



THE EFFECTS OF INTERNAL AND EXTERNAL FOCUS ATTENTION ON THE STANDING LONG JUMP AMONG HIGH SCHOOL FEMALE ATHLETES

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Abstract:

Coaches and trainers often use verbal cues to help players improve their sport performance and training quality. The type of verbal instructions implemented by a coach may influence how players execute certain tasks. External and internal focus attention are verbal cues that may help athletes improve performance in various tasks such as running and jumping. **Purpose:** This study attempted to determine if implementing external focus attention cues (EFAQ) improved standing long jump (SLJ) performance when compared to implementing internal focus attention cues (IFAQ). **Methods:** Female (n=14) high school soccer players completed three testing sessions where three trials of the SLJ were collected (3 sessions with 3 trials each). Prior to each testing session a dynamic warmup was implemented to prepare the participants for the subsequent SLJ trials. During the initial test session, the coach/investigator provided no attention cues (NQ) prior to the SLJ trials. During the other two testing sessions the coach provided either an EFAQ or IFAQ prior to the SLJ trials. Second and third testing session were carried out in a randomized repeated measures fashion. The testing sessions occurred on three different days at the beginning of the week over three weeks. The best SLJ score from each testing session was used for statistical analysis. A paired t-test was used to compare the SLJ scores between the sessions. Gain scores and effect size (EF) differences between the NQ SLJ scores and the EFAQ and IFAQ conditions were also calculated. **Results:** The best SLJ scores for the test conditions were as follows: NQ=174.0±17.4, IFAQ=169.1±20.7 and EFAQ=178.2±16.4 (cms). The EFAQ SLJ scores were significantly greater than both the IFAQ and NQ SLJ scores (p<0.05). The IFAQ SLJ scores were significantly less than the NQ SLJ scores (p<0.05). The ES difference and gain score between the EFAQ and NQ were: 0.24 SD and 4.2±7.3 cms. The ES difference and gain score between the IFAQ and NQ were: -0.28 SD and -4.9±10.0 cms. **Conclusion:** Within

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the parameters of this study, EFAQ improves SLJ scores when compared to either NQ or IFAQ scenarios. Further, IFAQ appears to degrade SLJ performance when compared to a NQ scenario.

Keywords: external focus attention, standing long jump, high school, female, soccer

1. Introduction

Coaches give instructions to help players improve their sports performance. For example, in basketball, coaching cues are given to players to improve shooting accuracy such as, "arm in a C," "fingertips on the ball," and "look at the back of the rim." For players, it can be beneficial for them to receive specific instructions on the different skills of their sport or training (Tsetseli et al., 2016).

Internal and external focus attention cues (IFAQ and EFAQ) are two different ways coaches can give instructions (Bertollo et al., 2015). Association and dissociation are two different ways that focus attention can be defined (Bertollo et al., 2015). Association is when an athlete monitors their own body sensations while dissociation is when body sensations are ignored and focus is on an external performance outcome (Bertollo et al., 2015). Association is used with internal focus attention when athletes are thinking about their body movements when performing a certain task (Bertollo et al., 2015). Dissociation applies to external focus attention as athletes will be focusing on external performance outcomes (Bertollo et al., 2015).

When comparing the difference between IFAQ and EFAQ, studies have determined that external focus attention can be beneficial in improving the skills in athletes (Tsetseli et al., 2016). A study by Tsetseli et al. (2016), examined tennis performance among youth players. It was determined that the EFAQ group experienced improvement in the different tennis game situations. Other studies have been conducted with running and throwing that have also demonstrated improvement through EFAQ (Hill et al., 2017; Pascua et al., 2015). EFAQ specific instructions may help coaches be deliberate in verbal cue instruction to improve player skills from simple to complex movements.

EFAQ can improve how motor skills such as balance can be performed among populations with little experience in a task (Wulf & McNevin, 2003). Wulf and McNevin (2003) completed a study to determine if EFAQ could improve balance performance among university students. The study examined four different cue strategies: EFAQ, IFAQ, no cue, and a distractor cue. The EFAQ strategy demonstrated the most effective results in enhancing balance and the authors concluded that EFAQ can improve the use of the automatic control process in the body (Wulf & McNevin, 2003).

A study by Kershner et al. (2019) demonstrated improved countermovement jump performance with EFAQ compared to IFAQ among NCAA Division I athletes. The notion of Constrained Action Hypothesis (CAH) is one way to explain why athletes who are proficient at a skill can increase their performance when using EFAQ (McNevin, Shea, &

Wulf, 2003; Kershner et al., 2019). The CAH states, “*the brain defaults to subconscious self-organization when performing a skill*” (Kershner et al., 2019). As such, if the focus of an athlete is an external performance outcome (i.e. EFAQ), the CAH may likely come into play. For example, athletes might be able to focus on where they need to throw an object or perform a lay-up and their body will perform the correct movements without the athletes having to concentrate on performing the task, instead the process of subconscious self-organization is engaged. As such, it may be reasonable for strength and conditioning coaches to consider using EFAQ as an instructional mechanism to help athletes enhance full body movements such as squat variations, deadlifts, Olympic lifting derivatives, and bounding/jumping movements (i.e. vertical jump-VJ, standing long jump-SLJ).

Jumping is a skill common in many sports (Vassil & Bazanovk, 2012; Kershner et al., 2019). It has been documented that VJ performance can be improved by using EFAQ. In a study by Wulf et al. (2010), physically active college students were asked to complete a VJ with the use of either IFAQ or EFAQ. For the IFAQ scenario, participants focused on their own fingers when jumping while the EFAQ focused on the object being touched. The results of the study suggested that the improvement in VJ height were likely due to a difference in neuromuscular coordination as a result of EFAQ rather than an improvement in muscular power output (Wulf et al., 2010).

The SLJ is a test used to assess muscular power and is a modality to develop lower body power output (Ah Sue, Harris, Adams, Berning, & DeBeliso, 2017; Baechle & Earle, 2008; Reid, Dolan, & DeBeliso, 2017). Porter et al. (2010) examined IFAQ and EFAQ among college students to determine if their performance in the SLJ could be improved. The IFAQ group was instructed to focus on their body movement mechanics while the EFAQ group was instructed on where to jump and land. The results demonstrated that the EFAQ group had a significant increase in SLJ performance compared to the IFAQ group (Porter et al., 2010).

The results from the aforementioned studies suggest that college aged students and athletes may have increased skill performance when EFAQ is employed compared to IFAQ. However, these studies have not investigated the effects of EFAQ and IFAQ on performance measures among high school female athletes. Therefore, the purpose of this research effort was to examine the effects of IFAQ and EFAQ on SLJ performance among high school female athletes. It was hypothesized that high school female athletes will have increased performance in the SLJ with EFAQ compared to IFAQ.

2. Methods

2.1 Participants

Participants in this study were female varsity soccer players from a High School (HS) located in California, US. The female athletes were physically active as a result of their participation in a varsity sport.

Prior to recruitment, the Southern Utah University Institution Review Board granted study approval. Participants were recruited for this study by the testing administrator and high school athletic director. The student athletes were informed about the study through written and verbal form. For players under the age of 18, consent and parental assent were obtained. Any players ≥ 18 years of age had their own consent form. All participation was voluntary. Participants were excluded from the study if they had any injuries that would deter them from playing their sport. Participants were able to withdraw from the study at any time without penalty.

2.2 Instruments and Apparatus

Testing sessions were performed at the HS practice soccer field. The soccer field is composed of level grass and is well maintained. The SLJ was the assessment used for this testing protocol. The SLJ is used to assess lower body explosive power (Miller, 2012). To conduct this test a flat surface, tape measure, and tape were used to collect the SLJ data (Miller, 2012). The high reliability of the SLJ has been previously reported with ICC's ranging from 0.91-0.99 when administering at least three trials (Ah Sue et al., 2017; Reid, Dolan, & DeBeliso, 2017).

2.3 Procedures

Testing occurred at the HS practice soccer field during three separate sessions with 6 rest days in between. Testing sessions occurred before players started soccer practices, so all athletes were wearing cleats during testing. The testing administrator and one research assistant collected the data for the SLJ. The research assistant was trained by the testing administrator on a valid SLJ, how to measure the SLJ and the specific cues to read during testing.

Day one of testing, athletes were given a participant number, and their height, weight, and age were recorded. Participant numbers were given to the players by random selection. The participant then performed a warm-up (WU), this was the same WU the players performed before each soccer practice. The seniors of the team led WU. Players completed a series of dynamic stretches especially focused on the lower body such as high knees, side shuffles, and walking lunges. Following the WU, the participants were instructed by the testing administrator on how to complete a valid SLJ (noting that the participants had executed the SLJ many times in the past). The instructions were based on the NSCA's Guide to Tests and Assessment (Miller, 2012). When players were ready to attempt the SLJ, the testing administrator read the following statement to players: "*Start with your toes on the starting line and using a rapid countermovement, jump as far as possible*" (Miller, 2012). Players were allowed two practice attempts to get comfortable with the SLJ. Three attempts of the SLJ were recorded with a two-minute rest between each attempt. If a player fell or their feet moved after the jump was completed, the trial was invalid and they had to re-do the trial. Figure 1 is an example of a SLJ being completed indoors by a male adult.

On the second day of testing, half of the players were tested using EFAQ and the other half were tested using IFAQ prior to executing the SLJ. Groups were separated based on players' participant number. All players with an even participant number were in the EFAQ group and all players with an odd subject number were in the IFAQ group. Before attempts were recorded, a 10-minute WU was completed as described above. The EFAQ group was read the following directions by the research assistant: "*When you are attempting to jump as far as possible, focus your attention on jumping as far past the starting line as possible*" (Porter et al., 2010). Three attempts were performed with a 2-minute rest between attempts. The best trial of the three attempts was used for analysis. The IFAQ group was read the following directions by the testing administrator: "*When you are attempting to jump as far as possible, focus your attention on extending your knees as rapidly as possible*" (Porter et al., 2010). Three attempts were performed with a 2-minute rest between attempts. The best trial of the three attempts was used for analysis.

On the third day of testing, participants switched IFAQ and EFAQ instructions. The same testing protocol was used as day two of testing.



Figure 1: Standing Long Jump (Image reprinted with permission from Bodybuilding.com).

2.4 Design and Analysis

The SLJ scores (dependent variable-DV) were compared between the NQ, IFAQ and EFAQ with paired t-tests. Gain scores and Cohen's (1988) effect sizes (ES) were also calculated in order to compare the SLJ scores between the NQ, IFAQ and EFAQ conditions. Data management and statistical analysis were carried out in a MS Excel 2016 spreadsheet. The spreadsheet of data/analysis was peer reviewed for accuracy (AlTarawneh & Thorne, 2017). The statistical significance was considered as $\alpha \leq 0.05$.

3. Results

Fourteen participants (female=14) completed the study without incident and the demographics are presented in Table 1. Table 2 provides the SLJ scores for the NQ, IFAQ,

and EFAQ conditions. Table 3 provides statistics regarding change in SLJ scores between the NQ & IFAQ, NQ & EFAQ, and the IFAQ & EFAQ conditions.

The IFAQ SLJ scores were significantly less than the NQ SLJ scores ($p < 0.05$, $ES = -0.28$). The EFAQ scores were significantly greater than the NQ SLJ scores ($p < 0.05$, $ES = 0.24$). The EFAQ scores were significantly greater than the IFAQ SLJ scores ($p < 0.05$).

Table 1: Participant Descriptive Information

	Age (years)	Height (cm)	Mass (kg)
Female (n=14)	15.8±1.2	163.1±5.9	56.1±6.0

Table 2: Standing Long Jump Data (cm)

	Trial 1	Trial 2	Trial 3	Best Trial Average
NQ	168.5±16.3	168.4±18.5	170.0±16.6	174.0±17.4
IFAQ	162.4±21.3	166.1±19.9	165.8±21.7	169.1±20.7
EFAQ	170.7±16.9	175.5±14.9	174.4±17.0	178.2±16.4

Note: NQ-no que, IFAQ-internal focus attention que, EFAQ-external focus attention que.

Table 3: Standing Long Jump Differences

Que Type	Gain Score	Effect Size	p-value
NQ			
IFAQ	-4.9±10.0	-0.28	*
EFAQ	4.2±7.3	0.24	**, ***

Note: Effect size-Cohen's effect size (Cohen, 1988), NQ-no que, IFAQ-internal focus attention que, EFAQ-external focus attention que, *significantly less than the NQ $p < 0.05$, **significantly greater than the NQ and IFAQ $p < 0.05$).

4. Discussion

The purpose of this study was to examine the effects of IFAQ and EFAQ on SLJ performance among high school female athletes. It was hypothesized there would be an increased performance in the SLJ using EFAQ compared to IFAQ. The results of the current study supported the hypothesis in that there was a significant increase in the SLJ scores when EFAQ was employed when compared to IFAQ. Further, the use of IFAQ led to a significant reduction in SLJ when compared to NQ.

High school female athletes were the focus population of this study. To our knowledge, this population has not been investigated in previous studies with regards to EFAQ and IFAQ. The SLJ scores collected during the NQ conditions ranked the study participants as "excellent" when compared to normative data (Baechle & Earle, 2008). It is not known if SLJ performance would be improved via EFAQ in HS female athletes that would be considered less than "excellent" with regards to SLJ ability. However, the fact that these athletes were considered as "excellent" may explain why SLJ performance degraded during the IFAQ conditions. It is possible that during the IFAQ conditions the instructions were perceived as interruptive with regards to the athlete's automatic motor control processes and as such performance was degraded.

The use of EFAQ and IFAQ has been examined in prior investigations with SLJ as the outcome variable among differing participant populations (Porter et al., 2010; Coker, 2018; Hebert & Williams, 2017). The use of EFAQ has demonstrated to be more effective when compared to IFAQ with regards to enhancing SLJ performance (Porter et al., 2010; Coker, 2018; Hebert & Williams, 2017). The results of the current study with HS female athletes as the participants were consistent with the previous aforementioned studies regarding EFAQ and improving SLJ performance.

Other research efforts have demonstrated the positive benefits of EFAQ with respect to other jumping tasks, such as a countermovement VJ (Kershner et al., 2019; Wulf et al., 2010). In an investigation by Wulf et al. (2010), participants attempted a VJ and reach task. The authors suggested that the results were likely due to enhanced neuromuscular coordination rather than muscular power output (Wulf et al., 2010). It is possible that the improvement in SLJ performance as a result of EFAQ in the current study could be explained in the same manner. Specifically, it is possible that the use of EFAQ led the participants to experience an enhancement in neuromuscular coordination, hence leading to an improvement in SLJ performance.

Recent research in the use of EFAQ includes the CAH, which states that automatic motor control processes are used more when a person thinks about an external point when completing a task (McNevin, Shea, & Wulf, 2003; Kershner et al., 2019). The CAH may explain the results in the current study in that the use of EFAQ led to improved SLJ scores when compared to the IFAQ and NQ scenarios. Likewise, the use of IFAQ may have disrupted the athletes' automatic motor control processes, which led to degraded SLJ performance when compared to the NQ scenario. Prior research investigating EFAQ and EMG activity has demonstrated a reduction in EMG activity follows EFAQ with an accompanying improvement in performance, suggesting that EFAQ facilitates coordination within the muscles (Kershner et al., 2019; Lohse, Sherwood, & Healy, 2009; Marchant et al., 2009).

Research has shown that EFAQ is not consistently practiced among coaches and athletes, even though literature has reported that EFAQ can improve performance. In a recent study by Yamada et al. (2020), recreational adult runners were asked to self-report their attention focus while fatigued during running. The findings concluded that runners received more IFAQ than EFAQ from coaches and their own thoughts were not focused on EFAQ (Yamada et al., 2020). The authors suggested that these results may be due to a lack of knowledge and understanding of these different types of verbal cues and their potential impact on performance (Yamada et al., 2020). The results of the Yamada et al. (2020) study should be considered as important relative to the type of professional training coaches receive through Universities and professional certifying organizations with regards to verbal coaching technique.

When conducting a research study, potential shortcomings need to be considered. In the present study, several limitations should be taken into consideration. A small convenience sample of high school female athletes was the focus of this study. A flat hard floor is the preferred surface to conduct the SLJ assessment (Miller, 2012). The SLJ

assessment in the current study was conducted outside on a well-maintained grass field; a more consistent environment such as a gym floor surface could have been a more ideal surface area. This data was collected outdoors and athletes were all wearing their soccer cleats. With that said, the SLJ scores collected in the current study were considered as “Excellent” (Baechle & Earle, 2008), which could be the result of wearing cleats; allowing for a greater transmission of horizontal propulsive force. Another shortcoming of the study has to do with ambient weather conditions. The data in the current study was collected in January, as such the weather was colder and temperatures could have varied between testing sessions. If data was collected inside, the temperature could have been more controlled and athletes could have worn tennis shoes instead of cleats. Finally, the data was collected after the school day was completed. Different factors during the school day (or prior to) such as lack of sleep, poor grades, or insufficient nutrition could have caused the athletes to not put forth their best effort.

Practical applications of EFAQ can pertain to both players and coaches. If coaches are working with athletes developmentally similar to those in the current study, they could effectively use the technique of EFAQ. Coaches could emphasize their external verbal instruction with the use of external targets such as a throwing target or landing area for players to focus on instead of giving cues on body mechanics. Likewise, the use of EFAQ may allow coaches to develop new protocols for sport skill development as well as physical performance enhancement of their athletes. Finally, the results of the current study indicate a degradation in performance when using IFAQ when compared to a NQ scenario. As such, coaches should cautiously approach the use of IFAQ when working with their athletes.

A focus of future research could be conducted in the areas of EFAQ and self-efficacy. In a study by Pascua et al. (2015), college students were observed in accuracy of throwing with their non-dominant hand. Four different groups were examined: EFAQ, enhanced expectancy, EFAQ enhanced expectancy, and control (Pascua et al., 2015). The EFAQ-enhanced expectancy group received external focus instructions and positive feedback on their performance even if they had less than average performance. When data were analyzed, the EFAQ-enhanced expectancy group demonstrated the most effective results (Pascua et al., 2015).

With that said, future research could be conducted in order to determine if motor skill performance could be further improved by combining EFAQ with positive feedback among athletes of different levels of development as well as gender.

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