for the first grade classes at Koelsch Elementary School. The purpose of this research is to better understand the effectiveness of different types of feedback on learning a new skill. As part of my master's thesis, I would like to provide different types of feedback, videotape your child's performance and audio record responses from your child about their participation in this task.

➢ PROCEDURES

This study will include a four-day observation in your child's physical education class, where your child will learn and perform the underhand toss. This study will not require your child to do anything above and beyond what they would normally be doing in their physical education class. If you choose not to allow your child to participate, s/he will still participate in the physical education activities; however, no data will be collected on their performance.

Your child's physical education class will be videotaped in order to assess both the accuracy and overall performance of their underhand toss. Additionally, your child will be individually asked to respond to a few questions regarding their thoughts about the underhand tossing task. Your child's responses to these questions will be audio tape

recorded. This research study will be conducted during your child's regular physical education class and at no time will your child be separated from their peers or their teacher.

- **RISKS/DISCOMFORTS**

Your child may feel uncomfortable being videotaped, but the camera will be placed in a manner that should not distract them. Additionally, your child will be asked to respond to interview questions regarding their thoughts during the underhand tossing task. It is possible that your child may feel uncomfortable responding to these questions and/or having their responses tape-recorded. You can ask for your child not to be audio and/or video taped at any time. Your child may also ask not to be audio and/or video taped at any time. You are also able to remove your child from the study at any time.

- **EXTENT OF CONFIDENTIALITY**

Reasonable efforts will be made to maintain personal information regarding your child's privacy and confidentiality. Any identifiable information obtained in connection with this study will remain confidential and will be disclosed only with your permission or as required by law. The members of the research team and the Boise State University Office of Research Compliance (ORC) may have access to the data. The ORC monitors research studies to protect the rights and welfare of research participants.

Your child's name will not be used in any written reports or publications, which result from this research. Data will be kept for three years (per federal regulations) after the study is complete and then destroyed.

- **BENEFITS**

By participating in this study your child may benefit by increasing their skill level in the underhand tossing task. The information gained from this research may help education professionals, coaches and clinicians better understand how to provide children with effective feedback when learning a new skill.

- **PAYMENT**

There will be no payment to you or your child as a result of your child taking part in this study.

- **QUESTIONS**

If you have any questions or concerns about participation in this study, you should first talk with the investigator Amanda Seneri or her advisor, Dr. Laura Jones Petranek, at (208) 426-4366.

If you have questions about your rights as a research participant, you may contact the Boise State University Institutional Review Board (IRB), which is concerned with the protection of volunteers in research projects. You may reach the board office between 8:00 AM and 5:00 PM, Monday through Friday, by calling (208) 426-5401 or by writing:

Institutional Review Board, Office of Research Compliance, Boise State University, 1910 University Dr., Boise, ID 83725-1138.

DOCUMENTATION OF CONSENT

I have read this form and decided that my child will participate in the project described above. Its general purposes, the particulars of involvement and possible risks have been explained to my satisfaction. I will discuss this research study with my child and explain the procedures that will take place. I understand I can withdraw my child at any time.

_____

Printed Name of Child

_____ _____

Printed Name of Parent/Guardian **Signature** of Parent/Guardian Date

_____ _____

Signature of Person Obtaining Consent Date

KOELSCH ELEMENTARY
2015 N. Curtis Road Boise, ID. 83706
208-854-5300

December, 2014

Dear parents of 1st grade students,

We have a wonderful opportunity coming up after the first of the New Year!

Our community university students from Boise State University would like to assist 1st graders with practicing their underhand tossing skills. We welcome our guests to Koelsch as they will work with individuals and groups.

First grade students will be performing taught skills to see which methodology of instruction and demonstration will best assist them in improving those skills.

Our principle, Mr. Totorica, has given his approval and I, as the Physical Education Specialist will work closely with B.S.U. as we guide your child in learning.

Physical Education is a very important part of your child's overall educational experience. The learning that takes place contributes to a lifetime of wellness. The interest you show in your child's activities reinforces learning. I support your involvement and invite you to join us during P.E. class!

P.E. 4 U 'N ME…

Mrs. Morgan

APPENDIX C

Verbal Assent Script

VERBAL ASSENT SCRIPT

Hello class, we have the opportunity to participate in a research study by a student at Boise State University. She wants to learn more about the kinds of information you receive when you are practicing your underhand tossing skills. She is asking you to take part in a research study because you are a first grader at Koelsch Elementary. I'm going to tell you a little bit about the study so you can decide if you want to be in it or not.

If you do not want to be in the study you will still participate in regular PE activities with your classmates.

If you want to be in this study, she and her friends will be videotaping our class while you are underhand tossing a beanbag to a target. They will also ask you a few questions at the end of class and your answers will be tape-recorded. You do not have to answer any question you don't want to and you can stop at any time. You can start and then if you want to stop being in the study at some point, that's okay too. No one will be mad at you.

Do you have any questions? At the end of class before you leave please come up to me one at a time and tell me "yes" if you want to be in the study or "no" if you do not want to be in the study.

APPENDIX D

External Group Daily Scripts

External Day 1

PROMPT:

"Good afternoon, today we are going to be practicing our underhand tossing skills. I want you to watch this video with me of Ms. Morgan showing you an example of how to practice an underhand toss. **(**Play GENERAL INSTRUCTIONAL VIDEO**).** Can you repeat back to me the 3 things that Ms. Morgan did in the video?"

- At this point, you are looking for the participant to talk about bringing the arm backwards, stepping with opposite foot and swinging the arm forward (Or something along these lines)
- If they recite it correctly continue on, if not, help them identify and understand what they are supposed to be doing by replaying the video and pointing out the 3 components of the toss, after doing so ask them to repeat back to you what you said during the video.

"Ok, great, now it is your turn to practice. I want you to stand at this line and toss your beanbag like Ms. Morgan did at this target. I will say, "Ready, set, toss" and then you will toss the beanbag"

"Ready set toss"

- Allow the participant to toss the beanbag. You will repeat this 10 times. **(DO NOT PROVIDE FEEDBACK DURING THIS TIME)**
    - If participant is off task at any point, you can say "Remember to focus on tossing towards the center of the target"

"Great! I want you to watch another video with me of Ms. Morgan practicing her beanbag tossing, this time, I would like you to pay attention to what she is saying in the video. **(**Play SPECIFIC INSTRUCTIONAL VIDEO**)** Can you repeat back to me what Ms. Morgan said in this video?"

- At this point, you are looking for the participant to talk about bringing the beanbag backwards, stepping with the opposite shoe, and swinging the beanbag towards the target
- Again, if they recite it correctly continue and if not help them to correctly identify and understand the instructions by replaying the video and verbally pointing out the 3 components of the video during the replay.

"We are going to practice again, this time, I would like you to keep in mind the things that Ms. Morgan talked about in her video ok?" I want you to stand at this line and toss your beanbag like Ms. Morgan did at this target. I will say, "Ready, set, toss" and then you will toss the beanbag"

"Ready set toss"

- Allow the participant to toss beanbag twice, providing feedback from the approved list of statements after every second thrown. Repeat for a total of 10 tosses.
    - If the participant asks for clarification about the feedback provided, you can repeat the statement or answer their questions with either “yes” or “no”
    - If participant is off task at any point, you can say “Remember to focus on tossing towards the center of the target”

“Thank you very much, now I would like to ask you a few questions about your beanbag tossing experience” (Refer to manipulation check group 1)

External Day 2

PROMPT:

"Good afternoon, today we are going to be practicing our underhand tossing skills. I want you to watch this video with me of Ms. Morgan showing you an example of how to practice an underhand toss. During the video, I would like you to pay attention to the things that Ms. Morgan is saying. **(**Play SPECIFIC INSTRUCTIONAL VIDEO**).** Can you repeat back to me the 3 things that Ms. Morgan did in the video?"

- At this point, you are looking for the participant to talk about bringing the beanbag backwards, stepping with opposite shoe and swinging the beanbag forward (Or something along these lines)
- If they recite it correctly continue and if not help them to correctly identify and understand the instructions by replaying the video and verbally pointing out the 3 components of the video during the replay.

"Ok great, now it is your turn to practice, I would like you to keep in mind the things that Ms. Morgan talked about in her video ok? I want you to stand at this line and toss your beanbag like Ms. Morgan did at this target. I will say, "Ready, set, toss" and then you will toss the beanbag"

"Ready set toss"

- Allow the participant to toss beanbag twice, providing feedback from the approved list of statements after every second thrown. Repeat for a total of 10 tosses.
    - If the participant asks for clarification about the feedback provided, you can repeat the statement or answer their questions with either "yes" or "no"
    - If participant is off task at any point, you can say "Remember to focus on tossing towards the center of the target"

"Great job! I want you to watch the video of Ms. Morgan practicing her beanbag toss with me again, remember to pay attention to what she is saying in the video. **(**Play SPECIFIC INSTRUCTIONAL VIDEO**)** Can you repeat back to me what Ms. Morgan said in this video?"

- At this point, you are looking for the participant to talk about bringing the beanbag backwards, stepping with opposite shoe and swinging the beanbag forward (Or something along these lines)
- If they recite it correctly continue and if not help them to correctly identify and understand the instructions by replaying the video and verbally pointing out the 3 components of the video during the replay.

“We are going to practice again, remember to keep in mind the things that Ms. Morgan talked about in her video ok? I want you to stand at this line and toss your beanbag like Ms. Morgan did at this target. I will say, “Ready, set, toss” and then you will toss the beanbag”

“Ready set toss”

- Allow the participant to toss beanbag twice, providing feedback from the approved list of statements after every second thrown. Repeat for a total of 10 tosses.
    - If the participant asks for clarification about the feedback provided, you can repeat the statement or answer their questions with either “yes” or “no”
    - If participant is off task at any point, you can say “Remember to focus on tossing towards the center of the target”

“Thank you very much, now I would like to ask you a few questions about your beanbag tossing experience” (Refer to manipulation check group 1)

External Day 3

PROMPT:

"Good afternoon, today we are going to be practicing our underhand tossing skills. I want you to watch this video with me of Ms. Morgan showing you an example of how to practice an underhand toss. During the video, I would like you to pay attention to the things that Ms. Morgan is saying. **(**Play SPECIFIC INSTRUCTIONAL VIDEO**).** Can you repeat back to me the 3 things that Ms. Morgan did in the video?"

- At this point, you are looking for the participant to talk about bringing the beanbag backwards, stepping with opposite shoe and swinging the beanbag forward (Or something along these lines)
- If they recite it correctly continue and if not help them to correctly identify and understand the instructions by replaying the video and verbally pointing out the 3 components of the video during the replay.

"Ok great, now it is your turn to practice, I would like you to keep in mind the things that Ms. Morgan talked about in her video ok? I want you to stand at this line and toss your beanbag like Ms. Morgan did at this target. I will say, "Ready, set, toss" and then you will toss the beanbag"

"Ready set toss"

- Allow the participant to toss beanbag twice, providing feedback from the approved list of statements after every second thrown. Repeat for a total of 10 tosses.
    - If the participant asks for clarification about the feedback provided, you can repeat the statement or answer their questions with either "yes" or "no"
    - If participant is off task at any point, you can say "Remember to focus on tossing towards the center of the target"

"Great job! I want you to watch the video of Ms. Morgan practicing her beanbag toss with me again, remember to pay attention to what she is saying in the video. **(**Play SPECIFIC INSTRUCTIONAL VIDEO**)** Can you repeat back to me what Ms. Morgan said in this video?"

- At this point, you are looking for the participant to talk about bringing the beanbag backwards, stepping with opposite shoe and swinging the beanbag forward (Or something along these lines)
- If they recite it correctly continue and if not help them to correctly identify and understand the instructions by replaying the video and verbally pointing out the 3 components of the video during the replay.

“We are going to practice again, remember to keep in mind the things that Ms. Morgan talked about in her video ok? I want you to stand at this line and toss your beanbag like Ms. Morgan did at this target. I will say, “Ready, set, toss” and then you will toss the beanbag”

“Ready set toss”

- Allow the participant to toss beanbag twice, providing feedback from the approved list of statements after every second thrown. Repeat for a total of 10 tosses.
    - If the participant asks for clarification about the feedback provided, you can repeat the statement or answer their questions with either “yes” or “no”
    - If participant is off task at any point, you can say “Remember to focus on tossing towards the center of the target”

“Thank you very much, now I would like to ask you a few questions about your beanbag tossing experience” (Refer to manipulation check group 1)

External Day 4

PROMPT:

"Good afternoon, today we are going to be practicing our underhand tossing skills. I want you to watch this video with me of Ms. Morgan showing you an example of how to practice an underhand toss. **(**Play GENERAL INSTRUCTIONAL VIDEO**).** Can you repeat back to me the 3 things that Ms. Morgan did in the video?"

- At this point, you are looking for the participant to talk about bringing the arm backwards, stepping with opposite foot and swinging the arm forward (Or something along these lines)
- If they recite it correctly continue on, if not, help them identify and understand what they are supposed to be doing by replaying the video and pointing out the 3 components of the toss, after doing so ask them to repeat back to you what you said during the video.

"Ok, great, now it is your turn to practice. I want you to stand at this line and toss your beanbag like Ms. Morgan did at this target. I will say, "Ready, set, toss" and then you will toss the beanbag"

- Have participant line up on the **FIRST LINE**.

"Ready set toss"

- Allow participant to toss beanbag. **DO NOT PROVIDE ANY FEEDBACK DURING THESE TRIALS**. Repeat 10 times
    - If participant is off task at any point, you can say "Remember to focus on tossing towards the center of the target"

"Great job! We are going to watch the video of Ms. Morgan practicing one more time ok? **(**Play GENERAL INSTRUCTIONAL VIDEO**).** Can you repeat back to me the 3 things that Ms. Morgan did in the video?"

- At this point, you are looking for the participant to talk about bringing the arm backwards, stepping with opposite foot and swinging the arm forward (Or something along these lines)
- If they recite it correctly continue on, if not, help them identify and understand what they are supposed to be doing by replaying the video and pointing out the 3 components of the toss, after doing so ask them to repeat back to you what you said during the video.

"We are going to practice your beanbag tossing again but this time we are going to practice from this line a little further back. . I want you to stand at this line and toss your beanbag like Ms. Morgan did at this target. I will say, "Ready, set, toss" and then you will toss the beanbag"

- Have participant line up on the **SECOND LINE**.

"Ready set toss"

- Allow participant to toss beanbag. **DO NOT PROVIDE ANY FEEDBACK DURING THESE TRIALS**. Repeat 10 times
    - If participant is off task at any point, you can say "Remember to focus on tossing towards the center of the target"

"Thank you very much, now I would like to ask you a few questions about your beanbag tossing experience ok?" (Refer to manipulation check group 1)

APPENDIX E

Internal Group Daily Scripts

Internal Day 1

PROMPT:

"Good afternoon, today we are going to be practicing our underhand tossing skills. I want you to watch this video with me of Ms. Morgan showing you an example of how to practice an underhand toss. **(**Play GENERAL INSTRUCTIONAL VIDEO**).** Can you repeat back to me the 3 things that Ms. Morgan did in the video?"

- At this point, you are looking for the participant to talk about bringing the arm backwards, stepping with opposite foot and swinging the arm forward (Or something along these lines)
- If they recite it correctly continue on, if not, help them identify and understand what they are supposed to be doing by replaying the video and pointing out the 3 components of the toss, after doing so ask them to repeat back to you what you said during the video.

"Ok, great, now it is your turn to practice. I want you to stand at this line and toss your beanbag like Ms. Morgan did at this target. I will say, "Ready, set, toss" and then you will toss the beanbag"

"Ready set toss"

- Allow the participant to toss the beanbag. You will repeat this 10 times. **(DO NOT PROVIDE FEEDBACK DURING THIS TIME)**
    - If participant is off task at any point, you can say "Remember to focus on tossing towards the center of the target"

"Great! I want you to watch another video with me of Ms. Morgan practicing her beanbag tossing, this time, I would like you to pay attention to what she is saying in the video. **(**Play SPECIFIC INSTRUCTIONAL VIDEO**)** Can you repeat back to me what Ms. Morgan said in this video?"

- At this point, you are looking for the participant to talk about bringing the arm backwards, stepping with the opposite foot, and swinging the hand towards the target
- Again, if they recite it correctly continue and if not help them to correctly identify and understand the instructions by replaying the video and verbally pointing out the 3 components of the video during the replay.

"We are going to practice again, this time, I would like you to keep in mind the things that Ms. Morgan talked about in her video ok?" I want you to stand at this line and toss your beanbag like Ms. Morgan did at this target. I will say, "Ready, set, toss" and then you will toss the beanbag"

"Ready set toss"

- Allow the participant to toss beanbag twice, providing feedback from the approved list of statements after every second thrown. Repeat for a total of 10 tosses.
    - If the participant asks for clarification about the feedback provided, you can repeat the statement or answer their questions with either “yes” or “no”
    - If participant is off task at any point, you can say “Remember to focus on tossing towards the center of the target”

“Thank you very much, now I would like to ask you a few questions about your beanbag tossing experience” (Refer to manipulation check group 2)

Internal Day 2

PROMPT:

"Good afternoon, today we are going to be practicing our underhand tossing skills. I want you to watch this video with me of Ms. Morgan showing you an example of how to practice an underhand toss. During the video, I would like you to pay attention to the things that Ms. Morgan is saying. **(**Play SPECIFIC INSTRUCTIONAL VIDEO**).** Can you repeat back to me the 3 things that Ms. Morgan did in the video?"

- At this point, you are looking for the participant to talk about bringing the arm backwards, stepping with the opposite foot and swinging the hand forward (Or something along these lines)
- If they recite it correctly continue and if not help them to correctly identify and understand the instructions by replaying the video and verbally pointing out the 3 components of the video during the replay.

"Ok great, now it is your turn to practice, I would like you to keep in mind the things that Ms. Morgan talked about in her video ok? I want you to stand at this line and toss your beanbag like Ms. Morgan did at this target. I will say, "Ready, set, toss" and then you will toss the beanbag"

"Ready set toss"

- Allow the participant to toss beanbag twice, providing feedback from the approved list of statements after every second thrown. Repeat for a total of 10 tosses.
    - If the participant asks for clarification about the feedback provided, you can repeat the statement or answer their questions with either "yes" or "no"
    - If participant is off task at any point, you can say "Remember to focus on tossing towards the center of the target"

"Great job! I want you to watch the video of Ms. Morgan practicing her beanbag toss with me again, remember to pay attention to what she is saying in the video. **(**Play SPECIFIC INSTRUCTIONAL VIDEO**)** Can you repeat back to me what Ms. Morgan said in this video?"

- At this point, you are looking for the participant to talk about bringing the arm backwards, stepping with the opposite foot and swinging the hand forward (Or something along these lines)
- If they recite it correctly continue and if not help them to correctly identify and understand the instructions by replaying the video and verbally pointing out the 3 components of the video during the replay.

“We are going to practice again, remember to keep in mind the things that Ms. Morgan talked about in her video ok? I want you to stand at this line and toss your beanbag like Ms. Morgan did at this target. I will say, “Ready, set, toss” and then you will toss the beanbag”

“Ready set toss”

- Allow the participant to toss beanbag twice, providing feedback from the approved list of statements after every second thrown. Repeat for a total of 10 tosses.
    - If the participant asks for clarification about the feedback provided, you can repeat the statement or answer their questions with either “yes” or “no”
    - If participant is off task at any point, you can say “Remember to focus on tossing towards the center of the target”

“Thank you very much, now I would like to ask you a few questions about your beanbag tossing experience” (Refer to manipulation check group 2)

Internal Day 3

PROMPT:

"Good afternoon, today we are going to be practicing our underhand tossing skills. I want you to watch this video with me of Ms. Morgan showing you an example of how to practice an underhand toss. During the video, I would like you to pay attention to the things that Ms. Morgan is saying. **(**Play SPECIFIC INSTRUCTIONAL VIDEO**).** Can you repeat back to me the 3 things that Ms. Morgan did in the video?"

- At this point, you are looking for the participant to talk about bringing the arm backwards, stepping with the opposite foot and swinging the hand forward (Or something along these lines)
- If they recite it correctly continue and if not help them to correctly identify and understand the instructions by replaying the video and verbally pointing out the 3 components of the video during the replay.

"Ok great, now it is your turn to practice, I would like you to keep in mind the things that Ms. Morgan talked about in her video ok? I want you to stand at this line and toss your beanbag like Ms. Morgan did at this target. I will say, "Ready, set, toss" and then you will toss the beanbag"

"Ready set toss"

- Allow the participant to toss beanbag twice, providing feedback from the approved list of statements after every second thrown. Repeat for a total of 10 tosses.
    - If the participant asks for clarification about the feedback provided, you can repeat the statement or answer their questions with either "yes" or "no"
    - If participant is off task at any point, you can say "Remember to focus on tossing towards the center of the target"

"Great job! I want you to watch the video of Ms. Morgan practicing her beanbag toss with me again, remember to pay attention to what she is saying in the video. **(**Play SPECIFIC INSTRUCTIONAL VIDEO**)** Can you repeat back to me what Ms. Morgan said in this video?"

- At this point, you are looking for the participant to talk about bringing the arm backwards, stepping with the opposite foot and swinging the hand forward (Or something along these lines)
- If they recite it correctly continue and if not help them to correctly identify and understand the instructions by replaying the video and verbally pointing out the 3 components of the video during the replay.

“We are going to practice again, remember to keep in mind the things that Ms. Morgan talked about in her video ok? I want you to stand at this line and toss your beanbag like Ms. Morgan did at this target. I will say, “Ready, set, toss” and then you will toss the beanbag”

“Ready set toss”

- Allow the participant to toss beanbag twice, providing feedback from the approved list of statements after every second thrown. Repeat for a total of 10 tosses.
    - If the participant asks for clarification about the feedback provided, you can repeat the statement or answer their questions with either “yes” or “no”
    - If participant is off task at any point, you can say “Remember to focus on tossing towards the center of the target”

“Thank you very much, now I would like to ask you a few questions about your beanbag tossing experience” (Refer to manipulation check group 2)

Internal Day 4

PROMPT:

"Good afternoon, today we are going to be practicing our underhand tossing skills. I want you to watch this video with me of Ms. Morgan showing you an example of how to practice an underhand toss. **(**Play GENERAL INSTRUCTIONAL VIDEO**).** Can you repeat back to me the 3 things that Ms. Morgan did in the video?"

- At this point, you are looking for the participant to talk about bringing the arm backwards, stepping with opposite foot and swinging the arm forward (Or something along these lines)
- If they recite it correctly continue on, if not, help them identify and understand what they are supposed to be doing by replaying the video and pointing out the 3 components of the toss, after doing so ask them to repeat back to you what you said during the video.

"Ok, great, now it is your turn to practice. I want you to stand at this line and toss your beanbag like Ms. Morgan did at this target. I will say, "Ready, set, toss" and then you will toss the beanbag"

- Have participant line up on the **FIRST LINE**.

"Ready set toss"

- Allow participant to toss beanbag. **DO NOT PROVIDE ANY FEEDBACK DURING THESE TRIALS**. Repeat 10 times
    - If participant is off task at any point, you can say "Remember to focus on tossing towards the center of the target"

"Great job! We are going to watch the video of Ms. Morgan practicing one more time ok? **(**Play GENERAL INSTRUCTIONAL VIDEO**).** Can you repeat back to me the 3 things that Ms. Morgan did in the video?"

- At this point, you are looking for the participant to talk about bringing the arm backwards, stepping with opposite foot and swinging the arm forward (Or something along these lines)
- If they recite it correctly continue on, if not, help them identify and understand what they are supposed to be doing by replaying the video and pointing out the 3 components of the toss, after doing so ask them to repeat back to you what you said during the video.

"We are going to practice your beanbag tossing again but this time we are going to practice from this line a little further back. . I want you to stand at this line and toss your beanbag like Ms. Morgan did at this target. I will say, "Ready, set, toss" and then you will toss the beanbag"

- Have participant line up on the **SECOND LINE**.

“Ready set toss”

- Allow participant to toss beanbag. **DO NOT PROVIDE ANY FEEDBACK DURING THESE TRIALS**. Repeat 10 times
    - If participant is off task at any point, you can say “Remember to focus on tossing towards the center of the target”

“Thank you very much, now I would like to ask you a few questions about your beanbag tossing experience ok?” (Refer to manipulation check group 2)