The effect of attentional focus on the performance and learning of a motor skill

on adolescent soccer players

By

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A thesis submitted to the
University of Birmingham
for the Mphil degree of
Sports Coaching

ACKNOWLEDGEMENTS

I would like to thank Dr Matt Bridge for his guidance and continued support, Dr Gabrielle Wulf for her invaluable input and support and most importantly my parents for all they have done for me.

CONTENTS PAGE

ABSTRACT

What a performer attends to when executing a skill has been studied extensively in the past several decades. Recently Wulf and colleagues (Wulf 2007b) have demonstrated that the adoption of an external focus of attention is preferable for the learning of complex motor skills. This present study aimed to extend the attentional focus research by comparing the effects of different attentional foci on learning and retention in 12 -14 year old skilled soccer players. Forty eight players were selected from a soccer academy and participated in a five week study. Each participant carried out ten trials on a soccer specific accuracy task each week. Participants were randomly allocated to one of three attentional focus groups; external, internal and control. Results show that those who learned with an external focus of attention had a greater accuracy in the performance practice trials (3.5±1.1) than the internal focus group (2.4±1.0) and control group (2.5±0.9). An external focus of attention was also found to benefit retention where the performance of the external focus group was superior (2.9±1.2) compared to the internal (1.9±0.8) and the control group (2.8±0.7). These findings offer support for the previous work on attentional focus and have furthered the research by showing the advantages of an external focus of attention in a real learning environment and adolescent participants.

INTRODUCTION

This chapter will introduce the purpose of the study and highlight the reasons as to why this research question was chosen.

1.1 Background of the study

Scientists and educators have been trying for decades to understand the basis of skilled performance and the factors that influence motor skill learning in order to develop both novice and advanced performers (Maxwell and Masters, 2008, Wulf 2007b, Beilock and Carr, 2005). Athletes require key skills in order to progress to elite levels in a sport; skills such as motor (e.g. balance), cognitive (e.g. decision making) and physical skills (e.g. power) are all advantageous and sometimes essential to achieve excellence in a chosen sport (Abbott and Collins, 2004). As well as these skills research into motor skill development has found the importance that coaches and practitioners play in developing athletes (Starkes and Ericsson, 2003), particularly adolescents and thus the role of the coach plays a critical role in the development of athletes from novice to elite (Côté and Fraser-Thomas, 2007).

In order for performers in sport to progress from novice to elite, they must pass through several stages of learning. According to the seminal work of Fitts and Posner (1967) and their model of skill acquisition, a performer will pass through three stages of learning as they develop; cognitive, associative and autonomous. In the initial stages of skill acquisition the performer's movement execution relies heavily on the formation, retrieval, and implementation of consciously accessible declarative knowledge in working memory (Koedijker et al, 2011). As performers progress through the stages of learning, they begin to lessen their conscious control over the movement execution, which allows the performer to

become better at acquiring novel information from the environment (Dubrowski et al, 2012). For researchers therefore it is essential to understand how performers go from a novice to an expert.

An important part of motor skill development is feedback. When a performer is carrying out a task they will provide themself with feedback as to the success of their movement and will thus seek to change this in following attempts in order to improve performance (Wulf et al, 2010). As a performer progresses through the stages of learning they may receive feedback from external sources such as a coach, in order to further their development, this is called augmented feedback (Lewthwaite and Wulf, 2010, Badami et al, 2012). The understanding of augmented feedback has changed in the past several decades (see Williams and Hodges, 2005) and recently it has been found that instructions that focus the attention of the performer has a major impact on the outcome of the skill they are performing (see Wulf 2007b). Attention is closely tied with other domains of cognitive psychology, such as memory, learning, decision making and perception (see Wickens and McCarley, 2008).

The work into attentional focus has found that the wording of instructions and feedback can have a major impact on the performance and learning (retention) of a motor skill (Wulf and Su, 2007). This is an important consideration for coaching methods as augmented feedback has been shown to be very important for athletes and performers to improve their performance (Badami et al, 2012). Attentional focus research has found that by changing the wording of feedback to induce either an internal (focus on performer's body movements), or external (focus on movement outcome) focus differences can be found in both performance and learning (see Wulf 2007b).

1.2 Introduction to research goal

The research into attentional focus has furthered the understanding of motor skill development, from the learning of simple balance tasks (Wulf et al, 1998) to more complex, sport specific tasks such as soccer and volleyball (Wulf et al, 2002), tennis (Wulf et al, 2000), golf (Bell and Hardy 2009) and basketball (Zachry et al, 2005). Although the previous research into an attentional focus has been conclusive in its findings, there are still gaps in the literature which as of yet have not been sufficiently addressed. So far the attentional focus research has yet to study adolescent performers, an important sample for the development of motor skill development (Chiviacowsky et al, 2010). This study will therefore seek to take the current attentional focus findings and test them on an adolescent sample which has been which is arguably one of the most important in which to develop skill. However, it is important to be aware of the issues that maturation has on the development and performance of adolescent performers (Malina et al, 2005). Previous research into adolescents has focused more on physiological capabilities than sport-specific skills (Williams and Hodges, 2000). This study will therefore study a soccer specific skill which is not upon physiological development.

1.3 Ecological validity

With the emergence of the dynamical systems theory (see Glazers and David, 2010) performers are now viewed as complex systems. According to the dynamical systems theory there are three factors which influence the execution of a skill; environment, task and the performer (Davids et al, 2007). An important feature of complex neurobiological systems is the emergent relationship that develops between perception (information) and action (movement) as such systems coordinate their actions with respect to the environment

(Renshaw et al, 2010). There is a need therefore to study complex skills in a dynamic, ecologically valid environment in order to test whether the results found in controlled, laboratory based studies can be translated to more practical, ecologically valid settings (Aruajo et al, 2006, Pinder et al, 2011). However, historically, experimental research designs have been inherently systematic in nature, affording high levels of control and manipulation of individual variables (Dhami et al, 2004). Thus there are still questions over the design of motor skill studies which have been criticised due to their lack of ecological validity (Pinder et al, 2011).

1.4 Thesis structure

Following this introduction will be a review of the literature into the performance and learning of motor skills, the understanding of the role of augmented feedback in motor skill development and a deeper understanding of the attentional focus research. Chapter three will look at the methods used in the previous attentional focus research and consider methodological issues relevant for the present study. The following chapter four will then outline the method used in this study. Chapter five will provide the results from the study and chapter six will discuss the findings further, where conclusions will be drawn regarding the purpose and outcome of the study.

1.5 Conclusion

The research into attentional focus has furthered the understanding of feedback and attention on the learning of motor skills. However, it still contains gaps in terms of its lack of research into adolescent performers and its studies lack of ecological validity and representative design, which has restricted the research to be generalised into real life learning environments. The purpose of this study will be examine the effects of attentional focus on a

learning and retention of a soccer specific skill in a real life training environment, Thus, the importance of this research is that it will seek to further the research into attentional focus to test whether differences can be found in a real world environment with young skilled athletes.

LITERATURE REVIEW

2.1 Introduction

The previous chapter introduced the research topic and this chapter will look further at motor skill development and attentional focus. Firstly the chapter will look at the differences in performance and learning in motor skill development, followed by the importance of feedback in the development of motor skills. Following this overview of motor skill development the chapter will then be looking into the key research concerning an attentional focus, looking at how this research has sought to gain a greater understanding of how athletes and performers progress between the different stages of learning and the impact that an attentional focus has on the performance and learning of motor skills. The research into attentional focus will be evaluated and critiqued from the use of simple tasks to more complex skills and will also examine the influence that an attentional focus has on a person's attentional capacity. Finally, it will look into the limitations of the attentional focus research based on the selected sample used in the studies and the lack of ecological validity in the majority of the attentional focus research. The chapter will then summarise how the literature has guided the purpose and aim of this study.

2.2 Performance and learning

In motor skill development it is important to understand the differences between performance and learning. Schmidt and Wrisberg (2008) define performance as the execution of a skill which is always observable and can be influenced by many factors such as motivation, attentional focus, fatigue and physical fitness. Learning however is typically defined as a relatively permanent change in a person's capability to perform a skill (Wulf and Shea, 2010). When scientists study learning they are interested in the factors that produce the

relatively permanent gains in performance; gains which are seen as more accurate reflections of what a performer has learned, not the temporary changes seen from the practice trials (Schmidt and Wrisberg, 2008). There are major differences between temporary performance and long term learning (Wulf 2007b). Previous studies on motor skill learning however did not always carry out retention tests, or failed to do so effectively, which resulted in false findings; where the true learning effects of an experimental condition were not found (see Schute, 2008). The purpose of the retention test is to allow any temporary performance enhancing effects (from a guidance effect) or performance degradation (from increased fatigue) that certain practice conditions may have created to dissipate, leaving only the relatively permanent effects (Wulf et al, 2010). It is important to use delayed learning tests, such as retention or transfer tests, as the research is able to assess the actual learning that that an experimental condition has had on long term memory, in Figure 2.1 the results are shown from the practice trials in blocks 1-10 and then learning is found in a retention test (see Figure 2.1). Recently research into motor skill development has sought to investigate both the performance and learning of motor skills (see Wulf 2007b). In order to further the understanding of motor skills it is important to have a greater understanding of how motor skills are developed.

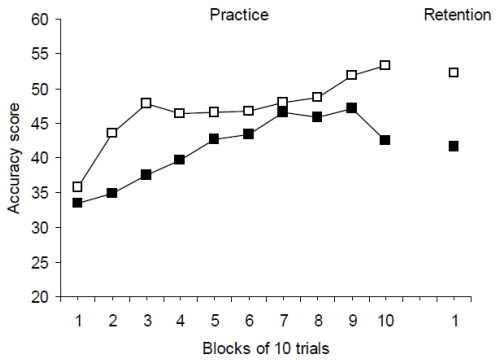

Figure.2.1 Example of a study into feedback assessing performance (practice) and learning (retention). Adapted from Badami et al, (2012 pg. 199)

2.3 Skill development

As adolescents develop in a sport there are a multitude of factors which can affect their progression from novice to elite. A performer may possess abilities; defined as an inherited, relatively enduring, stable trait of the individual that underlie or support various kinds of motor and cognitive activities or skills (Schmidt and Wrisberg, 2008). If a young athlete possesses the right abilities, then what is then important is their level of skill. Skill describes ones proficiency at a particular task; which can be easily modified by practice and represent the particular capability to perform a particular activity (Schmidt and Wrisberg, 2008). For practitioners and researchers, understanding the science behind motor skill learning will enable them to improve and develop skilled performers to perform at a high level.

According to traditional views of motor learning; in order to master a skill a performer must pass through different stages. The seminal works on models of skill acquisition from Fitts and Posner (1967) and Dreyfus (1986) are still accepted today. The models propose that at the beginning of learning a new skill, a performer attempts to generate an idea of the movement in order to understand the basic pattern of coordination, this is the novice stage, where performance in this stage is characterised by considerable inaccuracy, slowness and inconsistency as the performer is required to consciously focus on the movement (Maxwell and Masters, 2008). After some period of practice, learners reach the stage where their performance becomes more accurate and consistent; movement is controlled more automatically, allowing more attention to be given to outside aspects of performance (Wulf 2007b), such as the opposition and teammates positions in football for example. Anticipation and timing develop also, making performers movements appear smoother and less rushed (Prinz, 1991). If a performer is able to move all the way to an elite level, movements are

performed with little or no conscious control and movement is characterised by fluent and seemingly effortless motions (Wulf, 2007a). For coaches and researchers, knowing how an individual develops from a novice to a skilled performer is essential "in order to achieve excellence in any sport demands the execution of precise, fluent, effective movement patterns" (Beashel and Taylor pg226). Thus, what a performer attends to is crucial in developing athletes and performers from novice to elite (Wickens and McCarley, 2008).

2.4 Feedback

In order for a performer to progress from novice to elite then the use of feedback is instrumental in their development; feedback is information that athletes receive about their performance; it guides, instructs and aims to improve performance (Williams and Hodges, 2005). Feedback serves three important functions; it can be motivating, can reinforce good performance and can be used as error correction information (Wulf and Shea, 2004, Badami et al, 2012). In the initial stages of learning a performer will often receive intrinsic feedback; information that is a natural consequence of executing a movement and which comes from the performer (see Swinnen, 1996). They assess their own performance, being able to ascertain if their performance was successful or not, through visual, kinematic and audible cues. However, a performer's own internal feedback or solely knowledge of results may not be enough; they may need feedback from someone or something else in order to improve performance, known as augmented feedback (Wulf and Shea, 2004). Augmented feedback about movement outcome or quality (knowledge of results or knowledge of performance, respectively) has long been considered one of the most important variables for motor learning (Lewthwaite and Wulf, 2010). The role of augmented feedback in order to improve performance has been seen to be essential in the development of elite performers (see Starkes

and Ericsson, 2003) and thus the capability to provide feedback is one of the most important reasons why coaches are so vital to the learning process (Chen, 2001). Skilled coaches know the proper patterns of movement and are therefore able to provide learners with the type of feedback information needed for effective learning, which allows augmented feedback to provide specific information directed at correcting errors or reinforcing correct performance (Badami et al, 2012). Over the past century, there has been a vast amount of research looking at the effects of instructions and augmented feedback on motor performance which has sought to understand how coaches and practitioners can develop athletes and performers through the type of feedback and the frequency of feedback given (see Shute, 2008 for a full review of feedback).

2.5 Frequency of feedback

The amount of feedback given to a performer in terms of whether feedback is given after every trial (100%), or one in four trials (25%) for instance, has been called frequency of feedback and it has been a topic of discussion in the feedback literature over the past several decades (Salmoni et al, 1984, Shea and Wulf, 2004). In the initial stages of learning or when the task to be learnt is fairly difficult, performers may require feedback more frequently to improve performance (Wulf et al, 1998). As skill develops, the frequency of feedback provision may be reduced or ‘‘faded out’’ to encourage learners to detect and correct their own errors, this can be seen to coincide with the athletes progression through the stages of learning (Dreyfus, 1986) where the performer no longer needs constant feedback or attention to perform the skill effectively. It has been argued by Swinnen (1996) that learners become too dependent on the information provided by the augmented feedback and neglect the processing of intrinsic feedback. In a study looking into frequency of feedback on children, Weeks and Kordus (1999) found that 100% frequency of feedback affected the learning of a

soccer throw in, and that less feedback (33%) improved performance. It may be that frequent feedback might provide too much facilitation in the planning of the subsequent response, thereby reducing the participant's need to perform memory retrieval operations thought to be critical for learning (Wulf et al, 2002). As the complexity of the skill increases, the adjustments required to facilitate performance on subsequent practice attempts may not be readily apparent and consequently the absence of prescriptive guidance from the coach may encourage learners to become more involved in the problem-solving process (Wulf and Shea, 2004). The key issue for coaches is that learners should be encouraged to rely on their own intrinsic feedback mechanisms rather than solely on information provided by the coach. Learners must eventually perform without augmented feedback and unless they are encouraged to become active problem-solvers during practice, they will be unable to adequately draw upon their own intrinsic processes to guide performance when augmented feedback is removed. Williams and Hodges, (2005) have argued that the role of the coach in all stages of a performer's development is to improve the performance importantly learning a motor skills to further a performers development.

2.6 Attentional focus

There has been a lot of research carried out on motor skills and perception (see Williams and Ericcson, 2005) and in the past decade research into what a performer attends to has found that a person's attentional focus has a major impact on the performance and importantly learning of sport specific skills (Wulf, 2007b). The attentional focus research has shown that a simple change in the wording of instructions and feedback can have a significant impact on the performance and learning of a motor skill (Wulf et al, 2010). It has found that instructing subjects to focus on the effects of their actions, rather than on their body

movements has benefited both performance and learning (Wulf et al, 2002, Chiviacowsky et al, 2010, Lohse et al, 2010).

2.7 Constrained action hypothesis

It was argued by Prinz (1991) that a performer who directs their attention further from the body when performing a motor skill would improve performance. It was argued that focusing on the outcome of the action instead of the body's movements and execution improved performance because it did not allow performers to disrupt their automatic control processes. The idea of focusing attention on the outcome prompted Wulf et al, (1998) to carry out a balance task study and found that when a participant was instructed to focus externally, on the lines of the balance board, performance, improved balance, was superior to when participants were instructed to focus on their internal movements, such as focusing on their feet. This theory led Wulf et al, (2001) to put forward the "constrained action hypothesis" which proposes that individuals, who direct their attention internally during skill execution, interfere with their automatic control processes which normally regulate the movement. They hypothesised that if a performer attempts to focus on their movement, an internal focus, then these automatic processes would become consciously controlled, which they argued would interfere with the fluency of the movement. Wulf et al, (2001) argued that an external focus of attention allows unconscious, fast and reflexive processes to control the motor skill, whereas an internal focus causes an individual to consciously control their movements, resulting in performance becoming static and clumsy. They argued that in order to improve performance and restrict these constraints, focusing on the movement effect will lead to automatic, fluent movements resulting in more effective performance. Wulf et al, (2001) found that in a stabliometer task, participants instructed to adopt an external focus demonstrated more effective learning than those provided with an internal focus. Similar results were also found

in a ski simulator task (Wulf et al, 1998). As seen previously (see 2.3 Skill development) when a performer moves through the stages of learning, they go from requiring conscious control of their movements to having a more automatic execution, requiring less conscious control, an internal focus appears to force the participant to consciously control their movements which has the potential to degrade the performance and learning of a task (Wulf et al, 2001).

2.8 Complexity of tasks in the attentional focus research

In the initial studies into attentional research simple, laboratory based experiments were used in order to find if there were differences in performance when a performer adopted either an internal or external focus of attention (see Wulf 2007b for full review). These initial studies used balance tasks in order to examine if an external focus relative to an internal focus improved balance performance (Wulf and Weigelt, 1997, Wulf et al, 1998, Wulf and Shea 1999, McNevin et al, 2003, Wulf et al, 2004). These studies provided strong findings that an attentional focus, whether external or internal, influenced the performance and learning of a task. It was found that an external focus was found to be superior to an internal focus (Wulf et al, 1998), however Wulf (1998) argued for the need to study more complex skills in order to provide recommendations for the teaching of motor skills and therefore sought to study a broad range of tasks in order to test their theory; such as golf (Wulf et al, 1999, Wulf and Su, 2007, Bell and Hardy, 2009), basketball (Al-Abood et al, 2002, Zachry et al, 2005), darts (Marchant et al, 2007), American football (Zachry, 2005), soccer (Wulf et al, 2002, Chiviacowsky et al, 2010). The majority of these findings have shown that an external focus benefits performance and learning of a task which provides strong support for its use in coaching.

A complex task into golf chipping was carried out by Wulf and Su (2007) using skilled performers; they found that an external focus of attention improved performance whereas an internal was shown to cause a performance decrement. An interesting finding from this study was that they used a control group in order to compare results to a how a "normal" performer would perform with no instructions or feedback. They found the results of the control group were similar to the internal focus condition; indicating that a group with no instruction will naturally choose to focus on their body movements. This is an interesting consideration for coaching and for practitioners; that performers, especially skilled ones, may have a natural tendency to focus internally, perhaps from being nurtured in that method. However, in this study Wulf and Su (2007) did not carry out a manipulation check, such as a questionnaire asking the participants what they actually focused on. Although the results indicated similar performance to the internal group, it would have being interesting to find out exactly what the control group focused on.

2.9 Skill level

It is commonly accepted that an expert performer benefits from an external focus as conscious control of the body, an internal focus, will lead a performer to focus on their movement, which will constrain their action, resulting in the usual smooth movement to become staggered, resulting in performance to suffer (Wulf and Shea, 2002). It is argued that a skilled performer who has built up a strong knowledge of a skill can affect performance negatively when they consciously think about the skill during execution (Bell and Hardy, 2009). Yet Wulf et al (2002) aimed to find if external focus feedback benefited performance with novices while carrying out a sport specific skill. Wulf et al, (2002) carried out an experiment using both novice and experienced volleyball players performing a volleyball serve. The goal in the study was to examine the effectiveness of different types of feedback

for actual sport skills under more realistic conditions that approximate those of athletic training situations. That objective required that more than one feedback statement be used and that the feedback be given as a function of the participant's performance; it also required that the feedback statements given to each group in the study differ more from each other, in terms of the wording, than did the instructions or feedback used in previous studies. The feedback statements attempted to further the previous research by making them more sport specific, the feedback changed certain words which would induce either an internal or external focus. The experiment took place over three days; two practice trials and a retention test one week later, the participants performed twenty five trials on each of the practice days and fifteen trials in the retention test. Results showed that all groups improved over the two day practice trials, with the external focus groups showing the highest gains. These results were also found in the retention test where the external focus group outperformed the internal focus group.

Although the findings continued to show the benefits of adopting an external focus, the issue of skill level needs to be considered; the use of the term novice in the studies does not distinguish between the participant being a complete novice or an advanced novice. This difference needs to be addressed more in the attentional focus research, as the findings into the effectiveness of attentional focus should be understood in terms of the actual level of the performers participating in the experiments. There are also still doubts as to the ability to generalise these findings to a real life training environment (Pinder et al, 2011); the timescale of the research is not representative of a real life training environment, two continuous days of repetitive practice of fifty trials is not realistic to a real training environment. It would appear that the aspects of the environment were not considered, it was actually the complexity of the task which was altered, meaning the study was similar to previous laboratory based studies which were controlled and mechanistic (see section 2.16).

2.10 Attentional focus and frequency of feedback

The importance of feedback is a major factor in developing performers from novice to elite and the frequency of feedback has been seen to play a part in the performance and learning of a motor skill (Wulf and Shea, 2004). Wulf et al, (2002) examined if frequency of feedback using an external focus produced the same results. They carried out an accuracy task involving a soccer chip shot; the participants, who had previous experience of playing soccer, were split into four groups; external focus or internal focus with either 100% or 33% frequency of feedback. They found an external focus of attention improved performance and learning. It is interesting that the internal focus group who received 100% feedback performed worse than those that received internal with 33% frequency. The results confirmed the predicted interaction of feedback frequency and attentional focus. Specifically, they are in line with previous findings (Weeks and Kordus, 1998) of more effective performance during both practice and retention when the frequency of feedback directed at the performer's movements (internal focus) is reduced. Wulf et al, (2002) argued that when a performer receives 100% internal focus feedback, the constant internal focus feedback continues to focus the performer on their body movements, which has been seen to be detrimental to performance. However the opposite effect was found with the participants in the 100% external focus feedback condition where performance actually improved. It was argued that an increased frequency of external focus feedback enabled the performer to continually focus externally, on the movement outcome, thus preventing the performer from focusing on their body movements. In the delayed, no feedback retention test one week later, the external focus group with 100% frequency showed a marked improvement from practice, as well as the 33% external focus group who also improved. However, the findings in the internal focus groups were the most

revealing; the 100% and the 33% group scored much lower than the external focus groups clearly showing the impact that an attentional focus has on a performer.

In a study carried out by Chiviacowsky et al, (2010) into a soccer throw in, results found that a higher frequency of external focus feedback improved performance and learning. Forty eight children of 10-12 years old were split into four experimental groups; two internal focus and two external focus, one group received 33% frequency feedback and the other received 100%. As well as scoring points for accuracy, the researchers judged the children on their movement form, in order to assess this, a video camera was used and two judges, who were naïve to the experiment, rated the movement. The results of the this study confirmed the prediction that external-focus feedback provided after every trial (100%) would result in more effective learning than less frequent feedback (33%). In fact, the external focus 100% group outperformed all other groups in the learning test also. Considering that feedback, by its nature, implies an evaluation of an individual's performance, it may not be surprising that frequent feedback can have detrimental effects compared to less frequent feedback because the more a coach for instance gives feedback to the performer, they will have more conscious thoughts about the execution and the processes (Maxwell and Masters, 2008). These effects are most likely exacerbated when individuals are provided with specific internal-focus feedback because of the debilitating effects that conscious control has on the performance of motor skills (Wulf et al, 2001). An interesting point from this study was this the use of a different sample, the majority of the attentional focus research has used 18-24 year old college students, thus it is interesting to see the effects that an attentional focus can have on other samples (see section 2.11).

2.11 Attentional focus and learning

Earlier it was seen how differences in performance and learning play a part in the development of performers, as seen in the previous section, the type and frequency of augmented feedback given to a performer can have a major impact on their learning of a skill. Without the use of a retention or transfer test, a study may indicate that there are no benefits to an external focus of attention; this has been shown in attentional focus studies where it is not until the retention or transfer test that significant differences were found (Totsika and Wulf 2003, Hodges, and Franks 2000). Those studies which test for only practice effects may be failing to give a true indication of what is being learned. Researchers and most importantly coaches and teachers are interested in the factors that produce relatively permanent gains in performance (Schmidt and Wrisberg, 2008). It is clear that a study's failure to use delayed retention or transfer tests, may fail to show the full picture of the effects of an attentional focus (Wulf 2007b). The length between practice trials and retention tests are important; previous studies into learning effects carried out retention tests 10 minutes after practice (see Salmoni et al, 1984), which will not show learning but short term practice effects. It appears that at least 24 hours is needed for retention test to be valid as sleep may be a factor in the transfer of short term to long term memory (Macquet, 2001).

Studies into attentional focus have found that learning is enhanced when practicing with an external focus of attention. Totsika and Wulf (2003) required participants to ride a pedalo a certain distance, using a secondary task of counting backwards in 3's from 1000. A secondary task was used in order to increase the cognitive processes on the performer. It was found that the internal focus group suffered major performance decrements, whereas the external focus performance remained stable. In another study Hodges and Franks (2000)

found that only in delayed retention tests were differences between internal, external and no instruction found; an external focus showed superiority in learning. However, this is understandable considering the task was a laboratory based, simple flashing light task where participants will not be greatly challenged. The learning findings do point to the ability of an external focus to keep performance stable and points to the destabilising effect that an internal focus can have on performance, especially when extra attentional load is induced in a transfer test.

The studies above show the advantages of carrying out a retention or transfer test, it is important for research to see if the participants are effected long term, as for coaches this is an important aspect of performers developing (Schmidt and Wrisberg, 2008). There have been other studies carried out in the attentional focus research which have used retention tests also, (Wulf et al, 2002, Wulf and Su, 2007, McNevin and Wulf, 2002) however, an important consideration for researchers is the length of time between the practice trials and the retention tests. It is representative of a real life training environment to test for learning effects only twenty four hours later such as in the study from Totsika and Wulf (2003). The study by Hodges, and Franks (2000) and Wulf et al, (2002) represents a more real life time period where there is a gap of one week, as this reflects a real life learning environment. It is important to consider conducting performance trials and retention tests over many weeks and months to really see the learning effects which would be found in a real life learning situation. It appears that when a performer performs a task in retention or transfer test, where there are extra pressures such as competition, that a performer's attentional focus plays a part on the success of their performance. Yet along with this it has been found that a person's attentional capacity can play a major role in the execution of a skill.

2.12 Attentional capacity

For many skills there is an overwhelming amount of information that can be processed, some of it relevant to performance and some not (Maxwell and Masters, 2008). It has been found that the less a performer can consciously focus on their movements, and thus reducing the amount of information processed, may allow them to keep performance high, especially when a secondary task in introduced or feelings of anxiety are present (Totsika and Wulf, 2003). Research into attentional capacity and working memory (see Beilock and Carr 2005) has found that each person's working memory has a limit; an attentional capacity, which if exceeded, can cause performance to suffer. Beilock and Carr (2005) have indicated that coaches and practitioners should be aware of a performer's attentional capacity when performing and learning a motor skill, as the notion of attentional capacity has strong implications for the understanding of achieving high level performance especially when considered with the research into attentional focus.

Although cognitive processing may help when first learning a skill, it is widely believed that performance is best when there is limited attention paid to the procedures of a well-learned task (Vickers and Williams, 2007). In order to prevent a person exceeding their attentional capacity, performing a skill with no or little conscious control will aid performance as the performer is using less attentional space which frees up more space for secondary factors such as the opposition, tactics and decision making (Schmidt and Wrisberg, 2008). As figure 2.2 shows, when a primary task is relatively simple, it requires less attention load; leaving more room for a secondary task. However, in a complex task, availability for a secondary task is more limited (Schmidt and Wrisberg, 2008). Understanding a person's attentional capacity is very important in our understanding of high level skilled performance

as processing too much information has the potential to exceed attentional capacity, leading to a possible disruption of performance (Wulf 2007b). The theory of attentional capacity ties in with the work of Wulf and colleagues their research into attentional focus.

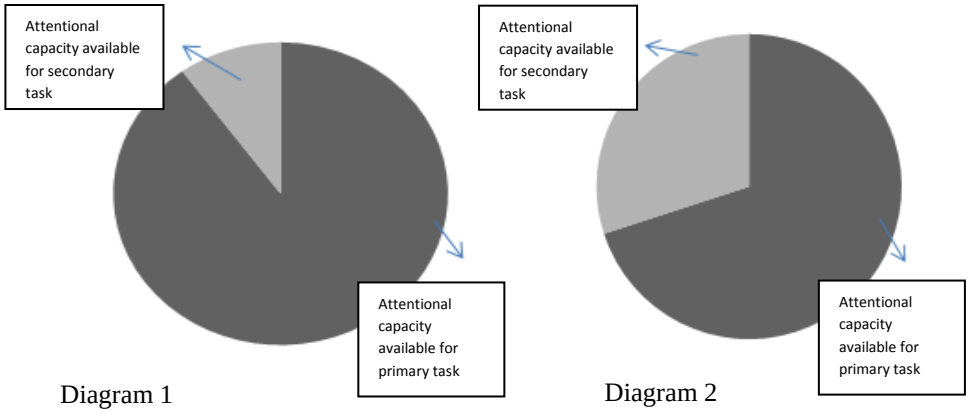

Figure 2.2. Fixed amount (or capacity) of attentional space might be devoted to the performance of a primary task and a secondary task. When the primary task is relatively simple (diagram 1), it requires less attention. When it is more complex (diagram 2), less room is available for a secondary task. If attentional capacity is exceeded, performance deteriorates (adapted from Schmidt and Wrisberg, 2008 pg. 44).

2.13 Attentional focus and attentional capacity

Research has shown that working memory capacity predicts performance in complex tasks even in individuals with high levels of domain-specific experience and knowledge (Hambrick and Meinz, 2011, Beilock and Carr, 2005). Wulf (2007b) has argued that as task becomes more complex, more attention is required, thus on more complex tasks it may be that performers who are using an internal focus are using more of their attentional capacity as they are consciously attending to the processes of the skill. The attentional focus research has found that adopting an external focus of attention enhances performance as an external focus uses less attentional load, resulting in more attentional capacity available in a secondary task,

resulting in consistent performance (Wulf 2007a). Evidence shows that an internal focus of attention needs additional cognitive resources and that anxiety related performance failure is associated with attentional capacity overload (Totsika and Wulf, 2003). Wulf (2007b) believes that an internal focus of attention increases the attentional load on a performer because it contains more processing information for the brain to process. Totsika and Wulf (2003) found that in a secondary task, with extra information to process, attentional capacity was overloaded when participants were using an internal focus of attention. There were no differences found in the practice trials, however to test for retention the participants were instructed to count backwards in 3's from 1000. They found in these tests that the external focus condition remained stable whereas the internal focus group suffered dramatically. It appears that using an internal focus has the potential to overload a person's attentional capacity resulting in performance breakdown. This is important for coaches to understand, as in sports like soccer, there is a lot of secondary information for the performer to attend to such as the opposition and team mates movements and position. If they consciously focus on their movements as well as attend to these secondary factors, it is possible that the performer may overload their attentional capacity and suffer a performance decrement. Wulf (2007b) argues that because an internal focus contains more explicit information, a person's attentional load has a higher risk of being exceeded.

According to self-focus models, performance decrements occur when individuals' attention is directed inwardly to technical, physiological, or emotional aspects that are normally automated with practice (Baumeister, 1984; Janelle, 2003; Lewis and Linder, 1997; Masters, 1992; Masters and Maxwell, 2004). For these models a skilled performer has developed implicit, highly automated routines that require little conscious effort. Their need to explicitly attend to internal processes has been replaced by an automatic form of control

characterized by a low level of conscious awareness and little attention to the control of the skill. In high pressure situations such as competition, arousal leads the performer to heighten their self-consciousness which can disrupt the performance of certain tasks (Baumeister 1984). Research by Masters and Maxwell (2008) have found that what performers focus on and what they learn in the early stage of acquisition is the important factor in determining whether a performer will overload their attentional capacity. Masters and Maxwell (2008) found that if a performer is given a large amount of information regarding a skill, termed explicit information, they were more likely to overload their attentional capacity and suffer a performance decrement, compared to those who learnt a skill implicitly. The work into self-focus is in line with Wulf's attentional focus research; by instructing performers to learn with an internal focus in the early novice stage of development, the performer may gain more explicit rules of the skill, thus focusing internally on the processes more. It is interesting therefore to consider how beneficial it could be for novice performers to learn a motor skill with an external focus or implicitly, thus increasing the amount of attentional capacity left for other secondary factors which will enable a high level of performance.

2.14 Anxiety and attentional focus

In any competitive environment, there is a pressure to perform well, through this pressure a performer is possibly in a state of high arousal or anxiety (Vickers and Williams 2007). When a performer's anxiety and self-focus increases, attentional load is increased, which if overloaded can detrimentally affect performance (Bell and Hardy 2009). Recently, Wulf and Lewthwaite (2010) expanded the attentional focus research by explaining that by merely suggesting reference to the participant's body parts (e.g., fingers, arms, feet) provokes a focus on the self. The fact that motor performance often takes place in the presence of

others and can be evaluated by them, may in and of itself lead to a state of self-consciousness and subsequent self-evaluation. This, in turn, can lead to "micro-choking" episodes and a switching of attention to self-regulatory activity (Wulf and Lewthwaite, 2010). Efforts to manage self-related thoughts and emotions may be so demanding that available attentional capacity is exceeded and performance suffers. It is possible that these processes promote a conscious control of both movement and self-regulatory activities. Bell and Hardy (2009) wanted to see how anxiety could influence results. In their opinion anxiety manipulations were not used enough in the attentional focus research and thus they used a combination of social evaluation and financial incentives to create anxiety in the participants; a video camera was used to evaluate the participant's shots and a financial incentive for an improvement on performance would be rewarded up to $80. The participants' anxiety was assessed using the CSAI-2R (see Cox et al, 2003) in order to ascertain the levels of somatic and cognitive anxiety and self-confidence levels. It was found that the further from the body the performer focused was more beneficial for performance in the anxiety condition. This study gives strong support for the external focus literature, particularly when carried out in an ecological setting, using a real life skill. This appears especially prominent in high pressure instances, where anxiety can increase the attentional load of a performer. The results are also important for coaches to understand the effects that instructions and augmented feedback can have on a performer and the research into attentional focus has furthered the understanding of feedback and attention in the development of motor skills.

2.15 Samples used in the attentional focus research

As conclusive as the work into attentional focus has been, there are still issues which need to be considered in terms of generalising the findings across different samples. Wulf et

al, (2007) sought to find if an attentional focus could be found on a jump and reach task. Participants performed a jump and reach vertical task in a within participant design. An external focus was found to be superior yet the issue is that the majority of studies into attentional focus have used college students, often based on convenience, which has restricted the findings of the attentional focus research on other samples. For instance, the jump and reach study by Wulf et al, (2007) would be difficult to translate with adolescents, as the physical factors which affect the outcome of a jump task are difficult to account for with participants between 9-14 because jumping requires leg strength which in adolescence is varied based on individual differences (Malina et al, 2005). A study by Thorn (2006) which did look into a younger population used 9-12 year olds to examine whether their balance performance would differ based on different attentional focus instructions. The study examined postural sway; where a difficult level of stability was chosen in order to challenge the participants sufficiently to see differences in performance. Another rare study from the attentional focus literature using a different sample was from Landers et al, (2005) who studied balance in patients with Parkinson's disease and found no differences between the external and internal focus groups in the simple tasks when the surface was stable. However on the most challenging task, where the surface was most unstable, those in the external focus condition outperformed the internal focus group. This is an interesting consideration for the benefits of an external focus as it appears to indicate that as tasks become more complex and challenging to the performer, an internal focus becomes more detrimental to performance. However, although these findings appear to continually find an advantage of adopting an external focus of attention, the limited research into other samples away from 18-24 year old college students still restricts the ability to generalise the findings across other samples. As there has been a minimal amount of studies on attentional focus carried out on children and

adolescents indicates that although the attentional focus research has so far been conclusive, there is clearly more to be done using different samples in order to show the benefits of using an external focus of attention with a wide range of participants. It is important therefore, for researchers and coaches of young athletes, to see if children and adolescents would benefit from instructions and feedback that direct their attention to the effects of their movements. Wulf (2007b) postulated if children were affected differently by an attentional focus perhaps by exerting less conscious control over their movements or spontaneously focusing more on the outcome of their actions. These questions therefore are very interesting which surely would have been interesting to test these ideas by carrying out research into adolescent performers. However, Wulf (2007b) has stated that the reason why the research has not used younger participants is because of the difficulties of consent.

2.16 Attentional focus and adolescent learning

The previous section indicated that the attentional focus research has been restricted mainly to studies using young and healthy adults between 18-24 years of age (Wulf 2007b). There is clearly a lack of studies into adolescent performers which is limiting the ability of the attentional focus research to generalize its findings across different samples. There is a serious consideration to be made when studying adolescent performers however. Techniques, or sport-specific technical skills, are a central component in the development of young athletes in many sports, including soccer (Malina et al, 2005). In soccer possessing the skill to pass at speed and with accuracy is an important attribute to be a successful soccer player. The issue with research into adolescents in soccer has focused more on physiological aspects than the technical aspects (Williams and Hodges, 2005). The impact that maturation and thus individual differences has on the research into this sample is an important consideration for researchers, therefore it is important to study factors where maturation does not play as large a

role in a task. Malina et al, (2005) wanted to estimate the contribution of experience, body size and maturity status to variation in sport-specific skills of adolescent soccer players. The participants were sixty nine players aged 13.2−15.1, the study's purpose was to estimate the contributions of age, experience in the sport, body size and sexual maturity status to performances on six soccer-specific skill tests; ball control with body, ball control with head, dribbling with a pass (skill and accuracy), dribbling (speed, skill), passing and shooting. Malina et al, (2005) found that age and state of maturity are significant predictors of performance in tests requiring dribbling speed, passing and receiving skills, this makes sense as for these skills leg power and strength will make a difference between participants. Malina et al, (2005) argues also that skill is more difficult to measure than physiological indicators such as speed and power, which is perhaps a reason why so few studies have been carried out to study this factor. As this study by Malina et al, (2005) indicates, it is important to be aware when studying adolescent athletes that it is difficult to give a general assessment of a player without taking into account maturation effects yet the study also highlights the need to extend studies of soccer specific skills to include other potential determinants.

Maturation is an important factor for adolescent soccer players in certain tasks; Vaeyens et al, (2006) found that the impact of maturation is a significant consideration when studying youth athletes. The study considered youth soccer players of different levels of skill and expertise attempting to identify significant predictors of talent in youth players of different playing levels in several age groups across adolescence. The study was a five year mixed-longitudinal study of the growth, maturation and performance of young players. An important finding from the study was that age, maturity status and body size contributed significantly to the variation in functional capacities (endurance, speed, power) but relatively little to variation in sport-specific skills (ball control, dribbling, passing, shooting) in soccer

players aged 13–15 years. Perhaps issues of maturation is a reason why the attentional focus research has not studied adolescent performers because of these variables, yet as this study by Vaeyens et al, (2006) found, a skill such as passing accuracy is not affected by the difference in maturation and as Williams and Hodges (2005) argue, more is needed to improve the understanding in the field of skilled adolescents skill level differences, not physiological differences. There is clearly a gap in the attentional focus research studying adolescent soccer players which needs to be addressed, assessing the technical skills of players, which would further the understanding of how performers develop novice to elite.

2.17 Ecological validity of the attentional focus research

One of the most important parts of any research is to be able to translate the findings into real life environments. Swinnen (1996) had previously argued for the study of more complex skills to support his concern regarding the generalizability of findings from relatively simple tasks to the learning of more complex skills. The attentional focus research sought to do this and the research has found that advantages that an external focus has on both the performance and learning of tasks such as balance (Wulf et al, 2001) and more sport specific skills such as volleyball (Wulf et al, 2002) and golf (Wulf and Su, 2007). However with any research, especially into motor skills, there is a need to be able to translate the findings into the real world and although coaches can use the findings and put them into their training environments, as of yet there has only been a few studies into attentional focus which have carried out the research in an ecologically valid environment (see Bell and Hardy, 2009).

Studying sports tasks in practical settings have been shown to be more complex than balance tasks as they involve multiple degrees of freedom (Wulf 2007a); adding to the ecological validity of the work. It has been argue that the term ecological validity has been misunderstood in the sport psychology research. According to Pinder et al, (2011) previous

studies which sought to add ecological validity altered the tasks to represent a more real life, sport specific skill. However, the original idea of ecological validity put forward by Brunswik (1956) stresses that a study which seeks to have ecological validity must have a design which emphasizes the need to ensure that experimental task constraints represent the task constraints of the performance or training environment that forms the specific focus of study (Dunwoody, 2006). A representative design contains a strong emphasis on the specificity of the relations between the participant and the environment, which is often neglected in traditional approaches to behavioural sciences (Renshaw et al, 2010**).** Just as participants of an experiment must be representative of those to which the study wishes to generalize, the experimental task constraints must also represent the environmental (performance) constraints to which they are to be generalized. The attentional focus research which has been covered in this review sought to use more real life skills in order to add ecological validity to the research and increase the validity of the theory (Wulf et al, 2002). However, based on the definition by Brunswik (1956) it would appear that attentional focus research has in fact sought to alter the task complexity, yet has failed to design the experiments to represent the actual environment of which the research is seeking to study.

In experiment one by Wulf et al, (2002) the participants carried out two days of practice trials and returned a week later for a retention test, this is not a true reflection of a real life learning environment, where training takes place usually once a week and learning is observed over many weeks of practice. It would be interesting therefore to see the effects of attentional focus when conducting research in a more complex environment, instead of the closed, controlled environments used in the attentional focus research (Wulf, 2007b). Bell and Hardy (2009) did attempt to use a representative design studying a golf chipping task when studying attentional focus. The study took place in a naturalistic environment of a golf

course in order to add ecological validity to the study. The study aimed to test if an external focus which made the performer focus further from the body (distal) produced a better performance than an external focus which focused closer to the body (proximal) in both a neutral condition and also in an anxiety condition where the use of a video camera and financial incentive based on performance was added. The task was to chip a golf ball to a flagstick from a distance of 20m, thirty three skilled golfers between 15-59 years of age were used and randomly placed them in three experimental conditions in a between group study; internal focus, proximal external focus and a distal external focus. Bell and Hardy (2009) found that those performers who were in the distal external condition performed better in both a neutral condition and in the anxiety condition. Based on the criticism of the attentional focus research the findings from this study are more representative and generalizable to the understanding and transfer into the coaching of a golf chipping task. This study may have shown more transferable findings as it was representative of the real life environment which the participants perform in and more future studies into attentional focus should seek to carry out the research in more ecologically valid environments.

2.18 Conclusion

This literature review focused on the importance and development of motor skills, on the importance that feedback and research into attentional focus which have been shown to have a major influence on the performance and learning of motor skills. There appears to be a need to understand the impact that an attentional focus can have on a performer's development. The research into attentional focus has given a new insight into the way performers can improve and maintain performance especially when carrying out complex tasks or under high pressure situations. Based on the literature review there are clearly gaps in the research which this study seeks to fill in order to further the attentional focus research.

The attentional focus research has not studied adolescent performers adequately enough (see section 2.14), which is puzzling considering the importance of developing young performers. By neglecting this sample, the attentional focus research is restricting its influence on the practical application of instruction and feedback by coaches in different domains. And although the attentional focus research has been able to validate findings across a diverse range of tasks (see section 2.8), the important factor for sport research is it's applicability to the real world and the majority of the research into attentional focus research has failed to address ecological validity sufficiently (see section 2.16), thus this study is seeking to further the attentional focus research by conducting the study in an ecologically valid environment using skilled adolescent soccer players. Based upon the observation above this study will test the hypothesis;

1) An external focus of attention will improve the learning and retention of a soccer specific skill in adolescent soccer players in a real life training environment

METHODOLOGY

3.1 Introduction

The purpose of this chapter is to consider the methodological issues relvant to the present study based on the research question and which have been reinforced by the review of the literature in the previous chapter. The chapter will look at the previous research to review the research methods used by previous studies before examining the implication for the current work. The chapter will be followed by the method for this study.

3.2 Research method

The previous research into attentional focus has used a positivist approach and quantitative method. This approach posts a hypothesis which is then tested in order to support or reject the hypothesis (Biddle et al, 2001). Research using a quantitative research method will allow hard, generalizable data to be found, with such a scientific approach helping to prevent researchers from influencing the world in which they collect their data (Johnson and Cassell, 2001). Positivist research aims to prove findings through using the logic of scientific confirmation, thus according to this school of thought, researchers should eliminate their biases, remain emotionally detached and uninvolved with the objects of study, and test or empirically justify their stated hypotheses (Johnson and Onwuegbuzie 2004). There are issues however which has been addressed in terms of positivist research such as observer bias and structural limitations which has been acknowledged further by (Tittle, 2004). As already mentioned **t**he majority of research into attentional focus has used a positivist method and this study will continue with this method. However, this study will be looking to address the concerns of the post positivist researchers by valuing and appreciating the impact that context

has on research and taking into account the impact of observer bias and the environment of where the study will be taking place.

3.2.1 Ecological validity

As addressed previously **(**see section 2.16**)** the attentional focus research has sought to use more complex tasks and skills and thus improve its ecological validity. However, there has been criticism to this based on how attentional focus studies have continued to use controlled environments which are not representative of the real life environments which are being studied (see Pinder et al, 2011). An advantage to these laboratory based studies was that the findings are more conclusive, as in a controlled laboratory environment, where there are few variables which could confound the experimental conditions. The mechanistic designs meant that the findings of these studies are clear; however, the argument is that these findings are difficult to transfer into real life skills and environments with more complex skills and dynamic situations (Pinder et al, 2011). The importance that researchers and practitioners place on ecological validity is a key component of modern studies in sport science research (Davids et al, 2006). The importance that studies containing representative design requires a strong emphasis on the specificity of the relationship between the participant and the environment, which is often neglected in traditional approaches to behavioural sciences (Renshaw et al, 2010). A study which lacks representative design is defined as a study not being representative of the environment being studied, which means that the findings are not easily generalizable to real life environments (Renshaw et al, 2010, Dunwoody, 2006).

Based on the criticisms of the previous attentional focus research this study's aim is to carry out research into attentional focus in a more dynamic coaching environment in order to find if the differences found between an external and internal focus can be found in a real life training environment which is in line with the constraints-led perspective which proposes that

movement coordination is achieved as a result of learners adapting to the constraints imposed on them during practice, these constraints include the individual characteristics of the learner, the nature of the task and the environmental conditions (Davids and Glazer 2010). By carrying out the study with skilled adolescent soccer players in their real training environment, the experimental design will be representative of the participant's real environment. This way the findings of the study will allow the researcher to validate and generalise the findings to a real life training environment, something which the majority of previous research into attentional focus has failed to do.

3.2.5 Task selection

As highlighted in the literature review (see section 2.7), there have been a vast number of studies carried out in the attentional focus research (see Wulf 2007b). As highlighted in the previous section, the intention of the attentional focus research was to find out if the findings from the simple balance tasks could be found in sport specific skills. Based on the aims of this study, a soccer specific accuracy task will be used. This will be a closed skill which consists of hitting a static soccer ball at a crossbar from 10 yards. This type of task is similar to the one used by Wulf et al, (2002) in their soccer accuracy test, although the target is different, in that study they aimed at a large square target 15m away measuring 1.4m in length and height. In this study the target is smaller, meaning that the task will be much more difficult yet the distance from the target will be shorter, taking place 10 yards away. The decision for this distance is to discount for the possible individual differences of the players in terms of their maturation (see section 2.15) and thus discount the influence of power and strength (Malina et al, 2005); meaning this task will be testing for the player's technical ability, not the power of their shot.

It can be argued that this task is not representative of the game of soccer, however the skill of being able to chip a ball to a required target is very much a soccer specific skill and a common skill for players to master is "crossbar challenge"; where the skill is being able to hit the top bar of the goal from a defined distance. If the study sought to use a more open skill, such as one which involving a penalty being taken against goalkeeper, then problems would be encountered with the added variables; such as the goalkeeper's decisions and his ability, which would mean the studies ability to show conclusive findings that the outcome was based on the independent variables, would reduce the validity of the study. Although the task in present study lacks a certain level of representative design as the task is not a real life soccer skill, the strength of this study is that it is taking place in a complex, open environment, which would be a realistic training environment, which will add ecological validity to the study, something which previous studies into attentional focus have not done (Wulf et al, 2000, Wulf and Su, 2007, Wulf et al, 2002).

3.2.3 Sample selection

When conducting quantitative research it is essential to use the correct sample and a significant amount of participants in order to increase the validity of the study (Rossman and Rallis, 2011). It is important therefore to consider the how representative the research is to the aims of the study, who will you use and why, as the quality of the research is influenced by the sample chosen. In the attentional focus research and in sport psychology research generally, there have been concerns over the external validity exemplified in studies of expert performance in sport (see section 2.14). This has meant that many attentional focus studies have lacked external validity, which refers to the generalization of research findings from the study of a specific sample, to either a larger population (Pinder et al, 2011) The limitation is that using this specific sample for the majority of the studies, means that the theory into

attentional focus is taken from a specific and limited sample of people. It is therefore difficult for the attentional focus research to generalize its findings to other samples and populations. There is clearly a gap in the research using skilled adolescent performers, especially one conducting the study in a real life learning environment.

In this study the sample will be selected from a specific soccer football academy; the reason for this are a mixture of convenience and relevance. The researcher has full access to a large number of skilled adolescent performers once a week, in a real life training environment. In a previous study by Wulf et al, (2002) on soccer accuracy, the 52 participants history of playing soccer was somewhat unknown, as the researchers state "the criterion for inclusion was that they have at least some experience in soccer" (Wulf et al, 2002 page 178). As this study has prior knowledge of the participants, the findings will be more valid due to the knowledge that the participants are all skilled for their age. The study also has external validity based on the common occurrence that soccer players between the ages of 12-14 attend regular training sessions on a weekly basis nationally and globally, receiving instruction and augmented feedback from their coach in order to improve the technical skills of the players.

3.3 Experimental design

3.3.1 Length of research

Much of the attentional focus research has failed to carry out studies which reflect a real life training environment (see section 2.16). The majority of the attentional focus studies have carried out one or two days of practice trials and a retention test twenty four hours later (McNevin et al, 2003, Wulf et al, 1998, Wulf and Su, 2007). Wulf et al, (2002) studied real life sport specific skills of volleyball and soccer. In experiment one, the practice trials took

place over a two week period, consisting of twenty five trials performed on each day. This was followed with a retention test taking place seven days later. This study reflects a more balanced training environment, where a week between sessions is a normal representation of a real life training environment. In experiment two however there was only one day of practice trials, consisting of thirty attempts per participant, and a retention test was carried out one week later. How beneficial one day's intervention can be is questionable. However as coaches find out that to change a performers learning, requires weeks and often months of practice. There have been no previous studies which conducted studies over this duration of time, such as several weeks or months. It can be argued these studies fail to represent a typical learning environment, as it is unrealistic to conduct an experiment which seeks to increase ecological validity when carrying out the study over just a two or three day period, especially when using novices, where the short period of time will not allow them to build a strong understanding of the skill in a matter of days and a few trials. A real life training environment for many adolescent performers in particular takes place once a week, thus a study which reflected this realistic time frame would be more realistic and thus more generalizable to a real life situation.

Thus, this study will be carrying out the research in a real life training environment over a period of 5 weeks; this to allow for the first week a pre-test, followed by 3 weeks of intervention and a final week to test for learning in a no feedback retention test. By conducting the study over a five week period, the study aims to reflect a real life learning environment, whereby if an attentional focus is found to have an influence on the task, then it can show that the theory can be found in real life, ecologically valid environments, and not just in controlled, laboratory based experiments.

3.3.2 Group design

In the previous research there is a common trend to use three experimental groups in a between groups design. This has been a common occurrence in the attentional focus research as it seeks to compare an internal with an external focus of attention. A between groups design has been favoured over a within groups design in order that the experimental design, the attentional focus, can be seen to influence performance and learning. Although it a within groups design has been used previously in the attentional focus research (see Zachry et al, 2005), where it was found that an external focus produced improved movement, the use of a within group design contains the issue of order and practice effects (Rossman and Rallis 2011) whereas a between groups design enables the researcher to show the advantages or disadvantages for the use of a particular experimental design.

The use of control conditions in the previous research has found that participants perform similar to those in the internal focus condition (Wulf and Su, 2007), which indicates that performers have a natural tendency to think about their body movements (Wulf 2007b). In the attentional focus research there have been numerous studies that have used control conditions (Landers et al, 2005, McNevin and Wulf, 2002, Wulf et al, 1998, Wulf et al, 2007, Wulf et al, 2003). It is thought that using a control condition in a study is important as it allows the researcher to understand how a participant performs when left to their own devices (Hodges and Ford, 2007). Hodges and Ford (2007 p23) argued that "control conditions enable investigation into what successful participants are doing when left to their own devices"; control conditions they argue, are important in order to indicate the effect, positive or negative of the experimental conditions used.

This study will use a three-group between groups design using two experimental groups; an external focus and internal focus and a control condition. The use of a control

condition was chosen because it is a common methodology used in the attentional focus research where the effects of the experimental groups can be compared to those who do not receive any attentional focus feedback.

3.3.3 Pre test

A major methodological issue regarding the attentional focus research has been the lack of pre-tests. In the attentional focus research Hodges and Ford (2007) argue that "the absence of pre-tests makes it difficult to know whether these groups were equally matched to start". Mullen (2007) argues that participants could be pre-tested and matched on their ability to perform the various experimental tasks, yet Wulf (2007b) has argued that pre-tests are not typically used because a random assignment of participants to different groups is used to ensure comparable skill levels at the beginning of practice. The pre-test measures the level of the dependent, or outcome, variable prior to any intervention or treatment is given. It would appear that none of the attentional focus research has used pre-tests; instead it has been used more in the research into skill focused attention (Beilock et al, 2002, Beilock and Carr 2001, Gray 2004). This is disappointing because pre-tests can show a researcher what the level of performance is like before any experimental condition takes place (Russell, 2011). Gauging performance before intervention is especially significant for advanced performers; as a researcher can assess the impact of the experimental condition from their performance on the pre-test, where all participants were at the same level and under the same condition, of no feedback. Also, by using a random assignment, which this study will do, the study ensures that you have comparable groups, but including pre-tests is a way of making sure (Russell, 2011). This study will use a pre-test as it believes it would add more to the results if the results can show performance prior to the intervention, especially if for instance all the participants showed similar performance in the pre-test.

3.3.4 Retention test

As seen in the literature review, (see section 2.11) when conducting research into motor skill development testing for learning effects and not just performance is important to gain a true understanding of the effects of the experimental conditions (Schmidt and Wrisberg, 2008). It is important then that studies assess not only the short term performance but also the long term learning effects when carrying out research (Wulf et al, 2010). In retention tests, all groups are given the same condition, which is most commonly a no feedback condition, this way all performers are tested equally; this takes away the practice effects or experimenter guidance. This study will use a retention test in order to test for the long term learning effects found from the 3 week intervention period, it will take place seven days after the final week of intervention and will involve a no feedback condition for all participants.

3.3.5 Manipulation checks

A major criticism of the attentional focus research has been the lack of manipulation checks that take place after the experiment (Mullen, 2007). As conclusive as the findings have been in the research into attentional focus, there are some who have argued that the lack of manipulation checks on the participants; in order to check if they have followed the experimental conditions, means that the findings cannot be fully vindicated (Mullen, 2007). Mullen (2007) argues that the fundamental problem with the attentional focus research relates to the absence of post experimental manipulation checks to examine adherence to treatment conditions. Thus, there is a need to ensure participants are adopting the experimental focus, which will enable researchers to validate their findings (Bell and Hardy, 2009) this is true

especially with young performers as it is important to check that they have understood and that they adhere to the instructions and feedback given (Thorn, 2006).

This study will use a questionnaire, similar to that of Thorn (2006) who found it important to test that the participants were actually following the experimental conditions given, in that study Thorn (2006) wanted to examine whether or not the participants were focusing on the specific focus of attention cue given by the experimenter as the problem with not using checks is that even if the results show that an external of attention is superior to other conditions, if it cannot be proven that the performer actually used the correct focus condition, then those results cannot be fully validated (Mullen, 2007). The use of a questionnaire is validated as a suitable method for measuring participant's adherence to the experimental conditions, allowing a strong combination between data from questionnaires with quick and precise numerical data, allowing the strengths of both research paradigms to be utilised (Johnson and Onwuebuzie, 2004). In order to validate the findings of the present study, a manipulation check will be used. The questionnaire will be used to seek the attentional focus used in week two of the three week intervention period, after the participants have performed their ten trials. Closed questions will also be asked in regards to the length of time the participants have playing soccer competitively and how many hours per week they are actually coached (see appendix)

3.4 The researcher

The researcher has played soccer for twenty years across different levels of amateur to semi-professional in different countries. He has been a coach in soccer for eight years, coaching a variety of players and ages across the world. His coaching knowledge has come from gaining qualifications and from learning from fellow coaches across his coaching career.

The researcher works full time in coaching players between 7-18 years of age and thus has a keen interest in the development and furthering of young soccer players. For him this study is of interest in order to understand further methods in coaching and player development in order to improve young soccer players. A key consideration for the researcher is if the findings found in the research can be translated into the real world. Thus this researcher wanted to find out if the theory of attentional focus could be applied to the real world in a soccer training environment using a real life skill.

In this experiment the researcher felt it difficult to remain with the script (see Table 4.1) when the participants performance was been negatively affected by the feedback. As a coach the intention is to improve performance, yet in this experiment it was important to continue to use the experimental feedback statements which continued to affect performance. Thus the difficulties of being a researcher and coach were apparent in this experiment. A lack of success can be demotivating, however, with the right guidance, performance can hopefully be improved. The problem with this study was seeing the players performing poorly, getting frustrated and being helpless to aid them. This occurred when giving internal focus instructions and feedback. A coach would aim to change their method if success was not occurring. The task of hitting a narrow bar is not an easy task, it is complex, which is why it was chosen. And even players in the external focus condition struggled to achieve over 30%. The internal focus group performed poorer than the other two conditions and their attitude was negative and removed. The difficulty therefore of being the researcher and the coach was apparent and it was not an easy task of keeping to the script.

3.5 Pilot study

To assess the suitability of the experimental design a small pilot with 13 participants (5 internal, 4 control and 4 external) was carried out. Participants were similar to those in the main experiment but took part in coaching at the academy on a different day of the week. The procedure was the same as the main experiment both in task, duration and feedback. Due to absences from coaching sessions the control group was reduced to 2 participants. The pattern of performance found (Figure 4.1) was similar to that of previous studies on attentional focus although not clearly defined due to small subject numbers.

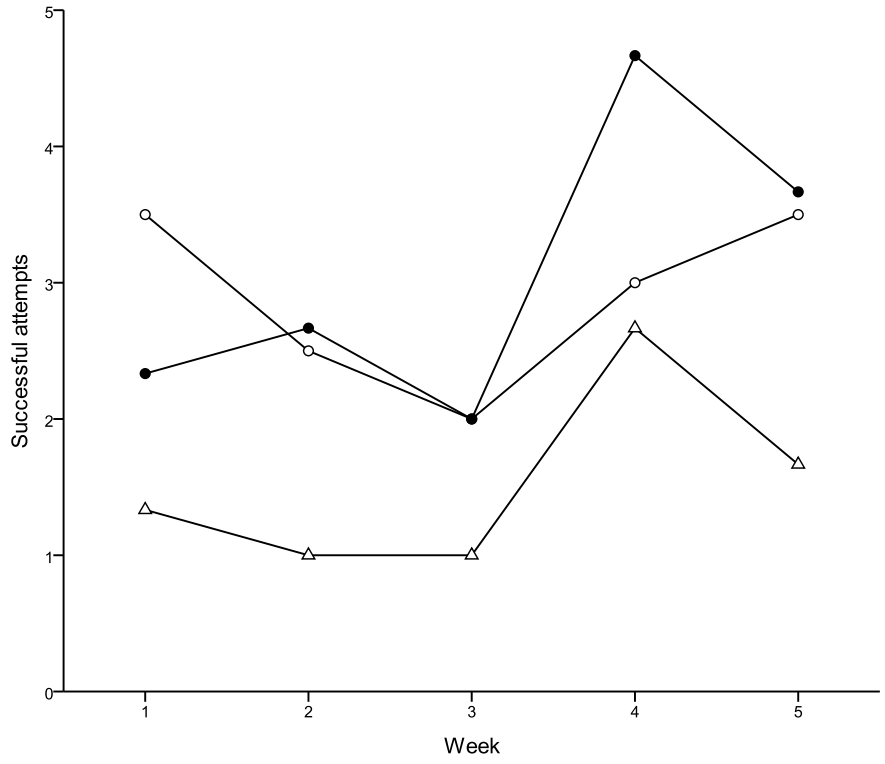

Figure 4.1 Weekly group mean scores for the pilot study ● external focus, ○ control group, △ internal focus.

Conducting a pilot study allowed for calculation of suitable sample sizes to result in a statistical power of 80% for the main experiment. Calculations were carried as per Hopkins (2006) with the standard error of measurement being calculated from sequential week scores (Hopkins, 2000) of the control group in the pilot (s=1.12) and the minimum important change being taken as 1.9 based on the difference in week 5 successful attempts in the pilot between the control (1.6±0.4) and external groups (3.5±0.4). Calculations showed that 12 participants per group would give a probability of a type II error of 20%. The pilot study highlighted some difficulties with attendance for participants either as a result of injury or being unable to attend through lack of transport. Due to this it was decided that initial group size would be 16 to give a total of 48 participants to allow for a potential 25% drop out rate and still maintain a group size of 12.

3.6 Considerations for main study

It was evident in the pilot study that the young participants were finding the skill of chipping a ball, of which they practice regularly with good success, more difficult in the experimental situation. This was apparent to the researcher through observations and field notes made during the pilot, which also indicated a potential influence of anxiety upon the participants and their performance. As seen in the literature review, anxiety can impact on performance and possibly overload an individual's attentional capacity (Beilock and Carr 2005). The study was not attempting to induce anxiety purposefully however; it was evident that participants found the skill of chipping a ball to hit a target difficult, which potentially led to self –induced pressure and subsequent anxiety as a result of their performance.

3.6.1 Anxiety test

Based on the observed findings from the pilot study, the researcher felt it necessary to see the effects that anxiety has on the adolescent performers in the main study. During the pilot study the participants found the task challenging, particularly those in the internal focus condition. Anxiety has been found to have an impact on performance and it is a psychological constraint which needs to be understood (Vickers and Williams, 2007). Anxiety has been shown to affect performance and thus it was felt that carrying out an anxiety questionnaire will be important in order to see if anxiety plays a part on the performance and learning of the task, or if it is an attentional focus which in fact makes a bigger difference. The attentional focus research has pointed towards the effects of anxiety on performance and Bell and Hardy (2009) have argued for more studies to test for this effect. The decision made by the researcher would be not to introduce an anxiety variable but use an anxiety test to measure anxiety levels in the participants in order to ascertain the extent that anxiety played in the findings of the study. By carrying out this test, the study can add more validity for seeking to test the factors which do affect performance on adolescent learners.

The anxiety measure decided on was the revised CSAI-2R questionnaire (Cox et al 2003) which was used by Bell and Hardy (2009). The CSAI-2R is a revised version of the original CSAI-2 questionnaire (Martens et al, 1990) which has been used in research published in over 35 articles on anxiety in sport and is perhaps the most well-known anxiety instrument used in sport psychology research. However, the CSAI-2 has been criticized for not having adequate psychometric support for partitioning anxiety into distinct cognitive and somatic subcomponents (see Cox et al, 2003). This led to Cox et al, (2003) developing a revised version of the instrument (CSAI-2R), using sound psychometric methods, which

maintains the theoretical structure of the original instrument. As a result the CSAI-2R (Cox et al 2003) was used to measure any potential anxiety influences in the current study.

3.7 Conclusion

An attentional focus has shown to have an impact on the development of motor skills in the performance and learning of these skills. However, there is very little attentional focus research carried out on samples other than college students between the ages of 18-24, because of this lack of research into other samples, this study is seeking to find if this theory can be applied to skilled adolescent soccer players. This study will also be seeking to enhance the issues surrounding the attentional focus research, notably seeking to add ecological validity to the current research. Based on the previous research and its lack of ecological validity and representative designs, this study will take place in an actual real life training environment, where the participants will be taking part in a normal weekly session as well as participating in the research study. By conducting the research in this environment, the study will seek to find if an attentional focus can make a difference in a real world setting with skilled performers. As a soccer coach also, the researcher is seeking to find if this relatively new approach to improving the performance and learning of a motor skill in soccer can actually be regarded as a step forward in the development and understanding of coaching instruction and feedback in soccer.

METHOD

A between group repeated measures design was used to investigate the effects of focus of attention on the learning and retention of a football related skill. All procedures were approved by the University's local research ethics committee.

4.1 Method

Participants

A convenience sample was used as the researcher worked in a football coaching academy. Forty eight, 12-14 year old male footballers (12.5 ± 1.301) took part in the study. All had over 3 years' experience of being coached football at an academy level and attended coaching on a weekly basis. All participants provided assent and their parents provided written informed consent. Participants were randomly allocated to one of three conditions; external focus, internal focus and a no feedback control group. Random allocation took place by based upon the order of return of informed parental consent with each participant being placed in the group with the least participants at that time starting with the external focus group. Participants were kept naïve to the nature and were led to believe it was just a competition over a 5 week period. This was carried out to ensure that they did not question the feedback given to them. All participant personal data was kept confidentially and anonymised upon completion of data collection.

Procedure

All data collection took place during a weekly football academy coaching session. Participants took part in the regular coaching session and were taken out of the session one at time to take part in the testing before returning to the group coaching session. Each week the order of the participants was varied to prevent any effects such as fatigue impacting upon the

findings. If a participant was always last each week they may have been more fatigued after performing in the coaching session for a longer period.

Task

The study took place on a 3G rubber crumb football field. Each participant was required to hit a size 4 adidas® *starfinder* football at the crossbar of a 5 a side goal, 1.2m in height and 3 metres wide and 10 yards away. 1 point was awarded if the ball hit the crossbar, 0 points if it missed. Each participant had 10 attempts using their preferred foot each week over a 5 week period with the outcome of each attempt being recorded. In week 1 the task was demonstrated by the researcher so that participants fully understood the nature of the task. Week 1 also served as a baseline condition with participants completing their 10 attempts with no feedback from the researcher. The study consisted of a pre-test, three weeks of intervention, where participants received feedback designed to influence their focus of attention and was dependent upon the group that they were in; external focus, internal focus or no feedback. In the final week participants completed a retention test with no feedback given.

Feedback

All feedback throughout the experiment was given by the same researcher who was a UEFA B qualified football coach. Feedback was given to participant in the external and internal groups after every other attempt. The control group received no feedback other than "good job" if they hit the crossbar or "unlucky" if they missed. Feedback for the external and internal groups was selected by the researcher from a set list of statements (table 4.1). Selection was based upon the aspect of the skill that needed the most improvement as judged by the researcher, and the group that the participant was in. The feedback to each group was similar in technical content but differed in the focus of attention with the external group

receiving feedback focused away from their body whilst the internal group received feedback which focused on their body movements (Table 4.1).

Internal focus feedback	**External focus feedback**
Position your foot below the ball midline to lift the ball.	Strike the ball below its midline to lift it, kick underneath it.
Position your bodyweight and the non-kicking foot behind the ball	Be behind the ball, not over it, and lean back.
Lock your ankle down and use the instep to strike the ball.	Stroke the ball toward the target player as if passing to another player.
Keep your knee bent as you swing your leg back, and straighten your knee before contact.	Use a long lever action like a swing of a golf club before contact.
To strike the ball, the swing of the leg should be as long as possible.	To strike the ball, create a pendulum-like motion with as long a duration as possible.

Table 4.1 Corresponding feedback statements for the internal focus and external focus groups. Statements are designed to focus identical except for the change of some words in order to induce an internal or external focus of attention.

To ensure that participants were focusing correctly with the feedback, manipulation checks were carried out in weeks 2 and in the retention test. In week 2 the participants were asked a series of questions about individual's focus of attention after their task was complete. This was carried out by a separate researcher who was blinded to participant condition to remove any bias. Participants were asked what their focus of attention was and their own feelings on their performance. Responses were scored on a Likert scale with 1 being pleased and 5 being poor. In the retention test participants also completed several questions asking what impact intervention may have had on different aspects of their performance, e.g. personal expectations, pressure from self, pressure from others. The manipulation check from

week five was used to ascertain if the participants continued the same focus as their experimental condition or if they altered it when given no feedback from the experimenter.

Questionnaires

All participants completed the CASI-2R questionnaire (Cox et al., 2003) to measure their anxiety in week 2. The CASI-2 questionnaire is a 17-item measure that is a revised version of the original CSAI-2 (Martens et al., 1990). It assesses somatic (7 items) and cognitive anxiety (5 items) along with self-confidence (5 items) with answers given on a four-point Likert scale ranging from, (1) 'Not at all', to (4) 'Very much so'. has been shown to provide a reliable and valid measure of state anxiety by previous work. It has been found to be more psychometrically sound than the original questionnaire (Cox et al., 2003), sport specific (Bell and Hardy 2009) and is largely considered a reliable indicator of performance pressure in sport. (Jones and Uphill, 2004, Mellalieu et al., 2003). It has been previously used by Bell and Hardy (2009) to assess anxiety in a study that manipulated focus of attention.

In week 2, the participants completed a questionnaire that asked them the amount of time that they played soccer a week, how many hours they were coached and their feelings about the study (Appendix A).

Post experiment

After the experiment has been complete all participants were informed of the true purpose of the experiment and external focus of attention was used.

4.2 Ethical considerations

4.2.1 Consent

Research involving humans means that ethical considerations have to be made (Robson, 2002). As this study used adolescent performers, it was important to understand the ethical considerations for this group of performers. The study took place in the same location as their regular training environment which they normally attend. In order for the participants to participate in the study, a consent form was sent to the parents of each performer, informing them about the study and its purpose (see Appendix D). A key consideration was the potential negative effects of the experimental conditions on enjoyment and participation. Therefore, a debrief was carried out after the final week, where the study was fully explained to each participant in order to not damage their future enjoyment and success in soccer. In addition an external focus of attention is normally used within the participants' regular coaching environment.

4.2.2 Protection of confidential information

To maintain participant confidentiality, all research documents were stored on a password protected computer. This is in accordance with the Data Protection Act (1998), which states that privacy of private information should be protected and can be only used for the specific purpose for which it was collected.

4.3 Data Analysis and Statistics

All data were tested for approximation to the normal distribution using a single sample Shapiro-Wilk test. CSAI-2R subscales were assessed for reliability using Cronbach alpha calculations. A Cronbach alpha of >0.7 was deemed to show internal reliability of a subscale after (Nunnally, 1967). Calculated Cronbach alphas showed that all subscales of the CASI-

2R were internally reliable somatic anxiety (α = 0.87) cognitive anxiety (α = 0.81) and self-confidence (α = 0.92). Participant subscale scores on the CSAI-2R were calculated by multiplying a participant's mean score for each subscale by 10 and any effects of group on subscale scores was assessed using a MANOVA. Any differences between groups in terms of single item subjective feeling of anxiety in week 2 (Appendix A, Question 5) were examined using a one-way ANOVA with the between-subject factor of group (control, external, internal).

The effects of the intervention on performance were analysed using a mixed factorial ANOVA with a repeated factor of week (pre-test, week 1, week 2, week 3) and a between-groups factor of group (control, external, internal). Performance in pre-test and retention was compared in a similar manner with the repeated factor being time (pre-test, retention). It was decided to compare pre-test and retention separately in the way to remove the effects of the coaching in weeks 1-3 from the analysis. The comparison between pre-test and retention was also repeated with participants being excluded based upon the manipulation check. This removed participants from the analysis whose attentional focus differed from the intervention condition that they received. Differences between groups in terms of hours played per week and hours coached per week were examined using a one-way ANOVA with the between-subject factor of group (control, external, internal).

Where data were incomplete from a participant exclusion was on an individual analysis basis. The overall type I error rate for each analysis was set at α=0.05. Post-hoc tests for all analyses were carried, where appropriate, using the Holm-Bonferroni correction to adjust the level of α for multiple comparisons. All data and reported as mean ± standard deviation unless otherwise stated.

RESULTS

5.1 Results

There were no differences in the hours of play (F_2 = 1.35, p=0.27, η^2=0.25, ANOVA) or coaching per week (F_2 = 1.03, p=0.37, η^2=0.22, ANOVA) were found between groups (see Table 5.1).

Group	**Hours per week of play**	**Hours of coaching**	***n***
External	8.1±2.6	3.6±2.3	14
Internal	8.8±1.8	4.6±1.8	15
Control	9.3±1.8	3.9±1.8	15

Table 5.1 Hours per week of play and coaching for each group. Data are mean ± standard deviation

There were no significant effects of group on the subscale scores of the CSAI-2 questionnaire (Wilk's λ = 0.81, F_6 = 1.49, p=0.19, η_p^2=0.10, MANOVA, Table 5.2). Neither were there differences between the groups on the subjective single item measure of anxiety (F_2 = 2.64, p=0.08, η^2=0.34, ANOVA).

	Subscale			
Group	**Self-confidence**	**Cognitive**	**Somatic**	***n***
External	29.1±5.7	20.4±4.0	15.5±4.5	14
Internal	24.0±6.4	24.5±5.3	21.0±4.8	15
Control	28.0±6.5	21.9±4.9	17.0±5.5	15

Table 5.2. Means and standard deviations for CSAI-2R subscale scores for each group

There was a significant main effect of week on performance during the pre-test and intervention weeks (F_3=2.8, p=0.04, η_p^2=0.09, ANOVA, Figure 5.1).

Group	**Pre-test**	**Week 1**	**Week 2**	**Week 3**	***n***
Control	2.3±1.4	2.1±1.1	2.4±1.1	2.5±0.9	12
External	1.8±1.0	2.6±1.4	2.4±1.1	3.5±1.1	8
Internal	3.0±1.4	2.0±1.1	1.9±0.9	2.4±1.0	13
Total	2.4±1.4	2.2±1.2	2.2±1.0	2.7±1.0	33

Table 5.3 Means and standard deviations for performance success during coaching weeks. Data are for all individuals with a complete set of data for each week.

There was an interaction effect between week and group with the groups performing differently over the pre-test and intervention weeks (F_6=3.6, p=0.003, η_p^2 =0.20, ANOVA). Post-hoc analyses showed significant effects of week on the internal and external groups. Performance in the internal group was significantly reduced in weeks 1 (p=0.01) and 2 (p=0.02) compared to the pre-test but was not different between the pre-test and week 3

(p=0.14, Table 5.3). Performance in the external group was significantly improved in week 3 compared to the pre-test (p<0.01), week 1 (p<0.01) and week 2 (p=0.03, Table 5.3).

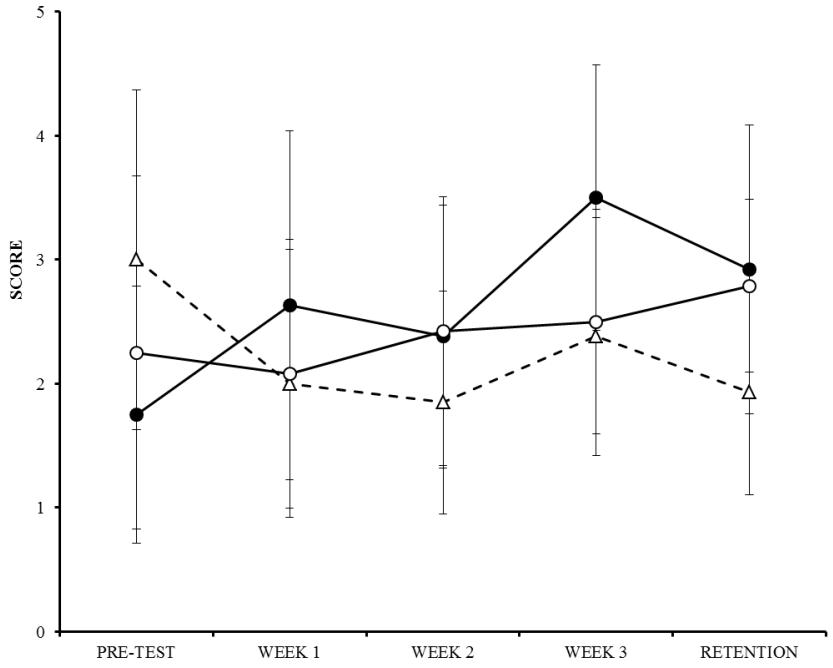

Figure 5.1 Weekly accuracy scores for each group. Week 1 - 3 intervention, ● external focus, ○ control group, △ internal focus.

There was no main effect of time on performance during the pre-test and retention weeks (F_1=0.31, p=0.58, η_p^2 =0.01, ANOVA). However, there was an interaction effect between time and group with the groups performing differently over the pre-test and intervention weeks (F_2=7.84, p<0.01, η_p^2 =0.30, ANOVA, Table 5.4 and Figure 5.1).

Group	Pre-test	Retention test	*n*
Control	2.4±1.3	2.8±0.7	14
External	2.0±1.1	2.9±1.2	12
Internal	2.9±1.3	1.9±0.8	14

Table 5.4. Means and standard deviations for performance successes during pre and retention weeks for each group.

Post-hoc analyses showed no significant differences in performance between groups in the pre-test. In the retention test performance of the external (p<0.01) and control (p=0.02) groups was significantly better than the internal group (table 5.4). The external group performance significantly improved between the pre and retention tests (p<0.01) with the performance of the internal group reducing (p=0.02) and the control group remaining unchanged.

	Week 2		Retention test	
Group	**External (%)**	**Internal (%)**	**External (%)**	**Internal (%)**
External	100	0	86	14
Internal	13	87	36	64
Control	73	27	67	33

Table 5.5. Percentage of participants reporting internal or external focus of attention after intervention week 2 and the retention test.

The post retention test manipulation check showed that not all participants reported using the focus of attention that they had received during the intervention (Table 5.5) When the pre-test – retention test analysis was adjusted using the results of the manipulation check to only include those whose focus of attention in the retention test matched their intervention group then the findings were the same (F_2=4.22, p=0.01, η_p^2 =0.25, ANOVA).

DISCUSSION

6.1 Main findings

This chapter will discuss the findings from the study. Firstly the main findings will be covered, looking at the differences between the experimental groups, the differences between performance and retention and any effect that anxiety had on the findings. Following the main findings, the discussion will cover the methodological issues which were addressed in order to improve on the shortcomings of the previous attentional focus research. A section covering the findings of the manipulation checks will follow, continued with a section on the researcher's personal experience of the study and ending with the limitations of the study and considerations for future research.

The hypothesis of the present study was that an external focus of attention would be superior to an internal focus in the performance and learning of a soccer specific skill with adolescent participants. Based on the research findings the hypothesis is partially accepted. The study has found that soccer players between 12-14 years of age show improved retention when they adopted an external focus of attention during a learning phase. However, they did not show significantly improved performance during the learning phase compared to control and internal focus groups. These results add to the growing support for the "constrained-action hypothesis" (Wulf et al, 2001) to account for the benefits of an external focus of attention. In this study, participants who were in the internal focus condition had a significant reduction in their performance during the learning phase of the study, and a poorer performance in the retention test compared to both the external focus and control groups. As seen by the results, the participants in the external focus condition significantly improved their performance on the task from the pre-test (1.8±1.0) to week three of intervention

(3.5±1.1**)**. Pre-test results indicated that performance there were no differences between the groups, however under intervention, performance differed between groups and the internal focus group suffered in accuracy (see Figure 5.1). These findings show that there is no benefit to young skilled performers adopt an internal focus of attention and that performance may be reduced. Masters and Maxwell (2008) have found that skilled performers who focus on themselves will produce a decline in performance. The findings in this present study confirm previous findings that skilled performers were debilitated by the use of an internal focus (Wulf and Su, 2007, Bell and Hardy, 2009, Wulf et al, 2002). This study therefore reaffirms previous research findings showing a negative effect of an internal focus (Wulf et al, 2002).

The study's aim was to test for learning using a retention test. It was felt this was important based on the needs of coaching and preparing young performers for aspects of competition. The attentional focus research has predominantly used delayed learning tests and has found at times that attentional focus differences are not found until a retention or transfer test (Totsika and Wulf, 2003). Retention results showed the external focus group outperformed the internal focus condition supporting the hypothesis and previous research (see section 2.6) which has found that an external focus of attention improves the learning of a task. A reason for the difference may be because as Wulf (2007b) considers, the more often a performer focuses externally, the more likely it is that performance will be enhanced. The provision of feedback after every other trial during intervention served as a constant reminder to adopt an external focus, which benefitted performance and learning (Chiviacowsky et al, 2010). In the present study the retention test showed a drop in performance from intervention; for external (3.5±1.1 to 2.9±1.2) and internal focus (2.4±1.0 to 1.9±0.8) participants, but an improvement with the control condition group (2.5±0.9 to 2.8±0.7). This could be because the

control condition was familiar with receiving no feedback, whereas the two experimental groups had feedback taken away.

This study found that overall, players under external focus conditions has superior performance compared to the internal focus and control conditions during both learning and retention (see Results). This study has found that contrary to previous attentional focus findings (Wulf and Su, 2007), with the control group performing similarly to the external focus group instead of the internal focus one. Based on the findings, the control condition findings showed a constant performance between the pre-test (2.3±1.4) and retention test (2.8±0.7). In the retention test, whilst both the experimental groups suffered a decline in performance, the control condition maintained the level from week three of the intervention. This is not surprising as the control condition participants were used to not receiving feedback; meaning that performance did not suffer in the retention test as there was no difference for them. These results are counter to Wulf's previous findings (see Wulf 2007b) where control group performance mirrored the internal focus group. However, in this instance it can be argued that as the natural coaching environment preferentially used an external focus in instruction, the participants in the control group they may have developed their own natural external focus through previous practice. It can be argued that more studies should assess skilled performers in a natural environment as this will enhance conclusions about the most appropriate and beneficial method to coaching young skilled performers.

It was felt from the pilot study that an aspect of performance and peer pressure played a part on the performance of the majority of the participants. Attentional capacity has been found to be a factor in the performance of motor skills, especially in situations where there is more information to process (Totsika and Wulf, 2003) or when pressure to perform is higher (Bell and Hardy, 2009). It is argued this occurs because performers have the potential to

overload their attentional capacity by thinking about the processes of the skill while attempting a secondary task or through feelings of high anxiety (Beilock and Carr, 2005). Based on this levels of anxiety were assessed in the main study in order to check that there were no differences between groups in any anxiety that occurred. Participants completed the CSAI-2R anxiety questionnaire which showed no significant differences between the groups.

6.2 Methodological issues

This study has sought to further the validity of attentional focus research by addressing the methodological issues which previous research has been criticised for. It was felt that in order to strengthen this study; previous criticisms about methodological issues in the attentional focus research would be addressed in order to add validity to the findings (see Wulf 2007b).

In the attentional focus research and in sport psychology research generally, there have been concerns over external validity (see section 2.14). Because the attentional focus has used college students in the majority of its research (Wulf et al, 2001, Wulf et al, 2000, Wulf et al, 2002, Totsika and Wulf, 2003) there are difficulties with the generalizability of the findings and they may not be representative of a wider sample of participants. Based on this criticism this study sought to investigate the effects of attentional focus in skilled adolescent soccer players. As a result it is one of only a few studies on focus of attention that has used skilled adolescent performers. The sample size for this study was based upon a pilot study and designed to take into account potential drop-out. Of the forty-eight participants all but one completed the pre-test, retention and at least one intervention week and 35 completed all 5 weeks of the study. The participants chosen were from a local football academy, the researcher had prior knowledge of the participants and their abilities, which added weight and

validity to the term “skilled”. The study by Wulf et al, (2002 pg. 178) used participants who had “at least some experience in soccer”. This is a broad mix of participants which could have influenced the validity of the research.

This study also sought to alleviate the potential issues of maturation (see section 2.15) by using a soccer specific accuracy task testing for technique, negating the influence of power and strength, which in previous studies has been found to influence the findings when studying adolescent soccer players (Malina et al, 2005, Vaeyens et al, 2006). Williams and Hodges, (2005) have argued that compared with the published work focusing on biological aspects of training, the research aimed at uncovering the important factors underpinning effective practice and instruction is noticeably limited. Thus, this study attempted to reduce the effects of maturation and find if the attentional focus given to a performer can influence performance on a technical skill.

One of the fundamental issues with research into sport has been its misconception of the use of the term ecological validity (see section 2.16). As the research into attentional focus has progressed, the need to show its effectiveness has led researchers to move from simple, laboratory based studies, using ski simulators (Wulf et al, 1998) to more real life, complex skills such as volleyball (Wulf et al, 2002) and golf (Wulf and Su, 2007). The present study sought to increase the ecological validity by carrying out the intervention and testing on the participants’ regular coaching night, this allowed the research design to be representative of the performer’s real training environment. The participants attended their normal ninety minute coaching session, consisting of a warm up, technical drills and small sided games. Bell and Hardy (2009) are one of the only researchers who have sought to carry out the research into attentional focus in a similarly ecologically valid setting. The previous research into attentional focus did not influence the environment; it only changed the complexity of the task

(Renshaw et al, 2010). This study therefore sought to find out if an attentional focus can influence the performance and learning of a soccer specific task in a complex, dynamic learning environment. This study has furthered the research by conducting the study in a real training environment; it is felt that the findings can be applied to real world situations more than the majority of the previous research.

In regard to the task (see section 3.2.2), the use of a closed skill, using a static ball, with the aim of hitting a static target, was so that there was more control over the task. The intention of the study was to alter the environment making it more variable and complex. If the task had been an open skill, it was felt the findings would have contained too many variables which would have reduced the validity to answer the research question of whether an external or internal focus of attention influences the performance and learning of a soccer specific skill (Schmidt and Wrisberg, 2008).

As addressed in the methodology (see section 3.3.3), there has been much criticism pointed at lack of pre-tests by various commentators (Mullen 2007, Hodges and Ford, 2007), the researcher felt that it was important to include a pre-test therefore in order to assess differences that occurred during intervention. It was found in the pre-test that there were no differences between the groups; this finding increases the effects that an attentional focus has on performance, as the results show that during the intervention stage, feedback which produced an internal focus was found to be detrimental to performance. Thus, it would appear that the use of a pre-test enhances the findings of an attentional focus by showing the detrimental effects that an internal focus can have on an adolescent performer.

6.3 Manipulation checks

A major methodological decision for this study was the use of multiple manipulation checks. The literature on attentional focus has been criticized for not carrying out manipulation checks (Mullen, 2007). The present study felt it essential to include two manipulation checks; the first in week two of the intervention period, in order to see if the participants were using the experimental focus given and after the retention test in week five. It is felt that by using these checks more weight can be given to the results and the research was able to clarify that performance and learning was influenced by the performer's focus of attention. Again, this enhances the strength of this study and shows that the results can be verified and supported by evidence of what the performers focused on. It can be argued that not carrying out these checks means the results cannot be fully accounted for, as participants may change their attentional focus throughout (Bell and Hardy, 2009). This is important for the validity of attentional focus experiments; if a performer is not adhering to specified instructions then the conclusions made may not be valid (Thorn, 2006).

Analysis of the manipulation checks in this study indicated that in the internal group, 76.4% of the participants focused internally in week two of intervention. In the retention test, this dropped to 64.7%. The reason for the drop may have been due to their poor performance during the study; the instructions and feedback of focusing internally had not helped or improved performance over the weeks previously, which means that some participants may therefore have discarded the experimental focus, instead using their own internal feedback mechanisms to improve performance. The checks validate this belief; as the remaining participants focused on the ball, a proximal external focus. None of the internal focus participants said they focused on the crossbar.

The external focus participants showed that all the participants followed the experimenter's feedback in week two; 53.3% of participants focused on the crossbar, a distal external focus and 40% focused on the ball; a proximal external focus. In the retention test there were some differences; there was a drop in those that used a distal external focus (46.6%) and a drop in the proximal external focus (33.3%). By analysing these results it would appear that by not having constant external feedback, participants were in effect, left to their own decisions and focus (Chiviacowsky et al, 2010); this may be why 13.3% focused on their technique, an internal focus. These findings however confirm Wulf et al's, (2002) argument that the more external focus feedback a performer receives, the more they will keep focusing externally and thus keep performance levels high. It is important to note that even though all performers are under the same conditions in the learning test, the independent variable used during practice cannot be completely removed in retention (Chiviacowsky et al, 2009); this is why carrying out a questionnaire after the retention test was important in order to determine if the participants continued to use the focus they were given (Thorn, 2006). The results from the checks indicate that participants followed the instructions from the experimenter, this shows how influential augmented feedback can be for a young performer and that the focus this gives can either improve or degrade performance.

Although the control groups were not provided a focus cue, the questionnaire results revealed that when participants were focusing on as it gives a researcher a chance to see their natural focus (Wulf and Su, 2007). It was found that those who used an external focus performed produced better accuracy than those who had an internal focus. For the control group the checks indicated that their natural focus was more mixed. In week two their focus was spread between internal (29.4%), proximal external (23.5%) and distal focus (35.3%). The use of extensive manipulation checks in this study have allowed the researcher to validate

the findings and strengthen the argument for the use of an external focus of attention when instructing young skilled soccer players to improve performance and learning of a soccer specific skill.

6.4 Personal experience

As the experimenter and the coach what I found was that it was difficult, especially in the internal focus feedback group, to have a young player perform continually poorly and for me not be able to help. There has been extensive discussion into the issues of being both a researcher with knowledge of the participants and a participant in the research process **(**Atkinson and Hammersley, 1998). As a coach, especially of young players, the important thing to give a player is a level of success and confidence in order to keep the player motivated (Lewthwaite and Wulf, 2010). As the researcher it was difficult to continually give the internal focus feedback even though it was affecting performance. The detrimental effects that an internal focus of attention produced meant that a debrief after the study was essential for the participants as they needed to realize that they were taking part in a study that had the potential to hamper performance, by de-briefing them, the participants were informed about the nature of the study and the performers were informed to use an external focus in the future. A de-brief thus alleviated any long lasting effects.

6.5 Limitations

The study aimed to be ecologically valid, and in using a real coaching environment it has succeeded. However, there are issues which still need to be addressed for future research. Because of the time constraints of twelve participants performing their trials over a 90 minute period, performers were only able to perform 10 trials per week. The limited amount of trials in the attentional focus research has been criticised (see Mullen, 2007) yet in this study it was

difficult for the performers to carry out more than the allocated trials. If the performer had carried out anymore then time constraints would have restricted the ability to see all participants during the allocated time period. The researcher was also aware of boredom and fatigue occurring, so although more carrying out more trials may bring about a bigger influence from the experimental conditions, it was felt that 10 trials was sufficient for each block. This being said, it would beneficial for future research to conduct the research over more weeks, this way exposing the participants to the experimental condition for longer.

The sample chosen, while being skilled adolescents were also based on convenience, and this group of players may have received more than the standard amount of external focus feedback before the study, as a result of the coaching environment. This may have resulted in the participants starting with more of an external focus than novices and resulted in increased detrimental effects of an internal focus. Therefore it is difficult to generalise these findings to other skilled footballers because of the context and environment in which other players have developed their football skills.

6.6 Recommendations for future research

One considerations for future research is to increase the length of the study; this would be of interest, as seen in week three of intervention, the external focus group started showing a significant increase in accuracy, if the participants had continued for another five weeks under external focus conditions, it would have been informative to see how far performance could have improved. As of now there has not been any research carried out into attentional focus over a substantial period of time. This current study has used a longer total duration (5 weeks) than previous work which has typically collected data and carried out learning trials in 3-5 days. Future work should consider the duration of the study in order to seek to replicate a real world training environment, where coaching sessions are not regularly on consecutive

days in the majority of amateur performers. As well as the duration future work should consider the number of trials used. In this study the participant performed only 30 learning trials under the experimental condition, it is possible that further separation between groups may have been seen with a greater number of learning trails and this is something that should be investigated. It would be interesting to see if these results were found in other areas with mixes of genders, the use of mixed gender research would give an insight into the effects of perception and attention between genders (see Barnett et al, 2010). In childhood and adolescence, boys are generally more proficient than girls in object control skill performance (Booth et al, 2006). Clearly there are differences between genders at this age group and it would be interesting to see if differences are found when conducting attentional focus research.

The validity of the task in this study is something to consider changing too. The task in this study was a closed skill with no physical or time pressure on the participant. Although the study improved the ecological validity of the environment, it would be interesting to see if altering the task to be open; using a moving target, may add more to the research, adding more ecological validity to the task. However, caution should be taken however that open skills leave less control to the experimenter (Schmidt and Wrisberg 2008). Perhaps the use of a free kick, using mannequins and specific targets in the goal, could add more ecological validity to the study without increasing dependent variables.

Also, all future research in attentional focus should seek to use manipulation checks (see Hodges, and Franks, 2007), conducting a check in the pre-test, prior to intervention would be interesting in order to see if any changes of focus occur during the experiment. This study found that not everyone adhered to the experimental conditions.

Finally, perhaps having an external distal and proximal group, similar to Bell and Hardy (2009) would enhance the findings further, as there were differences in the checks with some focusing on the "crossbar" and others on the "ball".

6.7 Attentional focus and coaching

Coaches play critical and diverse roles in athletes' development and the coach's influence is better understood when viewed within a conceptual model of coaching that includes ambient and behavioural components. Due to the complex interaction of these components of coaching, the learning environment of effective coaches needs to be consistently revisited and adapted (Côté 2005). Based on the previous research and furthered by this study, it would appear that for both novice and skilled performers focusing internally can constrain performance and restrict learning, whereas focusing externally maintains and improve performance (Chiviacowsky et al, 2010). Based on this there needs to be consideration given to coaching methods and the feedback used for motor skill development. Based on this theory into a performer's attentional focus, it would appear that performers learning under external focus conditions show accelerated learning than performing under an internal focus (Wulf 2007b, Maxwell and Masters 2008). The attentional focus research should therefore have implications for the training and coaching of motor skills that have high motor control demands and require precisely coordinated movements.

6.8 Conclusion

In conclusion this study has furthered the research on attentional focus and has found an advantage to adopting an external focus of attention when giving feedback to young skilled novice performers in a dynamic coaching environment. The study also agrees with previous work showing detrimental effects upon performance and retention when using an internal

focus of attention. In particular the current work adds to the field in having adopted a more complex, ecologically valid environment than much previous work in the area. In order for the research on attentional focus to be truly applicable to coaching, future studies should also seek to increase the ecological validity of both the tasks used and the setting they are in.

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Appendix A

Questionnaire Week 2 intervention

Name ……..

Age …….

1. How many hours a week do you play football?

……..

2. Of those hours, how many are you coached?

…….

3. What position do you play?

……..

4. What were you focusing on during the crossbar challenge?

Ball / Foot / Other (specifiy) ……

5. How does this task make you feel?

…….

1 = Very anxious
2 = somewhat anxious
3 = normal
4 = somewhat relaxed
5 = Very relaxed

Appendix B

CSAI-2R

1 – Not at all
2. A little bit
3.Quite a bit
4. Very much so

1. I feel jittery ……

2. I am concerned that I may not do as well in this competition as I could ……

3. I feel self confident ……

4. My body feels tense ……

5. I am concerned about losing ……

6. I feel tense in my stomach ……

7. I'm confident I can meet the challenge ……

8. I am concerned about choking under pressure ……

9. My heart is racing ……

10. I'm confident about performing well ……

11. I'm concerned about performing poorly ……

12. I feel my stomach sinking ……

13. I'm confident because I mentally picture myself reaching my goal ……

14. I'm concerned that others will be disappointed with my performance ……

15. My hands are clammy ……

16. I'm confident of coming through under pressure ……

17. My body feels tight ……

Appendix C

Questionnaire – Final week

Name ……. Age…….

What were you focusing on during the task?

…….

How do you think you have performed on this task?

1. Pleased
2. Exceeded expectations
3. What I expected
4. Below expectations
5. Poor

Have any of these had an impact on you in this task? (choose multiple if necessary)

1. Personal expectations
2. Pressure from self, to perform
3. Pressure from others
4. Pressure from coach
5. Other (please specify)…….

Appendix D

Consent form

This information is being collected as part of a research project concerned with instruction and feedback from the coach in the learning of a motor skill, in this case, using an accuracy test, by the Department of Education in the University of Birmingham in collaboration with [redacted] The information which you supply and that which may be collected as part of the research project will be entered into a filing system or database and will only be accessed by authorised personnel involved in the project. The information will be retained by the University of Birmingham and will only be used for the purpose of research, and statistical and audit purposes. By supplying this information you are consenting to the University storing your information for the purposes stated above. The information will be processed by the University of Birmingham in accordance with the provisions of the Data Protection Act 1998. No identifiable personal data will be published.

Please read the below statements, making sure that you are happy to go ahead with this research study.

- I confirm that I have read and understand the participant information leaflet for this study. I have had the opportunity to ask questions if necessary and have had these answered satisfactorily.

- I understand that my participation is voluntary and that I am free to withdraw at any time without giving any reason. If I withdraw my data will be removed from the study and will be destroyed.

- I understand that my personal data will be processed for the purposes detailed above, in accordance with the Data Protection Act 1998.

- Based upon the above, I agree to take part in this study.

Name, signature and date

Name of participant…… Date……
Signature……..

Name of parent…… Date…….. Signature……..

Name of researcher/individual obtaining consent…….....
Date……Signature……..

Please complete this form and bring it to [redacted]*. Failure to bring form will result in not being able to participate in study.*