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Effect of Attentional Focus on Learning and Performance in Youth Sports

Justin Wright

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Justin M. Wright

Florida School of Professional Psychology

Tampa, FL

Sierra Iwanicki, Ph.D.

Chair

Gary Howell, Psy.D.

Member

The Doctorate Program in Clinical Psychology
Florida School of Professional Psychology
At National Louis University

CERTIFICATE OF APPROVAL

Clinical Research Project

This is to certify that the Clinical Research Project of

Justin M. Wright

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Sierra Iwanicki, PhD

Committee Chair: Sierra Iwanicki, Ph.D

Member: Gary Howell, Psy.D

Abstract

Youth athletes are different from adult and elite athletes in several domains that include cognitive resources, working memory, automaticity of motor movements, conscious control for propensity, attentional focus, and acquisition of motor-skills. Due to significant differences between athletes, not all instructions and feedback provided by coaches are best suited for every player. Instructions and feedback may direct an athlete's attentional focus and cognitive resources incorrectly leading to poor acquisition and performance of motor-skills. Clinical psychologists with knowledge of motor-skill acquisition, cognitive resources, learning theory, conscious control propensity, automaticity of motor movements, constrained action hypothesis, and attentional focus can follow the Youth Sports Consultation Model when working with youth sports programs, coaches, and youth athletes to improve the youth athlete's experience by improving the language used by coaches and correctly directing the youth athlete's attentional focus during the performance and acquisition of motor-skills.

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CHAPTER ONE: INTRODUCTION

In December of 2013, members of the Allen Institute for Brain Science, the Lieber Institute for Brain Development, the National Institute on Alcohol Abuse and Alcoholism, and the National Institute of Mental Health gathered at the Banbury Center in Cold Spring Harbor, New York to openly discuss current research on the adolescent brain. The group conceded that the adolescent brain demonstrates incredible neuroplasticity and is very susceptibility to mental illness during this critical period of development (Lee et al., 2014). The National Comorbidity Survey-Replication found that nearly 50% percent of Americans will meet criteria for a Diagnostic Statistical Manual, 4th Edition (DSM-IV) disorder sometime in their life, with half of all lifetime cases starting by age 14 years (Kessler et al., 2005). Furthermore, a similar epidemiological survey of adolescents aged 13 to 17 (National Comorbidity Survey-Adolescent Supplement) found twelve-month prevalence estimates for any DSM-IV disorder to be 26% (Kessler, Chiu, Demler, & Walters, 2005).

Often adolescent mental illnesses are untreated and may significantly impact a child's development, the child's educational attainments, and his or her ability to achieve fulfilling and productive adult lives (Lee et al., 2014; Stolkols, 1992). A limited time frame exists during the adolescent developmental stage when the environment has a strong influence on the brain and upon the behavior of the adolescent (Lee et al., 2014). During adolescence, the human brain faces new challenges and developments such as character development. Sports is one significant environmental influence during adolescence that has been shown to provide those who participate with experiences that promote coping resources, character development, and increases one's resiliency toward adverse situations (Daley, Copeland, Wright, Rolfe, & Wales, 2006; Dilsad et al., 2016; Jezoirski, 1994; Donaldson & Ronan, 2006). Other benefits of participation

in sports over an extended period of time, include the establishment of life-long behaviors that will shape an individual's character, lifestyle, adulthood development (Ortega, Ruiz, Castillo, & Sjöström, 2005), improved physical health (Haskell, Blair, & Hill, 2009; Khan, Thompson, Blair, Powell, Bull, & Bauman, 2012), improved psychological well-being (Ishii, Shibata, Adachi, & Oka, 2016), improved cognitive health (Hillman, Erickson, & Kramer, 2008; Li, Dai, Jackson, & Zhang, 2008), defined self-concept (Barkoff & Heiby, 2004), and increased socialization with peers (Daniels & Leaper, 2006). Even with the established benefits of participation in sports, in 2017, the Centers for Disease Control and Prevention (CDC) Youth Risk Behavior Survey found that among high school students, 46% of high school students did not participate in at least one team sport, either with the school or within the community. It is recommended that high school students in the United States participate in at least 60 minutes of physical activity 5 day a week. However, 53% of high school students in the United States were not physically active for the recommended amount of time (CDC, 2018). Of those who do participate in sports, some may not experience success or continue participation into adulthood. A significant decline in sports participation, for both males and females, is correlated with an increase in age and a decline in sport participation is more significant during the adolescent period (Telama & Yang, 2000; Telama, Laakso, & Yang, 1994; Van Mechelen, Twisk, Post, Snel, & Kemper, 2000) and reasons for decreased participation significantly vary between individuals. One significant factor in creating a positive experience for each athlete is the coach or instructor (Smoll & Smith, 2002). Coaches who provide poor social support, lead with an autocratic style, are associated with negative outcomes, negative attitudes, decreased athlete motivation, increased burnout, and increased drop-out rates (Gould et al., 1996; Pelletier, Fortier, Vallerand, & Briere, 2001; Price & Weiss, 2000). A coach's language and choice of verbiage significantly contributes to an

athlete's sports experience (Gould et al., 1996). A coach's words can help direct an athlete to achieve success or experience failure, experience enjoyment or dislike, and can improve how well an athlete acquires and performs complex motor-skills (Perreault & French, 2013; Perreault & French, 2015; Perreault & French, 2016). Often overlooked is the effect a coach's language can have upon an athlete's correct use of attentional focus during the acquisition and performance of complex motor-skills. Understanding the dual nature of attentional focus and the cognitive resources, specifically the attentional ability of the adolescent athlete, influences a coach's specific language and approach toward training and feedback and highlights the difference in how each athlete should approach training and sporting activities. Clinical psychologists, with a deeper understanding of attentional focus, can improve motor-skill acquisition and increase optimal performances by an athlete.

Importance of Attention

William James (1890) defined attention, "the taking possession by the mind, in clear and vivid form, of one out of what seems several simultaneously possible objects or trains of thought… It implies withdrawal from some things in order to deal effectively with others" (p. 403-404). Taghizadeh, Dehghani, and Daneshfar (2015) defined attention as a process by which many senses are used by an individual to have a correct perception of the outer world. Attention has been considered a major topic in cognitive psychology since the 1930's when the Stroop effect was first developed (Stroop, 1935). Since then, attention has become one of the most intensely studied areas of cognition. For the most part, theories of attention have focused exclusively on attention's role in perceptual development. Prinz (1990) first proposed the common coding theory and described the link between perception and action through cognition. Within the common coding theory, sensory stimuli are encoded and integrated into mental

representations that are critical in the execution of planned motor movements (Prinz, 1990). Actions and the observed effects of an individual's actions are cognitively coded using the same representations. In order to perform an intended motor-skill, an individual needs to think about the expected perceptual effects to trigger the movement automatically (James, 1890). Therefore, given the importance of sensory integration during motor proficiency, the attending to specific sensory information during acquisition and performance of motor-skills may facilitate the development of such mental representations and an increased motor proficiency (Hodges & Franks, 2000). In the context of sports, one's ability to concentrate upon and focus attention, either internally or externally, allows for improved awareness toward the attended material during a specific sports task. When an athlete focuses his or her attention to specific aspects of the body or upon the effects of their actions, the athletes focus is defined as attentional focus. Attentional focus is, "the act of directing attention to information sources or to objects of an individual's attention" (Schmidt & Wrisberg, 2000). It is the awareness of one's attentional field that includes internal and external factors of thoughts, emotions, sights, sounds, and other external cues. Ericsson, Krampe, and Tech-Romer (1993) and Paus (1989) support the idea that attentional focus can vary among individuals, across age, and level of expertise.

Importance of Attentional Focus

Attentional focus is categorized into two types: internal attentional focus (IAF) and external attentional focus (EAF). Wulf, Ho€ß, and Prinz (1998) defined IAF as the attentional focus directed at the performer's body movements, as focus directed internally toward the athlete's own body, or directed toward the intended movement of the body. (Wulf et al., 1998). An example of IAF applied by an athlete is a golfer focusing upon his or her hands and the movement of the hands before, during, and after completing a full swing. The golfer's attentional

focus is directed inward, on the hands, or the focus is upon a specific body part. Another example of IAF is a runner focusing his or her attention toward his or her feet. The runner's focus may be upon the movement of the foot, the rolling of the pressure of the foot upon the ground as the body weight shifts from the heel to the toe while completing a full running stride. Another example of IAF is focusing the athlete's attention upon their breathing. In contrast, EAF is defined as the attentional focus directed toward the effects created by the body's movements upon the environment including a ball or instrument of play (Wulf, Ho€ß, & Prinz, 1998). An example of EAF applied during a golf swing the athlete directing his or her attention upon the preferred flight path the golf ball. Here the athlete's focus of attention is upon the effect of the athlete's movement to the environment, specifically upon the golf ball. An example of EAF used by a runner may include focusing upon their speed while completing a full running stride, the athlete's attention is upon the effect of their movement upon the environment created by their running motion.

Attentional focus is significantly related to how well a complex motor-skill is acquired, retained, and performed. Nideffer (1976) concluded that when acquiring and performing, adult athletes have a specific way of directing their attentional focus which is unique for each adult athlete. Specifically, the type of focus an individual adopts while practicing a skill significantly affects the athlete's process of acquiring specific motor-skills (Moran, 1996; Nideffer & Sgal, 1998; Wulf et. al.,1998). Numerous studies examining the use of attentional focus for optimal performance have found that EAF is more effective than IAF in motor proficiency as well as motor acquisition for adults and elite athletes (Kal, van der Kamp, & Houdijk, 2013; Pascua, Wulf, & Lewthwaite, 2015). Additionally, an instructor can correctly or incorrectly direct an athlete's attentional focus. When an instructor correctly directs an athlete's attentional focus, an

individual's ability to acquire and master the motor-skill can improve (Kal, van der Kamp, & Houdijk, 2013). Therefore, an individual athlete's focus of attention is significantly related to how well a complex motor-skill is acquired, retained, and performed. In addition, the type of focus an individual adopts while practicing a skill significantly affects the athlete's learning process and performance (Moran, 1996; Nideffer & Sgal, 1998; Wulf, HoB, & Prinz, 1998). When an instructor correctly directs an athlete's attentional focus, an individual's ability to master or learn the skill can improve (Kal, van der Kamp, & Houdijk, 2013).

Current research supports the notion that attentional focus varies with age, gender, and across levels of expertise (Agar, Humphries, Naquin, Herbert, & Wood, 2016; Ericsson, Krampe, & Tech-Romer,1993; Gale & Lynn, 1972; Gary, 2004; Paus,1989). Specifically, adolescent and novice athletes differ from elite athletes in that an adolescent and novice athlete attempt to gain mastery of specific skills required for success in sports (Emanuel, Jarus, & Bart, 2008) while an elite athlete attempts to achieve proficient performance of the required motor-skills. Adolescents are amateurs and novices in their acquisition and performance of motor-skills regarding sports. In contrast, elite and adult athletes have mastered the complex motor movement, are proficient in the application, and are attempting to optimally perform the motor-skill (Aglioti, Cesari, Romani, & Urgesi 2008; Gray, 2004).

Most research on attentional focus has been conducted with adult samples with limited research examining the attentional focus of adolescent or novice athletes. Even more so, few studies have examined the effects of attentional focus on the acquisition and performance of motor-skills for adolescent athletes. It is important to note that middle childhood is typically when sports are introduced as a physical activity. During this critical developmental period, the youth athlete is attempting to learn the requisite complex motor-skills required to experience

success in the chosen sport. Instead, the studied populations often exclude the novice, adolescent athlete, in middle childhood, in favor of elite youth athletes, in middle childhood, who compete at the national and international levels of athletics. The elite youth athlete and the elite adult athlete are easier subjects to study because of the constructed training environment in which they participate. Often elite athletes participate in many examinations across many different fields of study. As a result, extant literature reflects an overrepresentation of this small percentage of elite adult and elite youth athletes, while the typical adolescent athlete remains underrepresented. Consequently, the role of attentional focus for adolescent and novice athlete's when attempting to learn and perform complex motor-skills is under-represented.

Expertise and Participation Time

Most often expertise is calculated through the amount of time spent in participation with a specific domain related activity such as music, writing, and chess. Similarly, to music, writing, and chess, more time spent in directed sports-related activity often leads to a higher level of obtained expertise or an elite status by an athlete. Over-time, an athlete can increase his or her level of expertise from novice to elite (Ericsson et al., 1993). Therefore, older athletes are often described in studies as experts of a sport while younger athletes described as amateurs or novices based upon the time spent in the sport, similar to how the time spent in musical activities can change an individual’s descriptive group from amateur to novice to expert. (Ericsson et al., 1993). Many adolescent athletes have not spent the required time to achieve an elite status nor are most athletes innately gifted leading to the conclusion that typical adolescent athletes are different than elite athletes. A significant difference between elite and adolescent athletes is an adolescent athlete attempts to gain mastery of specific skills and may struggle to optimally perform the skill (Emanuel, Jarus, & Bart, 2008). While an elite athlete mastered the specific

skill and can consistently and optimally perform the skill. Adolescents are similar to amateurs and novices in his or her ability to acquire a motor-skill and in the application of the motor-skill. In contrast to amateur athletes, elite athletes, most often adults, can easily learn the complex motor movement and are proficient in the application of the skill. Specifically, a difference in attentional control structures exist between adolescent and novice athletes when compared to elite and adult athletes. Attentional control structures are attributed to governing an athlete's performance by affecting the athlete's attentional focus (Anderson, 1993; Beilock & Carr, 2001; Fitts & Posner, 1967; Keele & Summers, 1976). From an attentional focus perspective, an individual's use of attentional focus has a significant correlation in how well a complex motor-skill is acquired, retained, and performed. Specifically, the type of attentional focus an individual adopts while attempting to acquire a motor-skill significantly affects the athlete's learning process (Moran, 1996; Nideffer & Sgal, 1998; Wulf, HoB, & Prinz, 1998). Simply stated, due to differences in mechanisms of attention, an athlete's application of attentional focus varies between elite athletes when compared to a novice and adolescent athletes. Similar conclusions can be drawn between adolescent and adult athletes. Attentional performance improves with age, with the most significant change in performance occurring around the ages of 8 and 9 years old (Gale & Lynn, 1972) which signifies the need to further develop the understanding attentional focus of adolescent athletes when acquiring and performing specific motor-skills.

Athletic experts agree that youth athletes must learn complex motor movements to experience success in sports. Is it possible that a youth athlete's ability to acquire complex, sports-related motor-skills can be improved by correctly focusing the athlete's attentional focus either internally or externally according to the displayed developmental attentional abilities of the athlete? Instructions should vary for each athlete dependent on his or her age and achieved

developmental milestones that include attentional abilities, motor development, observed proficiency in motor-skills, and their preferred style of attentional focus. In the context of adolescent athletic performance, such an understanding can help coaches tailor training correctly. Additionally, a coach can improve the athlete's sports experience through mastery by improving how the adolescent athlete learns the motor movement and improving the efficiency of the movement. Specific language can be used by the coach to direct an athlete's attentional focus to understand and learn the required motor movements for athletic success (Wulf, 2013).

Purpose

The purpose of the literature review was to examine the role of attentional focus on the acquisition of sport-related skills among adolescent and novice athletes. The goals of the review were to investigate the following research questions:

1) What is the role of attentional focus (IAF versus EAF) for an adolescent and a novice athlete in the learning of sport-related skills?

2) What is the role of working memory in the acquisition of motor-skills by a youth athlete?

3) What strategies can be used to promote appropriate attentional focus to improve athletic skill acquisition for adolescent and novice athletes?

4) How can clinical psychologists effect the experiences of adolescent and novice athletes and influence the techniques used by instructors and coaches by incurring the correct attentional focus for each individual athlete?

Methods

Research Procedure

A systematic search of multiple databases was conducted for this literature review. Initially, electronic searches occurred using ProQuest, EBSCO, and Google Scholar. All searches included edited books and peer-reviewed articles written in English ranging from 1950 to 2018. To address the research questions mentioned above, Boolean searches were conducted with terms "attentional focus AND motor development," "attentional focus AND strategies AND sports," and "sports participation AND health" across multiple databases. When applicable, expanders to apply equivalent subject and related words were used to broaden the search results. Also, hand searches consisting of reviewing reference lists were conducted to identify additional studies.

Search Criteria

Several factors were considered to gain a deeper understanding and application of attentional focus to acquiring complex motor-skills in youth athletes. Although age was not limited to a specific range, this review attended to studies with participants in middle childhood, defined as aged 6 to 12. Also, consideration of the established athletic ability level of the participants occurred. This review focused on amateur or novice athletes rather than elite or competitive athletes due to the elite athlete being over represented in the existing literature. Additionally, the literature review paid particular attention toward the specific task in the study (e.g., free throw shooting, putting, chipping, etc.) as each task presents unique difficulties. Differences between tasks can be impacted by the use of equipment, which has profound implications for the application of IAF when compared to EAF (Wulf, 2013). Therefore,

consideration of the use of equipment and its effects occurred in the context of learning and application of complex motor-skills.

The literature review focused on athletic skill acquisition, not rehabilitation. Therefore, studies of injured participants were excluded. Also, there is ample empirical support substantiating the relationship between motor development and cognitive functions (Chomitz et al., 2009; Haapala, 2013). Therefore, the exclusion of studies that include participants with known psychiatric disorders characterized by cognitive dysfunction occurred. Diagnostic exclusions consisted of attention deficit hyperactivity disorder, traumatic brain injury, all developmental disorders, and current mood disorders. Studies that manipulated pressure as part of the research methodology were excluded. Pressure to optimally perform can be created by situational incentives that include social comparison, social reward, and evaluation (Baumeister & Showers, 1986). Often pressure is applied to the situation to examine the effect upon an athlete's ability to perform a task. Pressure can have a significant impact on efficient motor movement as well as the participant's ability to focus externally (Schucker, Hagemann, & Strauss, 2013).

CHAPTER TWO: Role of Attentional Focus in Athletic Skills Acquisition during Adolescence

Introduction

To date, the vast majority of the research related to attentional focus involves elite or adult athletes as participants. There are few studies investigating the role of attentional focus in the learning and application of complex motor-skills for novice and adolescent athletes. The current literature review attempted to gain a full understanding of attentional focus by defining attention across different dimensions, understanding the different dimensions of attentional focus, significant theories, applicable hypothesis, and the application of attentional focus to the acquisition of and the performance of complex motor movements for all athletes: elite, adult, novice and adolescent.

Attention: Attentional Focus

It is important to focus on the right thing at the right time (Morris & Summers, 1998; Schefke & Gronek, 2010). Attention is the cognitive process of focusing awareness toward a specific object, action, activity, situation, incident, or phenomenon, that effects the quality and effectiveness of perception, decision-making, and performance (Schefke & Gronek, 2010). The ability to shift attention between stimuli is described as mental flexibility. (Shefke & Gronek, 2010). Attentional focus is one aspect of sport-related motor-skill acquisition that has been identified by many experts as a significant contributing factor in optimal athletic performance (Wulf, 2013) and therefore attentional focus can be considered a viable variable in improving the acquisition of complex motor-skills and the performance of youth athletes. Identified as an important mental aspect in sport, attention is uniquely focused or directed by an athlete according to the athlete's preferred approach to the unique competitive situation (Nideffer, 1976;

Gallagher & Thomas, 1986) with the goal of achieving optimal performance and acquiring motor-skills. Included with the definition of attention are 4 general aspects (Czajowski, 1996). The first aspect is that attention is the focusing of awareness and is a cognitive process, hence the term attentional focus. Second, attention can be directed by one's desire or attention can be directed by external stimuli. Third, attention is always directed to something including an idea, an object, an action, an activity, a situation, an incident or a phenomenon. The fourth aspect is that attention has a significant and direct influence upon our perceptions, decision making, and behavioral performance (Czajkowski, 1996; Schefke & Gronek, 2010). Schefke & Gronek (2010) additionally conceptualize attention as an individual increasing mental effort or increasing awareness toward the stimuli and that attention is an important mental characteristic during the acquisition and performance of motor-skills. Also, an individual's ability to direct or focus attention correctly is significant cognitive attribute for athletes (Schefke & Gronek; 2010; Wulf et al., 1998; Wulf, Shea, & Park, 2001; Hadler, Chiviacowsky, Wulf, & Schlid, 2014). Shifting attention enables an athlete to quickly focus from one object or area to another, i.e. from one opponent to another, from one teammate to a coach, from a goal to the ball, from an internal processes to external stimuli, or away from external stimuli toward an internal process. Therefore, a coach may influence an athlete's attention by creating specific situations during deliberate play or deliberate practice or by shift the athlete's attentional focus with instructions or feedback (Schefke & Gronek, 2010; Wulf et. al., 1998).

Nideffer in 1976 produced a theory of attention and suggested that attention varies on a primary and a secondary dimension (Nideffer, 1976). The primary dimension is binary and spatial in nature, either attention is focused internally or externally. The secondary dimension is a spectrum, varying from broad to narrow. An example of narrow attentional focus would be an

archer focusing upon the bullseye. In contrast board attentional focus would be a basketball player focusing on his or her teammates and opponents while attempting to dribble that basketball. Athletes during play can direct attentional focus narrowly or broadly and internally or the athlete can direct attention narrowly or broadly and externally.

Nideffer (1976) highlights the notion that an average person can correctly shift her or his focus of attention across dimensions under most conditions. However, with an increase in arousal or when cognitive resources are limited, the difficulty of shifting attention can become evident for novice and youth athletes when compared to elite or adult athletes (Nideffer, 1976). Nideffer (1976) theorized that when competing, adult and elite athletes have a specific way of focusing attention, unique for each athlete which allows the athlete to acquire and perform motor-skills optimally. Therefore, the correct focus of attention across the primary dimension of attention, specifically IAF and EAF, is one aspect of sport-related motor-skill acquisition that has been identified as a significant contributing factor (Nideffer 1976; Gallagher & Thomas, 1986; Wulf, 2013) Therefore attentional focus can be considered a viable variable used to improve the acquisition of and performance of complex motor-skills. Attentional focus, identified as a crucial mental aspect in sport, is uniquely directed by an athlete according to the athlete's preferred approach (Nideffer, 1976; Gallagher & Thomas, 1986) with the goal of achieving optimal performance.

Attentional Focus and Sports

Historically, clinical psychologists have defined attentional focus through a binary approach, internal or external (Nideffer, 1976; Wulf et al., 1998). Wulf et al. (1998) defined IAF as focused attention directed at the performer's body movements. The focus of the athlete is directed internally, toward his or her own body and internal phenomenon including the

mechanical movement of the body (Wulf et al., 1998). In contrast to IAF, EAF was defined as focused attention upon the effects upon the environment created by an athlete's performance of complex motor-skills (Wulf et al., 1998). Concerning, athletic skill acquisition and performance, decades of voluminous research yielded robust results supporting the use of EAF to achieve optimal performance in elite athletes and adult athletes (Wulf, 2013). The advantages of EAF when employed by elite and adult athletes was demonstrated across a variety of motor-skills and development tasks, including a ski-simulator task (Wulf, Höß, & Prinz, 1998), golf swing (Wulf, Lauterbach, & Toole, 1999), as well as soccer and volleyball skills (Wulf, McConnel, Gärtner, & Schwarz, 2002). Furthermore, existing literature has almost exclusively focused on research involving novice adults (Wulf & Su, 2007) and remains unknown is if these findings generalize to novice youth athletes.

Attentional Focus: Applicable Theories and Hypothesis

Learning Theory

Felder and Silverman (1988) explored the significant aspects of learning style, including the preferred and unique learning style of the individual. Hadler, Chiviacowsky, Wulf, and Schild (2014), in congruence with Felder and Silverman (1998) support the concept of a unique learning style per individual that include an individual's weaknesses and strengths. One common weakness for children may be limited cognitive resources. An adolescent athlete's difficulty focusing attention well may be created by limited cognitive resources (Gallagher & Thomas, 1980, 1986; Polluck & Lee, 1997). Limited cognitive resources can hamper the athlete's ability to acquire and perform the required sport specific motor-skills (Felder & Silverman, 1988). One study suggests that children often struggle with distractibility and limited cognitive resources making it difficult to shift attentional focus in a non-natural manner (Gallagher &Thomas, 1980).

Therefore, a child's predisposition toward a preferred attentional focus approach, IAF or EAF, could create performance issues when instructions or feedback directs that athletes attentional focus in contrast to the athlete's preferred attentional focus approach (Gallagher & Thomas, 1986). An example includes a coach using language to direct the athlete's attention internally, when the athlete prefers an EAF approach, included with a limited attentional capacity, the coach's language may create performance issues for the athlete.

Another important aspect of motor-skill acquisition includes practice routines. Baddeley and Longman (1978) identified practice routines as an important aspect to motor-skill acquisition in sports. Ericsson, Krampe, and Tesch-Romer (1993) concluded that for an athlete to perform at an elite skill-level, the individual has engaged in prolonged efforts to improve performance. Often elite athletes engaged in deliberate play and deliberate practice beginning in childhood with the goal of improving performance (Ericsson et al., 1993). Baddeley (1966) discussed the contextual interference effect that occurs during deliberate practice and deliberate play. The contextual interference effect is a consistent finding that practicing several related tasks in a random order, creates high contextual interference. High contextual interference can decrease performance during acquisition and increase acquisition during retention and transfer phases of motor-skill acquisition (Baddeley, 1966). In comparison, when tasks are practiced in a block or repeating schedule such as often experienced during deliberate play and deliberate practice situations, performance during acquisition improves and performance decreases during retention and transfer performances (Baddley, 1966). To further understand contextual interference, Gallagher and Thomas (1986) gathered 48 participants, university-age adults and 7-year-old children, to perform a ballistic aiming task under either low contextual interference (blocked practice) or high contextual interference (random practice). Similar to previous findings,

Gallagher and Thomas (1986) concluded the adults performed the acquisition trials better under blocked than under random conditions. No differences in the acquisition trials were found between blocked and random practice conditions for the children suggesting that participation in deliberate practice and deliberate play improve the motor-skill acquisition of 7-year-old children. Gallagher and Thomas (1986) also concluded that when provided enough time to process, youth athletes performed similarly to adult athletes suggesting that processing speed is a major factor in the performance and acquisition of motor-skills. Chamberlin, Rimer, and Skaggs (1991) examined acquisition of basketball skills under the contextual interference. Chamberlin et al. (1991) gathered 64 novice female athletes and practiced a jump shot at 3 separate distances, 5, 10, and 15 feet, for 1 hour a day, 4 days per week for 4 weeks. Chamberlin et al. (1991) observed significant improvement in performance suggesting that random practice may improve immediate performance, yet it does not improve retention or transfer of the motor-skill across time and different setting. These findings suggest that participation in deliberate play and deliberate practice over time will improve acquisition of motor-skills. Further supporting the notion that deliberate practice and deliberate play are important aspects for youth programs to consider when developing youth athletes over time.

Constrained Action Hypothesis and Attentional Focus

The constrained action hypothesis, when applied to performance and motor-skill acquisition, suggest an EAF approach creates an optimal performance. As the hypothesis proposes, when a performer utilizes an internal focus of attention, the individuals may constrain or interfere with the automatic control processes which would regulate the movement. An EAF approach would allow the athlete's motor system to more naturally self-organize (Wulf et al., 2001; Shea & Wulf, 1999) and allowing for optimal performance of motor-skills. One study

(Wulf, Shea, & Park, 2001) consistent with the constrained action hypothesis observed the external focus participants demonstrated lower reaction times than the IAF participants suggesting that EAF allows for more efficient processing leading to a more optimal performance by the athlete (Wulf et al., 2001) Other studies have supported the findings of Wulf et al. (2001) when it comes to the constrained action hypothesis and concerning the optimal performance of athletes, specifically more automated movement are performed by the athlete (Kal, Vander Kamp, & Houdijk, 2013; McNevin, Shea, & Wulf, 2013; Maddux, Wulf, & Wright, 1999). Kal et al. (2013) noted that when attempting to perform a cognitive dual task an athlete using IAF required more cognitive resources when compared to an athlete using EAF. In accordance with the constrained action hypothesis, an EAF approach during performance allows for optimal movement automatization and optimal performance, however, many of the studies discussed were conducted with experienced athletes and adult athletes.

Conscious Control Propensity

Conscious control of propensity is the tendency of individuals to use implicit, verbalized knowledge to control motor movements leading to the application of an IAF approach(Tse & Van Ginneken, 2017). An individual's propensity toward conscious control can be measured using the Movement Specific Reinvestment Scale (MSRS, Masters, Maxwell, & Eves, 2005). Maxwell, Masters, and Eves (2000) attempted to ascertain whether a differences in performance occur between adult athletes who learned implicitly and adult athletes who learned explicitly. Participants completed 3,000 putting trials and the explicit group reported significantly fewer rules than the implicit group on subsequent verbal protocols suggesting implicit learning had occurred (Maxwell et al., 2000). Additionally, all groups experienced similar-shaped curves fr motor-skill acquisition and performance improvement across all trials. However, the explicit

learning athlete's performance was above the implicit learning athletes during the acquisition phase (Maxwell et al., 2000) supporting the constrained action hypothesis. No significant differences occurred between groups during a delayed retention test (Maxwell et al., 2000). Maxwell et al. (2000) speculate that with more completed trials both the implicit and explicit athletes would acquire motor-skills similarly again suggesting that time and practice significantly influence motor-skill acquisition and performance. In addition, Maxwell et al. (2000) discussed personality predispositions such as a propensity for conscious control that may also provide a reason behind adolescents perform well while using both IAF or EAF.

Tse and Ginneken (2017) investigated whether conscious control propensity moderates the role of attentional focus in motor-skill acquisition of children. Tse and Ginneken (2017) hypothesized that a child's propensity to consciously control can determine how well the youth athlete can perform and acquire motor-skills. Tse and Ginneken (2017) hypothesized that an adolescent's ability to consciously control and shift attentional focus would lead to an increase in the adolescent's ability to perform and acquire the motor-skills required to optimally perform a dart throwing task. The youth participants were placed into either IAF or EAF group and provided instructions and feedback to direct attentional focus to the assigned group (Tse & Ginneken, 2017). Findings suggest children's motor-skill acquisition is most effective when instructions and feedback from a coach align with the individual youth athlete's predisposed propensity for control (Tse & Ginneken, 2017).

Coaching Instructions

Instructions and feedback from a coach can shift an athlete's attentional focus across acquisition phases and during performance of complex motor-skills. To further understand the effect specific language used by coaches Porter, Wu, and Partridge (2010) examined the effect of

verbal instructions and feedback provided during deliberate practice to understand the influence upon elite athletes during competition. Instead of producing a vignette for instructors to use, Porter et al. (2010) asked athletes to reflect upon the received instructions and hypothesized that most the instructions and feedback provided directed the athlete's attention internally. The participants included 13 elite male and female track and field athletes competing in the USA Track and Field Outdoor National Championships. The instructors who participated are also considered highly skilled and elite instructors (Porter et al., 2010). Athletes completed a survey concerning their most recent performance included their thoughts, their attentional focus, and their coach's instructions and feedback (Porter et al., 2010). 84.6 % of the instructions provided by coach's during deliberate practice exclusively directed the athletes attentional focus internally. Another 15.4 % of the provided instructions during deliberate practice were associated with both IAF and EAF approaches. None of the provided instructions directed the athlete's attentional focus exclusively to an external point (Porter et al., 2010). Similar, the participating athletes reported employing an IAF approach during practice and competition 69.2 % and 7.7 % of the elite athletes used an EAF approach. Uniquely, 15.4 % of participating elite athletes switched between IAF and EAF approaches during practice and competition (Porter et al., 2010). Concerning feedback, provided to the athlete after performance, 38.5 % of the athletes reported receiving feedback related to joint angles, movement speed, and body/limb movements (Porter et al., 2010). Porter et al. (2010) concluded that elite track athletes often employee an IAF approach when competing contradictory to the literature which suggests an EAF is best for elite athletes when competing. Porter et al' (2010) conclusions emphasize the importance of understanding how the language used by a coach during instructions, feedback, performance and acquisition of motor-skills effects the athlete. The instructors who participated in the Porter et al. (2010) study

are considered elite and did not fully understand the effects of their language upon the cognitive resources and the performance of the elite athlete. Could the use of EAF instructions improve an elite athlete's performance by decreasing used cognitive resources? How would this effect the cognitive resources and performance of youth and novice athletes?

Cognitive resources significantly vary when adolescent athletes are compared to adult and elite athletes (Perreault, 2013; Gallagher & Thomas 1986). Gallagher and Thomas (1986) gathered 45 adolescent females, age range 7 to 11 years, and 45 adult females to examine processing abilities and cognitive resources. Gallagher and Thomas (1986) hypothesized that when provided a short time for processing information, adolescents perform less efficiently than older adolescents and adults due to limited cognitive resources and variable attentional abilities. In contrast, Gallagher and Thomas (1986) hypothesized that an increase in processing time allows adolescent time to perform motor-skills similar to the adult counterpart. In summary, the 7-year-old participants benefited most from longer processing time intervals and demonstrated improvement across all three motor-skill acquisition phases when provided an increased processing time (Gallagher and Thomas, 1986). Suggesting that when coaches provide instructions, an ample amount of time between instruction or feedback may be required for youth athletes to process the instructions or feedback.

In another experiment upon processing speed, Thomas, Mitchell, and Solomon (1979) demonstrated that increased age and increased cognitive resources, allows for an increased processing speed. Increased processing speed allows an individual to process the same amount of information in a shorter period of time (Thomas et al., 1979). In athletic competitions, an athlete is presented with multiple problems that can be similar in nature and the required performance of a motor-skill. An increased processing speed allows that athlete to gather information from the

environment including coaches more efficiently, make a decision using the increased cognitive resources, and optimally performing the required motor-skill. Gallagher and Thomas (1986) and Thomas et al. (1979) conclusions support the theory that decreased cognitive resources and limited processing ability can decrease the performance and acquisition of motor-skills of youth athletes. Therefore, what is the correct length of time for an individual athlete to process information that allows for an optimal performance? Based upon Gallagher and Thomas (1980, 1986) results, when provided with ample time, an adolescent can produce efficient motor-movements similar to an adult. Suggesting that coaches working with younger athletes allow ample time for the youth athlete to process instructions and feedback before attempting to perform and acquire the motor-skill.

The difference between a youth athlete's performance and an adult athlete's performance is created by a decreased automaticity of motor movements (Gallagher & Thomas,1986; Ruitenberg, Abrahamse, & Verwey, 2013). Youth athletes often are asked to perform motor-skills not yet mastered, leading to a decreased performance. Additionally, a youth athlete's performance may diminish when instructions and feedback direct the youth athlete to employ an EAF approach when compared to an IAF approach (Ruitenberg et al., 2013). Suggesting that an EAF approach possibly increases the youth athlete's use of lesser developed higher-order cognitive task such as during the optimal performance of motor-skills. Athletic performance requires the use of several cognitive resources, specifically attention and working memory (WM). The performance and acquisition of motor-skills forces the youth athlete to use her or his lesser developed cognitive resources leading to a lesser performance created by a lack of obtained motor-skills (Gallagher & Thomas, 1986; Ruitenberg, et al., 2013). Therefore, when instructing athletes, the coaches should assess the cognitive development of each youth athlete

and tailor instructions, feedback, deliberate play and deliberate practice accordingly with the youth athlete's cognitive developmental level.

Attentional Focus, Motor-Skill Acquisition, and Performance

Attentional Focus and Musical Performance

Does shifting the attentional focus of individuals, of varying skill level, have an effect upon the produced performance of a motor-skill? Duke, Cash, and Allen (2011) examined the effects of IAF and EAF upon the learning and performance of musical motor-skills. Sixteen adult music majors participated, 12 non-pianist and 4 advanced pianists, all had previous experience playing the piano (Duke et al., 2011). Participants performed a 13-note sequence, a total of 4 times, each time focusing attention differently between fingers, keys, the piano hammer, and the sound of the note. Focusing upon fingers is an IAF approach while the other 3 stimuli directed attentional focus externally (Duke et al., 2011). Data suggest that for the 4 advanced pianist all 3 EAF approaches produced an optimal performance when compared to the singular IAF approach. Simply stated, focusing away from the fingers allowed the advanced pianist to produce an optimal performance by demonstrating an even tempo. However, an improved performance effect for an EAF approach was only true for the 4 advanced pianists. Results indicated no difference in performance for the other 12 non-pianist music majors regardless of the applied attentional approach (Duke et al., 2011) suggesting that shifting attentional focus is not significant for adult novice performers when acquiring and performing the motor-skills for a novice task.

Attentional Focus and Balancing: A Simple Motor-Skill

Chiviacowsky, Wulf, and Wally (2010) examined the effect of shifting attentional focus during a balancing task for older adults. Balancing is a motor-skill learned early; however, it is a

common area of difficulty as cognitive resources decline with age. Thirty-two adults (M age= 69.4 years) from a university's older adult exercise program were asked to balance a wooden platform using their feet. IAF participants were instructed to "keep their feet horizontal" and EAF participants were informed to "keep the markers in front of their feet horizontal" (Chiviacowsky et al., 2010 p. 573). Both EAF and IAF participants improved performance across practice trials (Chiviacowsky et al., 2010). However, participants using an EAF approach were able to balance for longer periods of time compared to participants using an IAF approach, demonstrating an improved ability to sustain optimal performance. The EAF group was overall more effective at balancing than the IAF group (Chiviacowsky et al., 2010) Chiviacowsky et al.'s (2010) results demonstrate that when performing a simple, low-order task of balancing, EAF is more effective than IAF in sustaining optimal performance.

McNevin, Shea, and Wulf (2003) asked the participants to balance upon a balancing board while varying the participants attentional focus to determine the effect of different attentional focus upon performance. In a similar experiment with a similar task being used, a difference in age of participants provides insight into the effect of attentional focus upon performance for novice athletes. McNevin, et al. (2003) used 40 university students, 28 females and 12 males. None of the participants had previous experience with the balancing task (McNevin et al., 2003). Participants were randomly assigned to a single attentional focus group. Attentional focus groups consisted of 3 external focus conditions, varying in respect to the distance between the body and ground markers, and 1 internal focus condition. Before each trial, participants were provided feedback to focus on the respective markers. All groups demonstrated an increase in balance proficiency from day 1 to day 2 (McNevin et al., 2003). McNevin et al. (2003) were able to demonstrate an improved ability to acquire motor-skills by shifting

attentional focus, specifically by increasing the distance between the participant and the participant's object of focus. McNevin et al. (2003) suggest their results support the constrained action hypothesis in terms of the use of an EAF approach while performing improved the proficiency and automaticity of motor movement for novice athletes.

In a similar experiment to McNevin et al. (2003) and to Chiviacowsky et al. (2010), Thorn (2007) examined the effect of shifting attentional focus upon balance for youth athletes between the ages of 9 and 12. Eighty-eight participants were randomly assigned into 1 of 3 groups: an EAF, an IAF, and a control group, stratified by two levels of age (9-10-year-old and 11-12-year-old). In congruence with the constrained action hypothesis and the conscious control propensity theory, youth athletes who received EAF instructions and employed an EAF approach to balancing demonstrated an improved balance when compared to youth athletes using an IAF approach (Thorn, 2007) similar to the results of Chiviacowsky et al. (2010) and McNevin et al. (2003). Additionally, youth athletes who focused attention on external cues, regardless of the instructions received, demonstrated significantly better balance performance and learning than youth athletes who focused on internal cues (Thorn, 2007). Interestingly the 9-10-year-olds demonstrated an over-all improved performance when compared to the 11-12-year-olds (Thorn, 2007). Thorn (2007) speculated that differences in height and weight may have contributed to the performance of 9-10-years old.

Similar to the previously discussed experiments upon balance, Teixeira da Silva, Thofen, and Chiviacowsky (2017) investigated the effect of different attentional focus approaches upon the performance of a more complex, high-order balancing motor-skill, a *pirouette en dehors*, with 10-year-old ballerinas for participants. The youth athletes were randomly assigned between 2 groups, EAF and IAF (Teixeira da Silva et al., 2017). Participants performed 15 practice trials

of right rotation and 2 days later completed retention and transfer test of left rotation, without attentional ques (Teixeira da Silva et al., 2017). Results demonstrated a significant and superior performance for the EAF group compared to the IAF groups during and across all 3 phases of motor-skill acquisition (Teixeira da Silva et al., 2017). IAF group athletes reported experiencing more anxiety, fear and performance dissatisfaction when compared to EAF counterparts. An increase in environment stress or internal phenomena, decrease cognitive resources allocated to attention and working memory, creating a decrease in performance in accordance with the constrained action hypothesis. Teixeira da Silva et al. (2017) concluded that an EAF approach to performing and acquiring a complex motor-skill such as a pirouette is optimal for youth athletes when compared to an IAF approach.

Attentional Focus and Running: A Complex Motor-Skill

Porter, Wu, Crossley, Knopp, and Campbell (2015) used novice, adult sprinters to examine the effect an EAF approach upon sprinting performance. Sprinting is a lower complex motor movement that is often acquired at a young age, therefore Porter et al. (2015) is not exploring the relationship of attentional focus upon acquiring a motor-skill. 84 undergraduate students (n= 42 women, n= 42 men, M age = 20 years) with no previous track experience participated (Porter et al., 2015). Participants were randomly assigned to an IAF, an EAF, and a control group. Instructions were provided before each sprinting trial in congruence with the assigned attentional focus group (Porter et al., 2015) feedback was not provided to the athletes. Results suggest that athletes using an EAF approach sprinted significantly faster when compared to both athletes using an IAF approach and the control group. There was no difference discovered between the IAF and control groups. Porter et al. (2015) results suggest that instructions that encourage an EAF approach result in improved performance for novice

sprinters. Porter et al. (2015) experiment and conclusion suggest that verbal instructions should be structured to create an EAF approach when instructing novice or adolescent athletes, in congruence with the constrained action hypothesis.

Attentional Focus and Targets: Throwing and Catching

Lohse, Sherwood, and Healy (2014) examined the effect of shifting attentional focus upon the acquisition and performance of a dart throwing task. Participants included 40 college students, self-described as amateurs. Participants were provided basic throwing instructions, observed a demonstration, and performed the task aiming at the center of a dart board (Lohse et al., 2014). During the demonstration of the task and acquisition phase participants either received instructions from an EAF approach or an IAF approach. Lohse et al. (2014) discovered that an EAF approach lead to increased accuracy during both retention and transfer tests. No significant effect was observed during the acquisition phase for the EAF approach which suggests that an EAF approach may not benefit learning, yet the EAF approach benefits performance (Lohse et al., 2014). Lohse et al. (2014) conclusions suggest that an IAF approach can improve acquisition of a motor-skill and that a shift to an EAF approach lead to increased accuracy across retention and transfer phases. Therefore, shifting attentional focus in accordance with the current motor-skill acquisition phase can improve both acquisition and performance of the amateur athlete. Additionally, Lohse et al. (2014) provided a statement of support toward youth athletes engaging in deliberate play or deliberate practice stating that, “a skill must be sufficiently practiced in order for an EAF to be advantageous.” In accordance with the statement about deliberate play and deliberate practice, Lohse et al. (2014) conducted a second similar experiment upon 48 amateur dart throwers who completed 198 throws across 3 days and all 3 phases of motor-skill acquisition. Apparatus, measurements, and procedures were identical to the first experiment

(Lohse et al., 2014). Results from the second experiment suggest that by increasing attempts and engaging in an EAF approach during deliberate play or deliberate practice, increased performance in terms of accuracy across all 3 phases of motor-skill acquisition (Lohse et al., 2014).

Emanuel, Jarus, and Bart (2008) conducted a unique experiment with adults and adolescents performing the novel task of dart throwing to examine the effects of different attentional focus approaches during acquisition and performance of motor-skills (Emanuel et al. , 2008). This experiment is unique as it attempted to compare adults and adolescents while manipulating attentional focus. All the participants were unfamiliar with the experimental task of dart throwing and could be classified as novice. Emanuel et al. (2008) assigned participants to either an IAF group or an EAF group. During the acquisition and retention phases, the target remained the same distance, however, during the transfer phase the distance between participant and the target was increased. Over 2 days participants performed 50 attempts across 5 trial blocks, the acquisition phase, after each trial block instruction were verbalized and the dart were removed from the target. No feedback nor instructions were provided during the retention phase (Emanuel et al., 2008). No significant differences existed between participants at baseline and no significant interactions were discovered between age and focus of attention. However, a post hoc analysis revealed that adults using an IAF approach were less accurate and less consistent as they progressed through the 3 phases when compared to adults using an EAF approach (Emanuel et al., 2008). Adults in the EAF group demonstrated significant improvement throughout the trial blocks (Emanuel et al., 2008). However, for the adolescent participants, no consistent pattern of improved performance occurred between attentional focus groups and across all phases of motor-skill acquisition (Emanuel et al., 2008). Suggesting that attentional focus is not a significant

contributor to the athletic performance of the youth participant. Therefore, the results support the conscious control propensity theory suggesting that with deliberate play and deliberate practice an athlete can employ either attentional focus approach to acquire motor-skills. During the transfer phase, adults in the EAF group were more accurate than adults in the IAF group. However, similar results were not evident for adolescents. Instead, adolescents of the IAF group were more accurate when compared to the EAF group participants during the transfer phase. Emanuel et al. (2008) results to support other results, specifically Perkins-Ceccato et al. (2003) and Beilock et al.(2002), that an IAF approach can benefit lesser skilled athletes due to differing levels of motor efficiency and higher skilled athletes benefit from EAF approach due to an increased motor efficiency. Emanuel et al. (2008) attempt to explain their confounding results and suggest that adolescents lack implicit knowledge and may use body movement guidance, an IAF approach, to improve motor learning. While other differences in attentional focus between adults and adolescents include information processing and sensory system differences. Adolescents function and perform differently than adults due to slower information processing. Adolescents struggle to collect relevant spatial cues when compared to adults which guide performance. Therefore, directing an adolescent's attentional focus externally decreases his or her performance (Emanuel et al., 2008). Zarghami, Saemi, and Fathi (2012) examined the effect of EAF upon adult novice athletes performing an Olympic disc throw. Participants completed 5 trials under each attentional focus group, IAF and EAF. Each participant received instructions toward the correct discus throwing technique before each trial, no feedback was provided to the participants. Results indicated a significant difference between IAF and EAF conditions with the EAF group demonstrating an improved disc throw. (Zarghami et al., 2012).

Southard (2011) examined the effects of shifting attentional focus while performing the motor-skill, throwing a ball. Southard (2011) gathered 30 participants, all between 19 to 26 years old, and described as novice or amateur athletes because the participants performed the task using a non-preferred arm (Southward, 2011). Each condition differentiated by instructions received and included the instruction to increase velocity. The control group received no instructions nor feedback. (Southard, 2016). Southard (2011) concluded that increasing velocity improved throwing patterns more than using either IAF or EAF alone (Southard, 2011). Southard (2011) suggested an EAF approach created more change in throwing pattern when compared to IAF and the control group (Southward, 2011). For retention trials, both EAF and EAF with velocity instructions demonstrated significant retention of a throwing path change (Southard, 2011). Further, emphasizing velocity alone may decrease throwing accuracy yet when combined with an EAF approach, improved accuracy may be observed during later retention phases (Southard, 2011). In contrast to throwing an object, Abdollahipour and Psotta (2017) examined the effects of shifting attentional focus on a novice youth athlete's ability to catch a tennis ball. Participants were described as novice and consisted of 24 youth athletes (Abdollahipour & Psotta, 2017). Results indicated that an improved performance for youth athletes employing an EAF when compared to an IAF approach (Abdollahipour & Psotta, 2017). However, no significant differences in performance were discovered when comparing EAF and IAF to the control group. Closer examination of the control group found that 75 percent of participants employed an EAF approach (Abdollahipour & Psotta, 2017) suggesting that an EAF approach is more commonly used and the preferred control propensity for many youth athletes.

Perreault (2013) gathered 42, 9 to 11-year-old youth athletes and asked each athlete to perform 100 free throws over a 2-day period while using different attentional focus approaches

IAF and EAF. Results showed no significant learning differences between groups. The second similar study conducted by Perreault included an additional 28 children assigned to groups: internal focus feedback and external focus feedback (Perreault, 2013). These participants performed the same task 100 free throws over two days. Perreault (2013) discovered was a significant advantage during acquisition and performance for the youth athlete who received EAF feedback (Perreault, 2013). These results are important because they specifically examine the use of EAF feedback to improve performance as opposed to many other experiments that examine instructions. Later Perreault and French in 2016 furthered the understanding of attentional focus and adolescent athletes with another similar experiment upon similar athletes performing a basketball free-throw. A significant difference between the experiments is youth athletes observed a demonstration and received instructions on free-throws in accordance with the assigned attentional focus group (Perreault & French, 2016). Perreault and French (2016) examined the data and concluded that no significant difference was observed between all 3 groups suggesting that when combined with practice and continued instruction either an EAF or an IAF approaches are appropriate. However, when a youth athlete is provided with EAF feedback their performance of motor-skills improves.

Attentional Focus and Targets: Use of Sports Equipment

Agar, Humphries, Naquin, Herbert, and Wood (2016) examined how shifting attentional focus can affect the performance of a novel task by youth athletes between that age of 5-12 years. Youth athletes were randomly assigned to either an IAF or EAF group before performing a shuffleboard task. Participants performed practice trials while receiving group assigned feedback followed by retention and transfer tests across 2 days (Ager et al., 2016). No feedback was provided during retention or transfer shots and transfer shots were performed with the

opposite or less dominate hand (Agar et al., 2016). Data analysis showed no significant difference between the EAF and IAF groups, instead data demonstrated improved performance across all trails by both groups (Ager et al., 2016). However, a significant difference was discovered between older participants (9 to 12 years) and younger participants (5 to 8 years) in their performances across trials with the older participants performing better (Ager et al., 2016). Therefore, Ager et al. (2016) concluded that attentional focus does not influence the acquisition of a novel task by adolescents. Instead, Ager et al., (2016) concluded the difference in performance between younger and older youth athlete occurs due to further cognitive development and extended cognitive resources. Additionally, other motor-skills acquired by the older youth athletes generalized to the novel task and allowed the older youth athlete to perform better when compared to the younger youth athletes. When applied to coaching, Agar et al. (2016) results suggest that coaches may reference and generalized motor-skills through instructions and feedback to help improve a youth athlete's performance. For example, when shooting a basketball, a coach could share a story about reaching into the cookie that's above the fridge to highlight the finishing move of shooting a basketball. The coach has generalized a previously performed simple motor-skill to improve the performance of a basketball shot.

Hadler, Chiviacowsky, Wulf, and Schild (2014) examined the effect of EAF versus IAF approaches to learning a tennis forehand stroke by youth athletes between the ages of 10 to 12. Amateur youth athletes were randomly assigned to the external focus, internal focus, or control groups and asked to perform forehand tennis strokes with the dominant arm with the goal of hitting a target placed on the opposite side of a mini tennis court (Hadler et al., 2014). Athlete's individually performed the forehand stroke and observed an instructor perform 2 forehand strokes before beginning the practice phase (Hadler et al., 2014). Instructions during the practice

phase were provided after every 10th trial, all participants performed 80 trials over a 2-day period (Hadler et al., 2014). Hadler et al. (2014) concluded that all groups improved across the practice phase. As for the retention and transfer test, the EAF group outperformed both IAF and control groups (Hadler et al., 2014) suggesting that when acquiring skills, deliberate play or deliberate practice is more important than the adopted attentional focus approach, yet when performing the motor-skill an EAF approach improves performance. These results suggest a conscious control propensity for a certain attentional focus applies to deliberate practice and deliberate play situations, however, and in agreement with the constrained action hypothesis, an EAF approach is better when performing the motor-skill after acquiring the desired motor-skill through practice.

Castaneda and Gray (2007) conducted an experiment upon high and low skilled baseball players to examine benefits of an EAF approach compared to an IAF approach. 16 male baseball players, 8 active college athletes considered elite (M experience= 13.2 years) and 8 less-skilled, non-active, non-college athletes with experience performed a baseball swing upon a virtual baseball pitch (Castaneda & Gary, 2007). None of the participants were considered to be novice baseball players (Castaneda & Gary, 2007). Participants received auditory and visual feedback after performing each swing. Visual feedback was EAF in nature and included the ball moving away from the participant after contact with the bat and auditory feedback included “the crack of the bat against the ball” and verbal statements of “foul ball” and “home run.” All feedback directed the athletes to the effect of the athlete’s movement, an EAF approach to feedback (Castaneda & Gray, 2007). To ensure IAF feedback was received, athletes within the IAF group attempted to judge the movement of their hands, up or down, upon contact with the ball. EAF group athletes attempted the same as the IAF group athletes, however, the choice was upon the up or down movement of the bat, not the hands (Castaneda & Gary, 2007). EAF/ environmental

participants performed a bat swing and attempted to judge, a forced choice of left or right, the direction the ball traveled after contact (Castaneda & Gary, 2007). Irrelevant focus/ environmental participants directed attention away from the performance of swinging the bat and away from the effect of the batter's movement (Castaneda & Gary, 2007). Participants completed 20 trials for each group and 2 blocks of 20 trials for a control group which did not require a forced choice (Castaneda & Gary, 2007). Results indicate a benefit from an EAF approach, specifically when attention is directed toward the flight path of the ball after contact with the bat. The results were true for all participants because all participants were considered novice or elite (Castaneda & Gary, 2007). Further data analysis demonstrated that higher skilled participants, the college athletes, experienced a significantly improved batting performance with an EAF approach compared to an IAF approach. Importantly, there was no significant difference in performance between IAF and EAF approaches for less-skilled participants (Castaneda & Gary, 2007) suggesting that IAF and EAF may not impact a less-skilled athlete's performance when compared to a high-skilled athlete. Further, less-skilled athletes may experience a decline in performance if any attention is focused upon the environment as the less-skilled athlete does not have adequate skill-focused attention (Castaneda & Gary, 2007).

Perkins-Ceccato, Passmore and Lee (2003) examined the effect of different attentional focus instructions upon the performance and acquisition of motor-skills for varying skilled golfers. Specifically, the effects of an IAF instructions upon high skilled and low skilled golfers. Perkins et al., (2003) hypothesized that an IAF approach would negatively affect the performance of higher skilled golfers when compared to lower skilled golfers on a golf chip across 80 trials from 4 different distances (Perkins-Ceccato et al., 2003). Participants included 10 high-skill male gofers and 10 low-skill golfers. Participants were not provided feedback, nor

were the athletes permitted to see the results of the chip shot. This is critical as the experiment did not examine feedback (Perkins-Ceccato et al., 2003). To further enforce IAF or EAF grouping, participants were asked in the IAF groups to judge the force used to complete the golf shot on a 5-point Likert scale, directing the athlete's focus internally. The EAF group attempted to judge the distance from the target the ball came to rest (Perkins-Ceccato et al., 2003). Perkins-Ceccato et al. (2003) found that low-skill golfers who first received IAF instructions performed more consistently when compared to low-skilled golfers who first received EAF instructions (Perkins-Ceccato et al., 2003) suggesting that lower-skilled golfer had a propensity for control similar to an IAF approach. IAF approach matched the lower-skilled golfers skill level. Therefore, when the lower-skilled golfers used EAF, the increased automaticity of movement created by and EAF approach was difficult because the lower skilled golfers had not acquired the motor-skills to perform the golf shot optimally. Similar results were discovered for high-skill golfers, who first received EAF instructions when compared to high-skilled golfers who first received IAF instructions (Perkins-Ceccato et al., 2003) supporting the notion that experienced golfers with obtained motor-skills would perform optimally by employing an EAF approach to performance as it increases automaticity of motor movements. Perkins-Ceccato et al. (2003) demonstrated that as skill level increases, instructions should change and shift the attentional focus of the athlete from IAF to EAF. Additionally, Perkins-Ceccato et al. (2003) interpreted the results and support the notion that once the required motor-skills are acquired, the athlete's performance will benefit from an EAF instructions due to an increase in motor movement automaticity (Perkins-Ceccato et al., 2003).

Christina and Alpenfels (2014) examined how the correct attentional focus can benefit experienced golfers when learning and performing a swing path change. 45 adults (M age = 65

years) with established handicaps (M handicap= 18.34) were randomly assigned to one of three groups either IAF, EAF, or control. Participants completed a pre-test, post-test, and retention test and to test motor-skill acquisition participated in a deliberate practice designed as a 15-minute lesson from a PGA Master Professional Instructor to improve swing-path (Christina & Alpenfels, 2014). After the lesson, each participant completed alternating 36 practice and 36 actual swings. No instructions were provided during the practice trial, feedback was provided by viewing of the results of each swing (Christina & Alpenfels, 2014). After the lesson, EAF participants focused attention upon an imaginary club head path and IAF participants focused attention upon the movement of the right elbow during the swing (Christina & Alpenfels, 2014). As for the change in swing path, results indicate that when the instructor's language suggested an EAF approach more effective and optimal swing path was performed (Christina & Alpenfels, 2014). Christina and Alpenfels (2014) concluded that the EAF group, when compared to the IAF and control group produced a more optimal performance based upon factors of a better swing path, a faster club head speed, an increased ball speed, and ultimately a further carry distance. Carry distance is the distance traveled in the air by a golf ball. It is a golf specific statistic that suggest the performance of an efficient automated motor-skill. The performance produced by participants receiving EAF instructions and using an EAF approach are consistent with the constrained action hypothesis. The IAF group, when compared to the control group, produced further carry distance with more club head speed suggesting the importance of coaching and that an IAF approach, instructions, and feedback can produce more effort leading to an improved performance (Christina & Alpenfels, 2014).

In a second experiment Christina and Alpenfels (2014) expanded the previous results with the same experiment design except the instructions were provided to the participants after

the 12th and 24th shot and not delivered through a deliberate practice or lesson. Results indicated that both the EAF group and the control group were more effective in acquiring and performing a swing path change when compared to the IAF group (Christina & Alpenfels, 2014). Therefore, instructions provided intermittently should use language to create an EAF approach for the experienced athlete. Also, an experienced athlete can create change, with-out instruction or coaching, through the use of IAF approaches (Christina & Alpenfels, 2014). Furthermore, an experienced athlete, using IAF approach, is able to change his or her performance due to previously acquired motor-skills (Christina & Alpenfels, 2014). As for carry distance, participants using an EAF approach demonstrated further carry distance when compared to participants using an IAF approach with a driver (Christina & Alpenfels, 2014) contradictory to the results of the first experiment. A possible explanation for this contradiction is a 6-iron is shorter than a driver and therefore places the club head, an external focal point, closer to the body which may have influenced the results (Christina & Alpenfels, 2014). Another explanation is the difference in the delivery method of instructions, a 15-minute lesson compared to intermittent verbal instructions, more time spent in instruction such as deliberate play increased performance and overall ball carry. Overall, the results of both studies demonstrate the advantage of EAF instructions and feedback when coaching experienced athletes to acquire new motor-skills, change their motor movements, and produce a more automated performance supportive of the constrained action hypothesis (Christina & Alpenfels, 2014).

Wulf and Su (2007) conducted an experiment on the use of external focus of attention to improve the accuracy of golf shot performed by novice and elite athletes. Participants included 30 undergraduate students with little to no experience playing golf (Wulf & Su, 2007). Participants were randomly assigned to 1 of 3 groups, a control, an IAF, and an EAF group. All

participants performed 60 golf shots and received verbalized feedback after each 10 shots in accordance with the assigned attentional focus group. On day 2 participants performed 10 golf shots as the retention portion of the test (Wulf & Su, 2007). Wulf and Su (2007) discovered that all attentional focus groups increased accuracy with practice. Suggesting that deliberate play and deliberate practice are important behaviors to improve performance. During the retention phase, the EAF group was observed to be more accurate when compare to IAF group and the control group (Wulf & Su, 2007) suggesting that using an EAF approach during acquisition and transfer leads to the use of EAF during retention phase. The retention phase in motor-skill acquisition is comparative to game situations. Also, the results of Wulf and Su (2007) are in agreement with the constrained action hypothesis.

Conclusions

When participating in sports, athletes engage in activities of deliberate practice and deliberate play that over time and with effort allow the athlete to acquire and improve their performance of motor-skills (Hadler et al., 2014). Either an IAF or an EAF approach to practice will allow an athlete to acquire a motor-skill with the use of instructions and feedback from coaches. Coaches and instructors often organize and execute practice while providing instructions and feedback to influence the athlete to perform specific motor-skills optimally. It is recommended that coaches provide feedback that directs the athlete's attentional focus externally, feedback that directs an athlete's attentional focus internally does not help the athlete successfully acquire and perform the motor-skill.

Transfer and retention are the 2 other phases of motor-skill acquisition that are associated with performance of motor-skills and athletic competitions. During the later 2 phases of motor-skill acquisition, an EAF approach during performance has several benefit for athletes or varying

skill level including youth, novice, adult, and elite athletes. Athletes of varying age also demonstrated a significant increase in performance of a motor-skill by using an EAF approach when compared to athletes using an IAF approach. Additionally, when encouraged by a coach to give more effort and employ an EAF approach, athletes experienced an improved performance. Therefore, when an individual is required to perform a motor-skill such as balancing, sprinting, throwing a ball, catching, a ball, or using sport equipment the coach should use the correct language to direct the athlete to external stimuli, encouraging automaticity of motor movements, and directing focus away from internal phenonium.

CHAPTER THREE: THE ROLE OF WORKING MEMORY IN THE ACQUISITION AND PERFORMANCE OF MOTOR-SKILLS

Introduction

The majority of sports require the completion of high-order cognitive abilities and several complex motor-skills within the context of a competition that continually challenges the physical and cognitive limits of the athlete. (Williams & Ericsson, 2005). Working memory (WM) is a higher-order cognitive ability associated with attention and used during sports. WM is required for receiving instructions and feedback during the performance of complex motor-skills. Providing instructions and feedback to an athlete is a complex task for a coach or instructor with many confounding variables that lead to information being received correctly or incorrectly and translated into a physical action by the athlete. As previously discussed, with age comes higher-order cognitive abilities that allow for instructions and feedback provided by a coach to be better received, understood, and applied to performance during practice and competition.

Conway et al. (2005) concluded that WM is a part of clinical, cognitive, social, developmental, and educational fields of psychology. Therefore, WM is vital in several global models of cognition due the wide range of complex cognitive behaviors which actively use WM including comprehension, reasoning, and problem solving (Furley & Memmert, 2010). Athletes are required to use WM to complete the required motor-skills of sports successfully. Often a youth athlete can become overwhelmed with instructions or feedback and underperform due to his or her limited WM capabilities (Cowan, 2005). However, not all behaviors require the use of WM. Simple, daily activities such as walking and brushing teeth are completed with automaticity and minimal use WM (Schneider & Shiffrin, 1977). Daily activities become familiar with time and repetition, similar and in line with time spent in deliberate practice or deliberate play in

which repeated complex motor-skills develop into familiar complex motor-skills. An athlete can achieve a high level of mastery through repetition and by decreasing the use of cognitive resources specifically, WM.

Other experimenters have produced evidence and conclusions which draw a correlation between stress, anxiety and a reduced WM capacity (Derakshan & Eysenck, 1998; Schamader & Johns, 2003) suggesting that WM and WM capacity fluctuates over time and are dependent upon environmental factors. Therefore, creating a practice environment through deliberate play and deliberate practice with decreased environmental stressors would increase a youth athlete's available WM allowing for more optimal performance. Leach and Griffith (2008) provided support of these conclusions by observing a decrease in WM capacity during the stressful task of parachuting (Furley & Memmert, 2010). Stressful life events can also reduce the WM capacity of an individual due to cognitive resources being used to suppress negative feelings and thoughts (Klien & Boals, 2001). Coupled with lesser developed WM capabilities of a youth athlete, environmental stressors may create an environment not well suited for acquiring motor-skills. Other studies have demonstrated that working memory has a significant role in acquiring motor-skills, particularly early in the acquisition process (Anguera et al., 2010). Another study showed enhanced WM with an increase in exercise, specifically a small effect was discovered upon the WM of younger adults (Lamborne, 2006) suggesting that with time engaging in deliberate play or deliberate practice an athlete can improve her or his own WM capability leading to an ability to optimally perform specific and complex motor-skills. (Lamborne, 2006).

The discussed studies upon WM suggest it is essential to understand the role of WM during motor-skill acquisition through deliberate play or deliberate practice for youth and novice athletes. This review will attempt to provide answers to the following questions. How does WM

work during motor-skill acquisition, motor-skill instructions, and feedback across different stages of learning? What is the relationship between WM and attentional focus? Does WM effect the ability of an athlete to correctly use and shift attentional focus to promote the optimal motor-skill acquisition and optimal performance?

Working Memory: Structure and Theory

Baddeley and Hitch (1974) defined WM as the cognitive mechanism capable of holding and manipulating small amounts of information in an active state for use in an active task (Furley, & Memmert, 2010). WM, in theory is described as a multicomponent system involved in the active maintenance of information during active processing or while under distraction (Baddeley & Hitch, 1974; Kane & Engle, 2002, 2003; Furley & Memmert, 2010). Furley and Memmert (2010) suggest that WM has a limited compacity which significantly affects the cognition, attention, and performance of an athlete leading to either a decreased or an optimal performance. The controlled attention theory of WM concludes that WM capacity is strongly correlated to a youth athlete's ability to control her or his attention (Conway et al., 2005) suggesting that WM is a higher-order cognition (Furley & Memmert, 2010). Per high-order cognitive processes, the description of WM include the cognitive processes involved with the regulation, control, and active maintenance of information relevant to the current task while increasing complex cognitions for the completion of familiar and skilled tasks. Therefore, WM is not a single mechanism or a fixed cognitive schema. Instead, it is comprised of multiple representational codes and uniquely different subsystems and is strongly correlated to long-term memory (Furley & Memmert, 2010; Miyake & Shah, 1999).

Previous studies upon the ability to acquire motor-skills in young adults suggest the use of motor chunks within WM. Motor chunks are the building blocks of complex motor-skills.

Motor chunks allow for the rapid and automatic execution of specific motor-skills while also reducing the cognitive load and the conscious control of the athlete (Gallistel, 1980; Rhodes, Bullock, Verwey, Averbeck, & Page, 2004; Shea, Park, & Wilde Braden, 2006; Verwey, 1999; Verwey, Abrahamse, Ruitenberg, Jimenz, & Kleine, 2011). Motor chunks are integrated patterns of movement and are the foundation for professional sports activities such as serving a tennis ball, shooting a basketball, and kicking a soccer ball and can be developed through deliberate practice and deliberate play. If motor chunking was not used, complex motor-skills would require time and a high demand upon the attentional capacity as explicit decisions would be made during the execution of the motor-skill (Verwey et al., 2011) similar to an IAF approach or a step-by-step approach during the performance of a motor-skill and in accordance with the conscious control propensity and the constrained action hypothesis. The dual processor model of WM suggests a cognitive sequence that includes: selecting the required motor chunks, a cognitive process of loading the motor chunks into the motor buffer, an aspect including in WM processes, the processing of the motor chunk, and the immediate execution of the motor-sequence associated with the motor chunk (Verwey, 2003). Within the dual processor model of WM, the performance of the motor-skill does not require cognitive processing and therefore decreases the attentional load and WM load upon cognitive resources when executing the familiar motor-sequence (Verwey, 2003; Verwey et al., 2010) The athlete accesses the held motor chunks when attempting to perform the required motor-skill using their WM to keep the motor chunks readily available. The dual processor model suggests that for optimal performance it is ideal the athlete experience less cognitive processing through the use of motor chunking, similar to the effect of an EAF upon performance and in accordance with the constrained action hypothesis and the conscious control propensity theory (Verwey et al., 2010). Therefore,

instructions or feedback that encourage an EAF approach can increase cognitive resources, can elicit multiple motor chunks within the WM, and help the athlete acquire motor-skills while producing an optimal performance.

Working Memory: Motor-Skill Acquisition

As youth athletes progress through the 3 phases of motor-skill acquisition, an increase in declarative knowledge occurs and transformed into procedural knowledge as an increase in expertise and proficiency of motor-skills is obtained (Anderson, 1982). Declarative knowledge can improve motor chunking. When compared, declarative knowledge is what we can explain to others and procedural knowledge is an understanding of how to complete the desired motor-skill. Often procedural knowledge effects behaviors without conscious awareness (Anderson, 1982; Maxwell, Masters, & Eves, 2003). The 3 phases of cognitive processing during motor-skill acquisition include a cognitive phase, an associative phase, and an autonomous phase (Anderson, 1982; Furley & Memmert, 2010; Schneider & Shiffrin, 1977). The cognitive phase requires a high level of cognitive activity to process the incoming sensory information with the goal of producing an optimal behavioral response (Jongbloed-Pereboom et al., 2019). Other aspects of the cognitive phase include developing a simple understanding of motor-skills and rules and strategies to optimally manage the motor-skills (Jongbloed-Pereboom et al., 2019). In the associative phase, the athlete may choose between strategies and applying them. During the 3rd phase, the autonomous phase, a decrease in cognitive control occurs (Jongbloed-Pereboom et al., 2019) and thus, motor-skills becomes more efficient. Similarly, a youth or novice athlete may shift attentional focus internally to master a motor-skill, increasing cognitive control, increasing the available motor chunks, while decreasing available cognitive resources. As familiarity of the motor-skill increases through deliberate play or deliberate practice an athlete will shift attentional

focus externally, therefore decreasing the cognitive control and increasing the efficiency to perform the motor-skill (Fitts & Posner, 1967; Jongbloed-Pereboom et al., 2019).

During the 3 phases of motor-skill acquisition declarative knowledge, gained through instructions, feedback, and experience are applied to the required sports task. WM is required to hold the instructions and feedback during the performance (Berry & Broadbent, 1988; Furley & Memmert, 2010). As an athlete progresses through the 3 cognitive phases, the less WM is required to complete the athletic task because declarative knowledge becomes procedural knowledge. Anderson (1982) concluded that as declarative knowledge is transferred to procedural knowledge an athlete improves his or her skill level. Declarative knowledge, in the form of motor chunks, is held in WM during the performance of specific motor-skills. Declarative knowledge is used to create procedural knowledge and allows the motor chunks to become more closely associated with the specific motor-skill and therefore increasing the efficiency of the sport-related skill.

In contrast to the previously discussed studies on the acquisition of motor-skill, Maxwell et al. (2003) demonstrated that motor-skills could be acquired implicitly without dependence upon WM. Acquiring a motor-skill implicitly can be advantageous compared to explicit acquisition as it allows the youth athlete to avoid accumulation of declarative knowledge through the use of implicit and procedural knowledge, therefore, increasing available cognitive resources and improving the athlete's performance (Maxwell et al., 2003). Masters, Maxwell, and Eves (2003) attempted to measure the reliance of performing a motor-skill on WM and concluded that when feedback is available in the form of visual and auditory sensory information learning can occur yet is dependent upon WM. In contrast, when visual and auditory sensory information and feedback is unavailable learning can occur; however, it is independent of WM (Maxwell et al.,

2003). A coach's language in the form of feedback can then improve motor-skill acquisition by decreasing the required WM to perform a specific sports related task. Also, shown to be less prone to interference from psychological stress is implicit knowledge (Allen & Reber, 1980) allowing for better comprehension of instructions and feedback both from the coach and the competition of sports.

Working Memory, Attentional Focus and Instructions

Several studies have provided evidence demonstrating that the information, held in WM in the form of instructions or feedback, has an effect upon the guidance of attention during performance (Awh, Jonides, & Reuter-Lorenz, 1998; Downing, 2000; Furley &Memmert, 2010; Huang & Pashler, 2007) and therefore affecting the attentional focus of an athlete. Soto, Hodsoll, Rotshtien, and Humphreys (2008) concluded that both WM and visual attention use common resources suggesting that increasing WM workload may decrease the allocated cognitive resources for attention. Additionally, to sharing cognitive resources, information held within WM directs eye movements during performance toward related images (Huettin & Altmann, 2005). Suggesting that instructions or feedback held within WM can affect performance through decision making by decreasing cognitive resources allocated for attention and directing the eyes and attentional resources toward the identification of objects in the sports field similar to the related instructions or feedback. Furthermore, Lavie (2005) demonstrated that an increase in demand upon WM led to a weaker performance in target selection during a sports related task with distractors. Therefore, WM representations can guide the athlete's perceptual system to allocate attention to objects in a competitive field that match the representations (Anderson, Matessa, & Lebiere, 1997; Logan & Gordon, 2001; Furley & Memmert, 2010) ignoring other

environmental factors and contributing to improved decision making and an improved performance.

WM can affect an athlete's ability to acquire motor-skills (Maxwell et al., 2003). Maxwell et al. (2003) conducted experiments on WM, across the three motor-skill acquisition phases of a golf-putt using instructions and visual feedback to manipulate the use of WM. Maxwell et al. (2003) made conclusions that athletes dependent upon WM to perform were not as efficient or accurate when compared to athletes independent of WM to complete the task. Maxwell et al. (2003) results can be expanded to suggest that when athletes perform with implicit knowledge, knowledge independent upon WM, the athlete's performance is more efficient and more accurate when compared to athletes using declarative knowledge, knowledge dependent upon WM, during a performance. Additionally, the younger the athlete, who often has a lesser WM capacity when compared to adult athletes, is easier to overwhelm his or her WM capacity which can lead to less efficient and less accurate performance (Maxwell et al., 2003). Coaches and instructors who provided instructions and feedback too often and that encourage an IAF approach can easily overwhelm youth athletes because the IAF instructions and feedback provide declarative knowledge dependent upon WM. Therefore, overwhelming an athlete with declarative knowledge in the form of IAF instructions and feedback, increases the number of available motor chunks within WM while decreasing the athlete's attentional, cognitive resources, leading to a more internally aware state of being and a decreased performance of the required task. In contradiction, providing an athlete with EAF instructions and feedback decreases the number of motor chunks within WM while increasing the cognitive resources available, increasing motor-skill proficiency and allowing for optimal athletic performance.

Conclusions

WM is a higher-order cognitive ability that allows athletes to receive, manipulate, hold and apply information when acquiring and performing sports-related motor-skills. Theoretically, WM is a multicomponent system involved in maintaining information during active processing, active motor-skill performance, or while under distraction (Baddeley & Hitch, 1974; Kane & Engle, 2002, 2003; Furley & Memmert, 2010). Furley and Memmert (2010) suggest that WM has a limited capacity affecting the performance of athletes. WM shares cognitive resources with attention and depending upon the type of knowledge, implicit or declarative, being employed by the athlete to perform a motor-skill, the athlete will allocate cognitive resources for WM while decreasing cognitive resources allocated for attention leading to a decreased athletic performance. A coach's instructions and feedback can help an athlete gain and employ the correct knowledge to improve the athlete's performance.

Similarly, a coach's instructions and feedback can correctly shift a youth athlete's attentional focus to improve the acquisition and performance of motor-skills in sports. Understanding the complexity of language and the effects of language through instruction and feedback upon a youth athlete's performance can be difficult to understand and even more difficult to employee the correct techniques to language. A clinical psychologist can help coaches and instructors better understand the complexity of instructions and feedback. A clinical psychologist can also help individual youth and novice athletes improve cognitive capabilities, improve their performance, and their overall experience in sports.

CHAPTER FOUR:

APPLICATION OF STRATEGIES TO IMPROVE SKILL ACQUISITION THROUGH THE USE OF THE AGE AND SKILL-LEVEL APPROPRIATE ATTENTIONAL FOCUS

Introduction

Individuals are not created equal and certain individuals are gifted with specific skills and abilities that allow him or her to obtain excellence in a particular domain. Often gifted individuals are considered to be elite. (Bouchard, Malina, & Perusse, 1997; Rowe, 1998). Bouchard et al. (1997) also emphasized the amount of variation that occurs from one athlete to another athlete suggesting differences in the acquisition and application of motor-skills. Therefore, developing grand overarching strategies to improve skill acquisition can be difficult, yet the strategies should be age and skill level appropriate with an emphasis on attentional focus during critical stages and phases of motor-skill acquisition and the athletic experience. Motor-skill acquisition refers to a set of internal processes associated with deliberate play, deliberate practice or other athletic experiences which lead to relatively-permanent changes in motor behavior. Motor-skill acquisition involves three sequential phases: acquisition, retention, and transfer (Emanuel, Jarus, & Bart, 2008; Schmidt & Lee, 2006). Youth athletes acquire motor-skills differently than the adult or elite athletes. Adults and elite athletes apply complex motor-skills more effectively than youth and novice athletes (Agar, Humphries, Naquin, Herbert, & Wood, 2016). Agar et al. (2016) provide two separate reasons for the difference between adult athletes and youth athletes. First, a youth athlete uses information differently, causing the youth athlete to learn and acquire motor-skills differently than adult athletes. Second, youth athletes are novices at most motor-skills (Agar et al., 2016). Agar's et al. (2016) 2 suggested differences are

significant and indicate the importance of applying age appropriate and skill level appropriate strategies when instructing youth athletes during the acquisition, retention, and transfer phases of motor-skill acquisition. Agar's et al. (2002) differences in skill acquisition and motor development of the youth athlete provide the coach an opportunity to correctly shift the athlete's attentional focus and improve motor-skill acquisition and over time improve the athlete's overall performance and experience .

Research in the area of motor-skill acquisition demonstrates that specific factors affect acquisition and among the factors are the instruction provided and feedback received during all three phases, specifically during the acquisition and retention phases (Emanuel et al., 2008). Wulf et al. (1999) demonstrated that instructions are essential because the instructions direct the attentional focus of the athlete either internally or externally which can improve or restrict motor-skill acquisition and performance. Other studies conclusions suggest that properly directing attentional focus can enhance motor-skill acquisition (Wulf & Prinz, 2001). Thus, suggesting that directing a youth athlete's attentional focus correctly through instructions and feedback will enhance motor-skill acquisition and improve performance across all three motor-skill acquisition phases. Time is another significant factor in motor-skill acquisition and research has documented the amount of time required to achieve an elite athletic status (Ward et al., 2004). Most often elite level motor-skill acquisition and application occur through years of time spent in deliberate play and deliberate practice (Cote & Hay, 2002; Ericsson et al., 1993; Howe, Davidson, & Slaboda, 1998). Deliberate play occurs when an athlete engages in behavior that does not demand efficiency but encourages experimentation (Miller, 1973).

"Playing at play" describes free-flowing activities of young children, birth to 3 years of age. "Playing at a game" describes youth athletes involved in a game without knowing specific rules

of the game, an example would be kicking a ball between friends and not knowing how to play soccer. “Playing a game” describes an athlete who engages in activities with specific rules which motivate the use of skill and decrease the effect of chance in the game. (Cote & Hay, 2002). Deliberate play is different than the “playing a game” or “playing at a game” because deliberate play involves an explicit set of rules, which can be manipulated by a coach (Cote & Hay, 2002) to improve motor-skill acquisition and improve performance. Deliberate practice involves athletes attempting to improve performance through experimentation with new combinations of acquired motor-skills to discover the most effective method of application (Cote & Hay, 2002). One characteristic of deliberate practice is the desire to acquire motor-skills in the most effective manner and promoting the correct use of attentional focus can do it.

To describe the time of sports participation and the developmental stages an athlete will experience over time, Cote and Hay (2002) suggested a developmental model of sports participation (DMSP) based upon age, skill acquisition, and participation. Three of the four stages in the DMSP correspond with the acquisition, retention and transfer phases of the motor-skill learning model. The corresponding stages of the DMSP are the sampling stage, specialization stage, and the investment stage. Most athletes are not endowed with elite athletic ability and often do not enter the investment stage of the DMSP and therefore do not spend the required time to achieve elite athletic status. However, almost all athletes will experience the sampling and specialization stage during her or his athletic development (Cote & Hay, 2002) and would benefit from the correct use of age and skill level appropriate motor-skill acquisition programs. The focus of the program can be on the use of language which correctly directs the athlete’s attentional focus for optimal skill acquisition and performance. Also, most athletes after completing the sampling and specialization stage enter the recreational stage of the DMSP and

often no longer participate in deliberate practice nor receive organized instructions (Cote and Hay (2002). The recreational stage athlete would benefit from a better overall experience during the sampling and specialization stages of the DMSP and the three learning phases of the motor-skill development model. Cote and Hay (2002) suggest that youth athletes in the recreational stage have different needs when compared to youth athletes in the sampling, specialization, or investment stages. Thus, the possibility, of a reduced emphasis on elite competition should be adopted while maintaining a flexible program adaptable to the individual interests (Cote & Hay, 2002; Ewing & Seefeldt, 1996).

Mental skills training is the training of youth athletes from a psychological perspective (Holland, Woodcock, Cumming & Duda, 2010) and can be an area of work for clinical psychologists and mental health workers. Mental skills would include self-talk, relaxation, attention, and attentional focus (Vealy, 1988). The application of mental skills by the athlete allows for improved athletic performance and enhanced personal well-being (Holland et al., 2010). For improving performance, Krane and Williams (2006) suggested seven mental characteristics that should be present within an athlete. The third and sixth mental characteristics apply to attention. These mental characteristics to be demonstrated by a youth athlete include directing focus to the task at hand, maintaining a positive attitude, and the youth athlete's specific cognitions about her or his performance (Holland et al., 2010). Other suggestions about mental characteristics include the regular use of mental techniques. Observation by a coach allows the coach to correctly identify between an elite youth athlete and other youth athletes. By correctly identifying the presence of specific mental characteristics, coaches can classify youth athletes according to their DMSP stage and motor-skill acquisition ability. With the correct classification of a youth athlete according to the athletes demonstrated mental skills, DMSP

stage, and phase of motor learning, the coach or instructor could choose the correct language during instructing and feedback to best benefit the youth athlete.

Age and Motor-Skill Acquisition

According to motor-skill developmental model, motor-skill acquisition occurs in childhood and adolescence, not in adulthood (Deckler, 2008) and indicates the importance of applying age-appropriate techniques to youth athletes during the motor-skill acquisition phase, sampling stage, and specialty stage of the DMSP. Agar et al. (2016) demonstrated that older youth athletes perform motor-skills more effectively than younger youth athletes. A difference between youth athletes and adult athletes is youth athletes automatize the underlying process of longer complex motor movements slower than adult athletes and to a lesser extent than adult athletes (Ruitenberg, Verwey, Schutter, & Abrahamse, 2014), possibly due to cognitive resources. The slower and less effective processing effects the adolescent athlete's motor-skill efficiency (Ruitenberg et al., 2014). Therefore, Agar's et al. (2016) conclusions in combination with Ruitenberg et al. (2014) suggest that it is important to correctly coach younger athletes by directing the athlete's attentional focus when compared to older youth athletes. Supportive of Agar's et al. (2016) conclusion is the conclusion by Memisevic and Hadzic (2013) that age has a significant effect upon the development of fine motor-skills in children age 3 to 6. However, the reported conclusions by Memisevic and Hadzic (2013) did not indicate the exact nature of the relationship between age and motor-skill development. Instead, the results suggest a complex relationship between age and motor-skill development that includes periods of slow motor-skill acquisition and rapid motor-skill acquisition (Memisevic & Hadzic, 2013). Therefore, when combining the results with the motor-skill developmental model, suggestions are an individual

acquires motor-skills at unique rates during different developmental periods (Memisevic & Hadzic, 2013; Agar et al., 2016).

It is essential for coaches and instructors to understand the unique fluxing rate of motor-skill acquisition across ages and to adjust their language used during instructions and feedback to incite the correct attentional focus and adjust the practice settings to accommodate and promote motor-skill acquisition, especially for the younger youth athletes participating in individual sports such as tennis or golf. Emanuel et al. (2008) concluded that differences exist between adolescents and adults, specifically, in the acquisition and transfer phases of motor-skills (Emanuel et al., 2008). Therefore, youth athletes are more similar to amateur and novice athletes than elite and adult athletes in the context of the youth athlete's experience levels, the youth athlete's unfamiliarity with sports skills, and the youth athlete's limited motor-skill repertoire (Emanuel et al., 2008). These differing factors suggest that youth athletes differ in motor-skill acquisition and therefore varying skill level and should receive appropriate coaching informed in the correct use of attentional focus across phases and stages.

Skill Level, Sports Participation, and Motor-Skill Acquisition

Cote and Hay (2002) promoted a DMSP that has been researched and refined over the last 15 years and is a model for athletic development (Cote & Vierimaa, 2014). Cote and Hay's (2002) DMSP includes processes, pathways, and outcomes associated with sports development through childhood, adolescence, and adulthood. The DMSP helps individuals attempting to design sports programs by identifying each athlete's developmental stage of sport participation and skill level which entails directs the practice sessions, goals, and time spent in specific drills to ensure motor-skill acquisition. These drill types include the previously mentioned deliberate play and deliberate practice. Each stage of the DMSP is separated demands and challenges

across three separate domains psychological, social, and physical (Holland et al., 2010; Cote & Hay, 2002).

The first stage, the sampling stage, occurs within 6 to 12 years of age and is a time when fundamental motor-skills are acquired. Fundamental motor-skills include such activities as running, jumping, sliding, kicking, dribbling, and throwing (Holland et al., 2010). Often youth athletes in the sampling stage of the DMSP are also in the motor-skill acquisition phase as both stage and phase include the acquisition of motor-skills. Research in the area of motor-skill acquisition demonstrates that specific factors effect motor-skill acquisition and among the factors is instruction and feedback provided by the coach during the acquisition phase (Emanuel et al., 2008). If a youth athlete experiences intense training or an overemphasis on competition during the sampling stage, he or she may experience a decrease in the enjoyment of the sport (Cote & Hay, 2002). Coaches should be aware of language when providing instruction and feedback that promotes intense performance or directs focus toward competition aspects of sports. Preferably a coach's language would correctly focus an athlete's attention upon his or her individual performance and provide multiple pathways to successful motor-skill acquisition through shifting attentional focus internally or externally during the first stage of the DMSP.

Wulf et al. (1999) demonstrated that instructions and feedback are essential because of the instructions and feedback direct the attentional focus of the athlete either internally or externally which can affect the acquisition of motor-skills. During the sampling phase, youth athletes are improving his or her confidence and competence in fundamental motor-skills with the intent to combine and apply the fundamental skills in a variety of sports (Goodway & Robinson, 2015). Youth athletes in the sampling stage often participate in a variety of sports (Cote & Hay, 2002), unlike older youth athletes, adult, and elite athletes who specialize in a single sport or do not

receive instructions or feedback. Cote and Hay (2002) suggest that the sampling phase is a critical stage which all youth athletes should participate as the focus of the phase is to experience fun and excitement in sports.

The second stage of the DMSP, the specializing stage, often occurs between the ages of 12 and 15 and is signified by increased participation in only 1 or 2 sports and a decrease in other extracurricular activities (Holland et al., 2010). Fun and excitement remain important, yet other experiences influence the youth athlete to continue participating in sports (Cote & Hay, 2002). Practice becomes a more powerful factor in skill development (Cote & Hay, 2002; French & Thomas, 1987; Kuhlman & Beitel, 1988) and increasing the coach's influence upon the athlete. The specializing stage is an important time in motor-skill acquisition when the correct attentional focus, a mental skill, is required to produce optimal performance and effective motor-skill acquisition.

The third stage, the investment stage of the DMSP occurs around at the age of 16 and continues into adulthood. Characterized by an increased commitment to a singular sport with intense practice and deliberate development of skills and strategies is the investment stage. The strategic, competitive, and motor-skill development unique to a singular sport are the prominent goals of the third stage (Cote & Hay, 2002). As an athlete progresses through the three stages of the DMSP, the goals and direction of training change and the instructions and feedback directing attentional focus should change as well. Holland et al. (2010) suggest that variation in mental qualities of the youth athlete will exist between each youth athlete and become evident as each athlete progresses through the DMSP (Cote & Hay, 2002). Cote and Hay (2002) suggest within the DMSP that skill development and enjoyment are considered to be two significant factors in retention in sports and the transition of the youth athlete between stages. Fun and enjoyment in

the form of play should be used and introduced during the sampling stage (Cote & Hay, 2002). If the youth athlete continues to participate regularly yet does not aspire to reach an elite level of performance, the youth or adult athlete is considered to be in the recreational stage, the 4th stage of the DMSP. During the recreational stage, athletes rarely receive feedback or instructions or participate in deliberate, organized practice.

Ericsson, Krampe, and Tesch-Romer (1993) examined variables related to the acquisition of motor-skills with the goal of producing optimal performance and suggested that the most effective motor-skill acquisition occurs during the specialization stage and through participating in highly structured activities such as deliberate practice and play. Deliberate practice requires effort, are specifically designed to improve the athlete's current performance, and is not required to be enjoyable (Cote & Hay, 2002; Ericsson et al., 1993).

Specialization stage and deliberate practice are much different than both the sampling stage and deliberate play in the aspect of fun and enjoyment. Cote and Hay (2002) suggested that during the sampling stage, coaches and instructors should focus on fun and enjoyment through deliberate play and as the athlete progresses to the specialization stage a shift in focus should occur to the development of sport-specific skills through deliberate practice. Specifically designed for the youth athlete, it is age and skill appropriate is the deliberate stage (Cote & Hay, 2002). The program should incorporate age and skill appropriate instructions or feedback that can create fun and enjoyment while correctly directing attentional focus to improve the youth athlete's experience through enjoyment, fun, and successful motor-skill acquisition. Therefore, to improve the youth athlete's experience during the specialization stage and in deliberate practice, a coach can use specific and deliberate language to correctly shift the youth athlete's attentional focus between IAF and EAF based upon several factors that include the progression of the

athlete's motor-skill acquisition, the athlete's DMSP stage, the deliberate play situation, the deliberate practice situation, and the observed performance of the youth athlete. Other recommendations for the specializing years include the use of positive feedback (Cote & Hay, 2002). Therefore, included in the positive feedback coaches should use the correct language to direct the athlete's attentional focus to improve learning and performance.

Attentional Focus and Motor-Skill Acquisition

In 1972, Feldenkrais suggested a sequence of learning in which learners must gain control of muscles, emotions, and thoughts to produce a compelling performance. Feldenkrais' strategy for learning is an awareness strategy. By paying attention to details, athletes may understand what needs to be controlled and attempt to express their control most effectively. Athletes often feel movements, feel muscle tone, and then think about the course of action to change the movements to improve his or her body positions (Feldenkrais, 1972). Feldenkrais (1972) suggests using one fixed pattern for learning and applying motor-skills with the outcome objective of producing the desired movement to produce the desired outcome, similar to the expectation of athletes in sports. However, we know that individuals learn uniquely based upon the individual's naturally endowed abilities. Contradictory to Feldenkrais's conclusions, Hawk and Shah (2007) suggest that individuals learn in diverse ways and that one broad learning strategy does not work for every individual. Hawk and Shaw (2007) concluded that instructors often teach from a personal and preferred method of learning. Hawk and Shaw's (2007) results suggest that a broad approach toward coaching youth athletes to acquire motor-skills should be taken and therefore instructions should include both IAF and EAF approach language.

Singer (1988) suggested a Five-Step Approach for acquiring and performing motor-skills. The Five-Step Approach includes preparing for the act, to image the act, to focus on a

meaningful cue, to execute the act with a quiet mind, and to evaluate the act and how effectively the implementation of each step of the strategy was. The Five-Step approach combines aspects of awareness and nonawareness, similar to shifting attentional focus between IAF and EAF approaches. Athletes are instructed about mental preparation and are told to focus on one external cue and to not pay attention to self or other contextual cues which decreases the use of self and situational awareness during the performance, similar to an IAF approach. However, some have suggested that the Five-Step Approach is elaborate, time-consuming to teach, and more difficult to comprehend when compared to other learning strategies (Singer, Lidor, & Cauraugh, 1993) and possibly not appropriate for the sampling stage of DMSP. Singer (1998) concluded that the Five-Step approach is an "awareness approach" best used when learning a "self-paced" motor-skill. The Five-Step approach is best used in individual athletic events like tennis, golf, swimming, diving, and running (Singer, 1988) and should not be applied to team sports. Similarly, coaches often approach coaching in the manner which he or she experienced as effective for his or her self (Hawk & Shaw, 2007). Therefore, when applying narrow learning strategies to the motor-skill acquisition, a coach's instructions may not benefit all or most of the athletes while it may benefit only a select few. It is the coach's responsibility to adapt his or her instructional approach for each athlete and one method of adaptation would include using language that encourages both IAF and EAF approaches during motor-skill acquisition. Hawk and Shaw (2007) suggest many coaches are unfamiliar with learning models and uncomfortable with different learning styles, therefore limiting the coach's ability to teach and in turn, the coach's approach negatively affects the experience of the athlete possibly leading to decreased participation in sports. The use of correct attentional focus during motor-skill acquisition is a significant strategy for improving motor-skill acquisition, improving the overall athletic

experience, and improving the performance of youth athletes. As previously discussed, specific stages of development require different goals and use difference training situations to acquire motor-skills and achieve optimal athletic performance.

The different stages of the DMSP and phases of motor-skill acquisition require more time in training and include receiving different forms of instructions and feedback from coaches. The specific language used by a coach affects the motor-skill acquisition in both “aware” and “non-aware” approaches (Singer et al., 1993; Singer, 1988). When the coach utilizes the correct language during the acquisition phase, the sampling stage, or the specializing stage, a coach can direct the athlete to be “aware” or “non-aware” of the athlete’s body to improve the athlete's acquisition of motor-skills. Obtainment of motor-skills can occur through directing the athletes' attentional focus either internally or externally. Attentional focus is binary; there are two established ways to focus attention, IAF or EAF (Wulf et al., 2000). IAF requires the athlete to be aware of their emotions, muscle tone, and body positioning. EAF requires the athlete to become non-aware of specific aspects of their body and to remain aware of the effect created by their movements (Wulf, 2007). Another aspect of the use of IAF and EAF is through the feedback provided to the youth athlete by the coach. The feedback provided may also be in term of IAF or EAF and effects an individual’s acquisition and application of motor-skills (Wulf, 2007; Perreault & French, 2013).

Conclusions

Athletes are unique. Elite athletes have exceptional abilities that allow them to acquire and perform complex motor-skills more effectively when compared to amateur or novice athletes. Similarly, youth athletes are unique and different when compared to adult athletes specifically in the domains of age, motor-skill acquisition, DMSP stages, skill level, and

attentional abilities. The Five-Step Approach (Singer, 1988) and Feldenkrais' strategy (1972) both promote awareness during learning and performing motor-skills and are in direct contradiction of the Constrained Action Hypothesis (Wulf et al., 2001). Non-aware strategies including an EAF approach agree with the Constrained Action Hypothesis as non-aware strategies allow the motor system to naturally self-organize and apply the motor-skills as effectively as possible (Wulf et al., 2001). Non-aware strategies or an EAF approach would benefit elite youth athletes and youth athletes across all stages of the DMSP as well as during all 3 phases of motor-skill acquisition. Aware strategies would benefit youth athletes during the sampling, specialization and investment phases of the DMSP as well as during the acquisition and transfer phases of motor-skill acquisition. Other studies have demonstrated that no significant difference exists between the use of IAF and EAF approaches during the acquisition of motor-skill (Agar et al., 2016) allowing for the existence of possible benefit of using an IAF approach when applied to the correct DMSP stage or motor-skill learning phase. An example would include directing a youth athlete to an IAF approach during the acquisition and transfer phases for a youth athlete in either the sampling, specialization or investment stage of the DMSP. Agar et al. (2016) concluded that all individuals improved with practice and suggest that motor-skill acquisition in youth athletes improves with task-based instructions and practice, regardless of the specific attentional focus used by the athlete. Often those "less experienced" athletes benefit from IAF, and therefore it is possible during the acquisition stage of motor-skill learning that an athlete may benefit from IAF because it focuses his or her attention toward the correct movement pattern (Agar et al., 2016). Subsequently, once an effective movement pattern has been established, then the use of EAF may be realized and the benefits of EAF obtained (Agar et al., 2016).

CHAPTER FIVE: THE ROLE OF A CLINICAL PSYCHOLOGIST WHEN WORKING WITH NOVICE AND YOUTH ATHLETES: APPLICATION OF KNOWLEDGE AND PSYCHOLOGICAL TECHNIQUES TO IMPROVE PERFORMANCE AND MOTOR-SKILL ACQUISITION

Introduction

Sport psychology services, provided by clinical psychologist, are most often applied to the population of elite athletes, often excluding research and delivery of services to novice and youth athletes (Foster, & Weigand, 2008). Therefore, a unique opportunity exists for a clinical psychologist to work with youth sports clubs and youth athletes. A clinical psychologist attempting to deliver sport psychology services to youth athletes has an opportunity to educate youth athletes, parents, and coaches of the purpose, principle, and nature of psychological skills training while increasing expose to valuable psychological life skills. Sport psychology techniques, similar to clinical psychology techniques, provide a channel for youth athletes to acquire mental skills (Gilbert & Orlick, 1996; Weiss, 1991) improve attentional processes (Schefke & Gronk, 2010) and can increase the enjoyment of participating in sports across a lifetime (Orlick & Zirzekberger, 1996). However, delivering sport psychology techniques and services to youth athletes is rare and limited research has been conducted in the area. Therefore, a clinical psychologist must modify and adapt the sport psychological services provided to elite athletes to better accommodate the youth athlete. Often clinical psychologist attempting to deliver sport psychological services to the youth athlete population must consider the, “athletic triangle” consisting of coaches, parents, and athletes (Smith & Smoll, 2014) as well as the differences between adult athletes and youth athletes in physical and mental development, motor-skill acquisition, and cognitive resources. Conducting psychological services to youth

athletes can be difficult due to the aforementioned differences between adult and adolescents and the athletic triangle. A well-trained clinical psychologist acknowledges that techniques may require modifications when providing psychological services to youth athletes through youth sport organizations and youth clubs (Visek et al., 2009). A Youth Sport Consulting Model (YSCM) is a 5-stage model that can help a clinical psychologist plan, implement, and evaluate a working relationship between youth sports organizations, coaches, youth teams, individual youth athletes and the clinical psychologist (Visek et al., 2009). However, the YSCM model does not consider the effect of correct attentional focus and the cognitive resources of each individual athlete during the 3 phases of motor-skill acquisition. Therefore, this literature review will incorporate the previously discussed attentional focus approaches, WM capabilities of youth athletes, and the previously discussed strategies into the YSCM. Included will be the work a clinical psychologist can do with coaches to improve the coaches understanding and significance of the language used when providing instructions and feedback. This literature review will not be discussing the work of a clinical psychologist with parents. Although, this is an area for future discussions and research because parents are a significant aspect of the athletic triangle, the youth athlete's athletic experience, and the youth athlete's life outside of athletics.

Triangle of Youth Athletics

The athletic triangle as defined by Smith, Smoll, and Smith (1989) is a social system involving the interactions between coach-parent-athlete that can significantly affect the psychological development of the youth athlete (Davis & Jowett, 2010) and motor-skill acquisition (Wulf et al., 2007). As previously discussed, the introduction of sports occurs during an important developmental time period, middle childhood, when an individual increases their social relationships. One of the significant relationships developed during middle childhood is

the coach-athlete relationship. Included within the coach-athlete relationship are 3 types of psychological attachment similar to and adapted from concepts of attachment theory: secure, anxious, and avoidant (Jowett, 2007; Smith & Smoll, 2014). The latter 2 attachments are considered to be insecure attachments and can lead to an increase in anxiety and a negative sports perspective and decreased sports satisfaction (Davis & Jowett, 2010). As previously discussed, anxiety or environmental stressors can decrease available cognitive resources, decreasing WM capacity, decreasing attention and leading to a decrease in an athlete's ability to acquire motor-skills and a decreased ability to optimally perform. Performance anxiety, an environmental stressor, can lead to a decrease in WM capacity, decreasing the available motor chunks, and therefore decreasing performance and motor-skill acquisition. The coach-athlete relationship has been researched and conclusions suggest a significant effect upon the enjoyment of the sport, the attraction toward teammates, self-esteem, performance anxiety, team cohesion, and sport attrition (Fisher, Mancini, Hirsch, Proulx, & Staurowsky, 1982; Smith & Smoll, 2011; Westre & Weiss, 1991).

How an athlete perceives and interpret a coach's behaviors and language can significantly affect the athlete's sport experience including acquisition of motor-skills (Smith & Smoll, 2014; Smoll & Smith, 1989). Smith and Smoll (2014) suggest the use of the Coaching Behavior Assessment System (CBAS) an observational measure used to code a coaches' actions during deliberate practice, deliberate play, and game situations. The coach's behavior is determined to either be spontaneous or reactive across 12 behavioral classes that include supportiveness, instructiveness, and punitiveness. Observed behavior is compared to the athlete's recorded perception and to coach's self-perception with the intent of modifying the coach's behavior through continued training with the clinical psychologist (Smith & Smoll, 2014; Smith,

Smoll, & Hunt, 1977) With the CBAS, the clinical psychologist is given an opportunity to educate coaches how language used during interactions with youth athletes can significantly affect the athlete's perception, motor-skill perceptions, and the competitive environment. Two of the behavioral dimensions concern the use of language to provide instructions, encouragement, and modify performance (Smith & Smoll, 2013). Results from the admission of the CBAS suggest that players responded well to coaches who engage in supportive and instructional behaviors (Smith & Smoll, 2013). With the knowledge of the relationship between attentional focus and WM during motor-skill acquisition, a clinical psychologist can educate coaches influencing the coach's language with the goal of improving motor-skill acquisition for the average youth athlete or novice athlete while also providing support and positive reinforcement to the coach leading to the creation of a mastery motivational environment for the youth athlete enjoy sports.

Creating the Optimal Athletic Environment for Motor-Skill Acquisition

Other findings indicate that when a coach creates a mastery motivational environment for practice and for games, youth athletes responded with adaptive achievement strategies that included selecting challenging tasks, providing maximum effort, persistence in the face of difficult tasks, and pride in personal improvement (Smith & Smoll, 2014). The coaches selected language during times of instructions and feedback help create the desired athletic environment while also directing an athlete's attentional focus to promote motor-skill acquisition leading to an increased optimal performance (Smith & Smoll, 2014; Perkins-Ceccato, Passmore, & Lee, 2003; Taghizadeh et al., 2015; Bell & Hardy, 2009; Duke, Cash, & Allen, 2011). The mastery motivational environment is not a "win-at-all-costs" environment. Instead, the environment allows the youth athlete an opportunity to take pride in personal improvement, demonstrate

persistence during setbacks, and apply adaptive achievement strategies that allow optimal performance (McArdle & Duda, 2002; Smith & Smoll, 2014). A mastery climate in youth sports is strongly associated with improved coach-athlete relationships and less associated with the team's win-lost record, (Cumming, Smoll, Smith, & Grossbard, 2007) while promoting intrinsic motivation, and voluntary participation (Roberts, Treasure, & Conroy, 2007). Smoll and Smith (2014) list 5 core principles for creating the mastery motivational environment. First, winning is defined in terms of giving maximum effort and making improvements. The emphasis is on having fun, deriving satisfaction from being on a team, acquiring motor-skills, and developing self-esteem. Second, highlights the required positive approach from the coach to the coach-athlete relationship of the athletic triangle. This includes use of positive reinforcement, encouragement, and correct technical instructions and feedback, which can be guided by a clinical psychologist. Third, a coach may attempt to establish mutual obligation, help, and support between teammates, individual athletes and the coach. Fourth principle is establishing team rules and expectations of each athlete to abide by the rules. Fifth, coaches are encouraged to continue in behavioral feedback, self-monitoring, and increased self-awareness to ensure continued following of the 5 principles (Smith & Smoll, 2014).

Youth Sport Consulting Model and Psychologist

Often the role of a clinical psychologist working with youth athletes is a contracted consulting role with a youth sports organization. One model for the clinical psychologist to follow is the Youth Sport Consulting Model (YSCM) (Visek et al., 2009). YSCM provides a framework for supporting and guiding the execution of sport psychology services by a clinical psychologist for youth athletes and youth sports organizations. The definition of youth athlete's in the YCSM is 6 to 17 years of age and those athletes who participate in sports activities that are

defined as being enjoyable, requiring effort, and accomplishment of a goal (Cote & Fraser-Thomas, 2007; Eitzen & Sage, 2003). The YSCM supports the use of practice settings deliberate play and deliberate practice with a focus upon educating youth athletes about mental techniques (Perna et al., 1995; Visek et al., 2009) which should include the correct application of attentional focus when attempting to optimally perform specific motor-skills. Within YSCM, a clinical psychologist can educate coaches how to reinforce the use of and development of the mental skill including IAF and EAF, observe the sport setting, and teach sport-specific mental skills. Poczwardski, Sherman, and Henschen (1998) constructed 11 factors to be considered when offering sport psychological services to youth athletes. The first 3 factors and the final 3 factors include beginning and terminating the relationship with the youth athlete, the parents, the coaches, and the youth sports organization (Visek et al., 2009). These 6 factors are important and critical to developing strong rapport with each individual involved in the youth athletic triangle as well as the youth sports organization yet are not as important to the current literature review. The fourth factor is assessment, the fifth is conceptualization of the athlete's concerns and possible interventions, the sixth factor is the organization of services, the seventh is implementation of the program and strategies, and the eighth is associated with planning and implementing the offering of mental skills training (Visek et al., 2009). As comprehensive as Poczwardski et al. (1998) 11 factors are to the YSCM, the factors do not address the issues of working with youth athletes in a group setting (Visek et al., 2009). Therefore, in addition to the YSCM, Visek et al. (2009) suggest complimenting the YSCM with 5 stages of group development for youth athletes as researched by Orton (1997) and similar to the formation of a group by a clinical psychologist for group therapy. Stage 1, formation, requires the clinical psychologist to seek input from all individuals of the athletic triangle concerning potential

services. Stage 2, exploration allows for the youth athlete to become aware of performance issues and set goals with the clinical psychologist (Orton, 1997; Visek et al., 2009). During this time, education upon the use of WM and shifting attentional focus during motor-skill acquisition can be completed by the clinical psychologist with the coaches and the athletes. In the 3rd stage, the transition stage, athletes acquire new motor-skills and attempt to overcome challenges associated with the acquisition of motor-skills. The working stage, 4th stage involves the performance of motor-skills in a competitive situation (Visek et al., 2009). During the third and fourth stages, a clinical psychologist is provided the opportunity to work with coaches specifically in the area of instructions, feedback, attentional focus during motor-skill acquisition, performance anxiety, and optimal performance. The 5th stage is the ending stage in which athletes combine all they have learned and attempt to optimally perform within a competitive setting. Within the 5th stage, clinical psychologist and athletes evaluate the experience and prepare for termination of the relationship (Visek et al., 2009) similar to ending a therapeutic relationship or a professional psychology relationship.

Therapeutic Interventions: Imagery and Attentional Focus

When conducting assessments with youth athletes in accordance to the YSCM, Harris, Blom and Visek (2013) suggest several developmental considerations for the development of an assessment plan of youth clubs and youth athletes. Considerations include and begin with understanding the athlete's mastery of critical developmental tasks specifically cognitive, social, and emotional developmental aspects. Other considerations are self-awareness, self-efficacy, self-control, social understanding, and the ability to process information (Harris et al., 2013). For the purpose of this study, the youth athlete's ability to process information is critical to the application of imagery training and shifting attentional focus. Visek et al. (2009) and Andersen

(2002) strongly recommend that clinical psychologist observe the coach and youth athletes during deliberate play, deliberate practice, competitive games, and social situations. Anderson (2002) concludes that a clinical psychologist can gather information through observation while providing an opportunity for stronger rapport, a more comprehensive assessment of dynamics, and more efficient application of psychological practices to the youth athletes and coach. When applying psychological skill training to youth athletes Orlick and McCaffery (1991) suggest the clinical psychologist keep it simple, physical, fun, meaningful, and attempt to be creative in the delivery of the skill. Imagery training is used by elite athletes more often than youth athletes (Hall, Mack, Paivio & Hausenblas, 1998). Orlick and McCaffery (1991) provide an example of teaching imagery to youth athletes between the age of 7 and 9 with the use of a soccer ball. Within the example, the language used by the clinical psychologist is clear, concise, and direct. The language is concrete and not abstract (Orlick & McCaffery, 1991). Due to the limited attention capabilities of youth athletes, the clinical psychologist is required to change typical imagery techniques often used with adults. To make the image activity physical and fun, the clinical psychologist may incorporate the soccer ball asking the youth athlete to describe the soccer ball using all 5 senses while moving the ball between his or her hands and feet (Orlick & McCaffery, 1991). Allowing the athlete to describe the ball while manipulating the ball's movements, makes the task of imagery more concrete and physical for the youth athlete (Orlick & McCaffery, 1991). When working outside of group and athletic settings, athletes may be required to bring in sports equipment such as a ball, golf club, or racquet to help stimulate visualization and imagery during the individual session. To support the use of imagery training with youth athletes, Munroe-Chandler, Hall, Fishburne, Murphy, and Hall (2012) conducted an experiment with youth athletes, 7 to 14 years of age, using an imagery intervention to determine

a difference in performance of a soccer skill. Monroe-Chandler et al (2012) concluded that young athletes who use a cognitive specific imagery intervention benefited when compared to their youth counterparts and suggested that beginning imagery training at an early age would maximize the benefits of the specific training. The 5 functions of imagery include cognitive general, cognitive specific, motivational specific, motivational general-arousal, and motivational general-mastery (Munroe- Chandler et al, 2012). The different attentional focus approaches apply to cognitive general, cognitive specific, and motivational general-arousal functions. Often a written script is read to the athletes when conducting imagery interventions (Munroe-Chandler et al., 2012). Within imagery training and the written script, a clinical psychologist can discuss and practice shifting attentional focus through imagery with the youth athlete. Specifically, the clinical psychologist can suggest using IAF when first developing the proper technique to perform the required complex move. Including the use of IAF with imagery such as viewing themselves perform the move from a 3rd person perspective, would be a possible way to apply attentional focus to imagery training. Dependent upon the athlete's developmental progress, skill level, and attentional capabilities, EAF approach could be applied to imagery training. For example, a golfer could use imagery to view themselves properly performing a golf swing, striking the golf ball, and experiencing the trajectory of the golf ball. Experiencing the trajectory of the golf ball and the movement of the club head is the EAF approach to imagery. An IAF approach to imagery techniques may include holding the golf club, focusing upon the grip of the hands while and performing the movement of the hand associated with the visualized golf-swing. To asses imagery use by an athlete the clinical psychologist can use the Sport Imagery Questionnaire for Children (SIQ-C) or the Movement Imagery Questionnaire Revised (MIQ-R; Hall, Munroe-Chandler, Fishburne, & Hall, 2009).

Therapeutic Interventions: Performance Enhancement and Attentional Focus

Concerning interventions and education with the coaches, a clinical psychologist can use behavioral coaching techniques (Martin, & Hyrcaiko, 1983; Stokes & Luisell, 2010) and improve the delivery of instructions and feedback by the coach, while increasing rapport with youth athletes, and creating a mastery motivational environment. Behavioral coaching involves educating coaches in the use of operant techniques, specifically behavioral graphing of the skill acquisition process, shaping procedures, and self-monitoring (Smith & Smoll, 2014). Operant techniques can be significant in the acquisition and performance of motor-skills across age levels, individual, and team sports (Smith, Smoll, & Christensen, 1996; Stokes & Luiselli, 2010). A clinical psychologist could adapt behavioral coaching techniques to include knowledge of IAF, EAF, and WM capabilities to improve the influence of a coach during the motor-skill acquisition phase and during the performance of motor-skills. Imagery-based performance enhancement techniques include relaxation, video observation, and team cohesion skills have demonstrated a significant effect upon the youth athlete's ability to acquire motor-skills and optimally perform motor-skills (Copeland, Bonnell, Reider, & Burton, 2009; Zhang, Ma, Orlick, & Zitzelberger, 1992). Imagery-based techniques reduce the anxiety experienced by the youth athlete. As previously discussed, reducing anxiety increases cognitive resources, specifically attentional cognitive resources. WM and attentional focus both use attentional cognitive resource and significantly effect motor-skill acquisition and performance. Therefore, applying imagery-based performance techniques modified with knowledge of the effects of attentional focus can improve an athlete's overall experience.

Conclusions

Within this chapter, the role of a clinical psychologist working with youth athletes, coaches, and youth sports programs has been reviewed. It is recommended that the clinical psychologist approach working with youth athletes as a clinical psychologist working in more typical therapy settings approaches working with youth clients. Some examples include the parents due to minor status, establish rapport with each youth athlete, observe the youth athlete, modify techniques to be developmentally appropriate, and ensure fun and enjoyment of sport psychology techniques, and terminate relationship appropriately. Specifically, a clinical psychologist can use of the imagery with knowledge and correct application of shifting attentional focus between IAF and EAF approaches to increase motor-skill acquisition and to improve the youth athlete's performance during deliberate play, deliberate practice, and competitions. Taking the information about IAF and EAF approaches allows the clinical psychologist to apply imagery techniques to the neglected non-elite youth athlete and or novice population while improving the athlete's sport experience, through improve motor-skill acquisition. Hopefully, with successful acquisition of motor-skills, youth athletes and novice athletes may continue participating in sports. Therefore, benefiting the individual and improving his or her over-all life style.

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