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The Effects of Focused Attention on Batting Performance of Collegiate Athletes

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By

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By _____

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Sincerely,

Lauren Craig

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Abstract

Proper thinking is essential to effective batting in baseball and softball. However, the qualities that define "proper thinking" are unspecified and therefore require examination. That is, on what should a batter focus for optimal performance? Ten baseball players and 13 softball players competing at the NCAA Division II collegiate level were individually given internal and external focus instructions related to their swings and completed four rounds of hitting. Two experimenters blind to condition recorded the result of each swing; hits in fair territory received one point and hits in foul territory received zero points. Results indicated no significant difference between Focus Instruction administered and the mean number of fair hits. However, a significant interaction was found for class level, with upperclassmen (juniors and seniors) performing significantly better during both distal and proximal external conditions compared to lowerclassmen (freshmen and sophomores). Results also indicated a significant effect for sex with females outperforming males during all conditions. This study is important in discovering the impacts of focused attention instructions on the performance of collegiate level players.

Keywords: focused attention, constrained action hypothesis, internal focus, external focus, batting performance

The Effects of Focused Attention on Batting Performance of Collegiate Athletes

Proper thinking is essential to effective batting in baseball and softball. However, the qualities that define "proper thinking" are unspecified and therefore require examination. That is, on what should a batter focus for optimal performance? The predominant view is one that is *internal* and directed toward the athlete's specific body movements (Wulf, McConnel, Gartner, & Schwarz, 2002). For example, Wulf and Prinz (2001) report that most coaches administer instructions that emphasize skills requiring the most improvement by referring to the coordination of various body movement components. A study by Stoate and Wulf (2011) indicates that 84.6% of collegiate track and field coaches report giving instructions that relate to an athlete's body or limb movements. Consequently, approximately 70% of athletes performing at the collegiate level report that they adopt an internal focus of attention when performing.

However, an internal focus of attention may not be optimal. Instead, an external focus may be more effective because it directs attention away from the athlete's body movements and emphasizes the desired movement effects (Freudenheim, Wulf, Madureira, Passetto, & Correa, 2010). Researchers indicate a number of advantageous effects of an external focus at both the novice and expert skill level (Wulf et al., 2002), and for a number of sport skills, including, golf, tennis, volleyball, basketball, and soccer (Wulf, McNevin, & Shea, 2001).

For example, Carpenter, Lohse, Healy, Bourne, and Clegg (2012) found that an external focus resulted in faster acquisition and greater retention during a speeded aiming shooting task compared to an internal focus. Similarly, Ford, Hodges, and Williams (2005) found that skill relevant external focus instructions were beneficial to novice soccer players during the acquisition of a dribbling task. Additionally, in a study examining the effects of focused attention on the accuracy of volleyball serves, Wulf and Prinz (2001) indicate form quality is not

jeopardized and is enhanced with an external focus compared to an internal focus.

Types of Focus

Focused attention is defined as "the influence of instructions to consciously attend to specific information during the production of an action" (Perkins-Ceccato, Passmore, & Lee, 2003, p. 593). The overall goal of administering a focus inducing instruction is to enhance the performance of the skill being executed. Specifically, it is important to distinguish which types of focus instructions are most effective in enhancing the overall performance of an athlete. The two primary types of focus instructions are statements that induce an *internal* focus of attention compared to those that induce an *external* focus.

Internal focus statements emphasize the coordination of an athlete's body movements (Wulf, et al., 2001). Examples of internally focused instructions include "concentrate on the form of your golf swing and adjust the force of your swing depending on the distance of your shot" (Perkins-Ceccato, at al., 2003, p. 595), or "Lock your ankle down and use the instep to strike the ball" (Wulf, et. al., 2002, p. 172). These statements direct the athlete's attention to a particular body part or a specific body movement in an effort to improve the form or accuracy of the produced action.

External instructions emphasize the effects that result from the athlete's body movements (Wulf, et al., 2001). Examples include "concentrate on hitting the ball as close to the target as possible" (Perkins-Ceccato, et al., 2003, p. 596), or "hit the ball as if using a whip, like a horseman driving horses" (Wulf et. al., 2002, p. 173). Compared to internally focused instructions, externally focused instructions translate the same information into a statement that refers less to specific body parts or movements and more to the effect the athlete is working to accomplish, often through the use of metaphors.

The Use of Metaphors

One major argument against using external focus instructions is the difficulty in administering statements that are completely devoid of movement references during the acquisition or execution of a skill. However, references to the athlete's movements do not need to be avoided, as long as a predominately external focus is induced. The use of metaphors can be particularly beneficial in addressing this concern (Wulf, et al., 2002).

Metaphors are advantageous for a number of reasons. They detract attention away from the athlete's body movement while providing a mental image of the movement goal to be accomplished. For example, the instruction "hit the ball as if using a whip, like a horseman driving horses" induces an external focus while emphasizing the goal of snapping the wrist and hitting the ball with the necessary force. Consequently, an external focus has the advantage over an internal focus of attention because it allows a connection between the action and the perceived effects while an internal focus interferes with these processes (Kasper, Elliot, & Giesbrecht, 2012).

Theory of Skill Acquisition

A number of theories have been posited to explain why an external focus of attention has been found to be superior to an internal focus during the execution of a complex motor skill, including the theory of skill acquisition. According to the theory of skill acquisition, there are qualitative changes that occur as a particular skill is performed with practice (Anderson, 2010). Consequently, as an athlete progresses through the three stages of acquisition and becomes more experienced, the athlete's focus of attention evolves from relying on explicit knowledge and results in relying on implicit knowledge (Masters, 1992).

As a novice, the athlete resides in Anderson's (2010) first stage, the *cognitive* or

declarative stage. During this stage, the execution of a skill depends upon a set of separate control structures being continually held in working memory and attended to in a step-by-step fashion (Gray, 2004). Explicit knowledge, defined as facts and rules that can be articulated are particularly important during this stage (Masters, 1992). Beilock and Carr's (2001) *explicit monitoring hypothesis* supplements the cognitive stage by arguing that the primary distinction between the attention of novices and experts is the need to attend to individual components early in the learning process (Kasper, Elliott, & Giesbrecht, 2012).

Next, the athlete reaches the *associative* stage, where errors in the developing procedure are detected and connections between individual elements of the motor act are strengthened (Anderson, 2010). The conclusion of the associative stage and the transition to the *autonomous*or *procedural* stage is marked by the development of a successful procedure for the execution of the skill. By the time the athlete reaches the *autonomous* stage, the step-by-step cognitive control is no longer necessary and the athlete relies on implicit knowledge that cannot be articulated (Masters, 1992). Instead, the execution of the skill is assumed to operate through fast and efficient control procedures that can function largely without the assistance of working memory or attention (Gray, 2004). This is due to individual components of the skill becoming proceduralized in long-term memory (Ford, Hodges, & Williams, 2005). In fact, Beilock and Carr (2001) argue that detrimental athletic performance occurs when proceduralized components are brought back into working memory. This process is known as the *deautomization of skills hypothesis* or the *theory of reinvestment* (Zentgraf & Munzert, 2009). Therefore, the attentional mechanisms involved in the execution of a skill distinguish a novice from an expert and an internal focus has negative effects on expert performers compared to beginners.

An important aspect of the theory of skill acquisition is the automatic nature of the

proceduralized function. This means that as a movement becomes proceduralized, performance requires less attentional resources. Gray (2004) argues that the athlete devotes less attention to the skill execution because memory for specific components of a motor act is weakened. Jackson, Ashford, and Norsworthy's (2006) findings that expert level performers exhibit a decreased ability to recall explicit rules of a motor act as well as relatively little episodic knowledge of the mechanics related to task performance during a soccer dribbling task evidence this.

Consequently, attentional resources previously required are effectively applied elsewhere. For example, Gray (2004) found that as expertise increases, athletes can detect visual cues that are not directly related to the task they are performing but are still relevant to successful completion of the skill. For example, in baseball and softball, as a batter's swing becomes proceduralized, more attention may be paid to details such as the location of defensive players on the field and where the catcher is setting up behind the plate prior to the pitch being released.

Proceduralization of a motor skill may also have important implications for anxiety-related research. Since it is well established that increased anxiety can have a detrimental effect on sport performance, some researchers have argued that increased levels of anxiety creates an environment in which the athlete becomes distracted and focuses on irrelevant cues that hinder the performance of the task (Bell & Hardy, 2009). According to the *processing efficiency theory*, anxiety during performance reduces the processing and storage capacity of working memory and also provides an increase of on-task effort (Wilson, Chattington, Marple-Horvat, & Smith, 2007). Increased pressure to succeed heightens an athlete's self-focus, leading to increased attention being paid to the step-by-step process of the action (Jackson, Ashford, & Norsworthy, 2006; Wilson et. al, 2007). The athlete's attentional capacity may then become exceeded with the

additional cognitive load, resulting in decreased performance (Mullen, Hardy, & Tattersall, 2005). For example, Wilson, Wood, and Vine (2009) found that when placed in high anxiety situations, experienced soccer players shifted their gaze and fixated for longer periods of time on task irrelevant cues, causing significant reductions in shooting accuracy. Consequently, an external focus that frees up attentional capacity and allows for focus to be directed to task relevant cues may be beneficial in enhancing performance under conditions of anxiety (Bell & Hardy, 2009).

The Constrained Action Hypothesis

Wulf's *constrained action hypothesis* also explains why an external focus is superior to an internal focus. The constrained action hypothesis posits that when an athlete attends to a particular body movement or a movement effect that is proximally close to one's body, the athlete will attempt to actively intervene in the execution of the motor act. The "freezing" or "constraining" of the degrees of freedom for the action leads to less fluid interactions and less automatic movement execution (Wulf, et al., 2001), resulting in a degradation to the quality of performance (Castaneda & Gray, 2007). Instead, an external focus allows the body to respond in a more natural and automatic manner.

During a task where participants were required to balance on a stabilometer while simultaneously listening for an auditory sound, those whose attentional focus was directed away from the body demonstrated more frequent responding (Zachry, Wulf, Mercer, & Bezodis, 2005). Bell and Hardy (2009) argue that more frequent responding is indicative of more automatic, reflexive type movements that are based on more active degrees of freedom and fluid task execution. Increased frequency of responding led to improved balance performance and a decrease in attentional demands for the task. In other words, focusing on a certain part of the

body not only has an influence on the body part that is receiving the focus, but also influences the action of other body parts as well, or the entire motor system (Zachry et al., 2005)

External focus instructions can also reduce EMG activity and heart rates during performance (Zachry, Wulf, Mercer, &Bezodis, 2005; Zarghami, Saemi, &Fathi, 2012). For example, according to the *intake-rejection hypothesis*, if athletes focus their attention externally, then a deceleration in heart rate should result immediately prior to the execution of the task (Neumann, & Thomas, 2011). This is evidenced by findings by Hassmen and Koivula (2001) that golfers exhibit deceleration prior to a putt and the decelerations are greater in expert compared to novice golfers. Consequently, when attention is directed away from skill execution through an external focus, the motor control procedures can operate uninterrupted by conscious control (Castaneda & Gray, 2007). While this is beneficial to novice learners of a skill, it is particularly advantageous for athletes who reach an expert level of performance.

Factors Affecting External Focus Efficacy

Although an external focus of attention has been found to be superior to an internal focus, there is still debate about which type of external feedback is optimal. The primary question is one of distance. For example, Stoate and Wulf (2011) found that expert golfers perform better when given a distal external focus as opposed to a more proximal focus during putt attempts. Likewise, McKay and Wulf (2012) found that dart-throwing participants not only performed significantly better when adopting a distal external focus, but a significant number of participants also preferred the distal external focus of aiming at a target as opposed to the proximal external focus of focusing on the flight of the dart when performing. Finally, in a simulated batting task by Castaneda and Gray (2007) enhanced performance was observed when the external focus was directed to a movement effect that was further from the athlete's body. Therefore, a more distal

external focus may be more beneficial because effects may be more distinguishable than when the focus is directed to proximal areas of the body, and consequently greater movement automaticity may be observed (Wulf & Prinz, 2011; McKay &Wulf, 2012). This qualification was tested in the present study by having one proximal external condition and one distal external condition.

Although the benefits of an external focus have been demonstrated for both the learning and retention of a complex motor skill, there are still few studies that examine the effects of different foci of attention in expert performers (Stoate &Wulf, 2011; Poolton et al., 2006). Additionally, there are no prominent studies examining the effects in a real-time, non-simulated batting task. This is important for a number of reasons. One is that according to Wulf and Prinz (2001), adding a purpose to a task has been found to enhance skills compared to simulated activity and as such, material based occupations have been found to be greater than imagery based occupations. Therefore, results from studies examining simulated tasks may not be generalized to those found in a real-life batting situation.

Additionally, previous researchers have observed the effects of internal and external focused attention for sports skills that are predominantly self-paced, such as golf putts, volleyball serves, and basketball free-throws. Hitting on the other hand is significantly less self-paced and is often affected by external factors such as the pace of the pitcher's wind-up. Therefore, it is important to determine whether findings can be generalized to less self-paced sport skills. Particularly, since Lohse, Sherwood, and Healy (2010) find an external focus of attention to minimize conscious control and, consequently require shorter preparation time for a motor skill compared to an internal focus, it is important to distinguish whether an external focus of attention is superior to an internal focus of attention on a non-self-paced task. As such, the

objective of the present research is to examine the effects of internal versus external focused feedback on the batting performance of collegiate level batters. If batters adopt an external focus, then more hits should be observed than when an internal focus is adopted. Additionally, if batters adopt a distal external focus, then more hits should be observed than when a proximal external focus is adopted.

Method

Participants

Participants were 23 players of a NCAA Division II Midwestern university's baseball and softball teams (10 baseball players, 13 softball players). The average age of the participants was 20.1 years (SD = 1.47). The batters were considered experts as they had been playing competitively for an average of 14.4 years (SD = 3.19). The study was approved by the university's institutional review board. All participants were naïve to the purpose of the experiment.

Procedure

Testing took place on the university baseball and softball fields during batting practice. Each participant completed four conditions of a hitting task. Each round consisted of ten pitches that were delivered from a *JUGS* model pitching machine. The pitching machine was set to deliver each pitch down the plate's center and pitch speed was controlled by setting the machine to 55.0 mph for softball players and 78.0 mph for the baseball players. These speeds were determined to be the average pitching speed for collegiate level pitchers (NCSA, 2002). Players warmed-up and were informed they would perform four rounds of 10 pitches. The instruction for each round was given only once by the primary investigator, prior to the participant stepping into the batter's box to begin the round. During the internal condition participants were told, "during

this round, focus on keeping your hands in and your swing level"; for the distal external condition participants were told, "during this round, focus on hitting the ball between the cones placed on the field."; for the proximal external condition participants were told "during this round, as you swing, imagine yourself shaking hands with the ball"; and for the control condition participants were told "I have no instructions for you for this round."

The order of the focus conditions were counterbalanced for each participant. An experimenter stood behind a screen on each side of the batter, and the result of each swing was recorded (see Appendix A). Hits that landed in fair territory were awarded one point, while hits that landed in foul territory were awarded no points. Each experimenter was blind to the condition of each batter.

After all four rounds, players completed a questionnaire with information regarding the player's year of eligibility (i.e. freshman, sophomore, junior, senior), the number of years of competitive experience, the number of training sessions per week, and the number of batting repetitions completed during each training session. These questions were asked in order to confirm criteria regarding level of expertise. The questionnaire also contained a series of questions which served as manipulation checks for the experimental focus conditions (see Appendix B). Players were then debriefed and thanked for their participation.

Results

Data Analysis

A one-way repeated measures ANOVA was conducted to compare the effects of instruction on the number of hits in the internal, distal external, proximal external, and control conditions. The results do not support the hypothesis that an external focus would result in a greater number of hits in fair territory, $F(3, 66) = .774$, $p = .513$, $\eta^2_p = .03$, *power* = .20.

Although the proximal external focus condition resulted in the greatest number of hits when compared to the other three conditions (see Table 1), this difference was not significant.

Table 1.

Mean Number of Hits Observed for each Condition

Instruction	N	*M*	*SD*	95% CI
Internal	23	7.47	1.89	[6.66, 8.29]
Distal External	23	7.08	1.69	[6.35, 7.81]
Proximal External	23	7.69	2.09	[6.79, 8.59]
Control	23	7.34	1.75	[6.59, 8.10]

Follow-up analysis in the form of a 2x2 (Sex x Class Level) factorial repeated measures ANOVA was conducted in order to determine if there were any interactions between instruction and sex or instruction and class level. A significant interaction between instruction and class level was indicated, $F(3, 57) = 5.180$, $p = .039$, $\eta^2_p = .136$, *power* = .675, with upperclassmen (juniors and seniors) achieving a greater number of hits during both the proximal and distal external conditions compared to underclassmen (freshmen and sophomores) (see Figure 1).

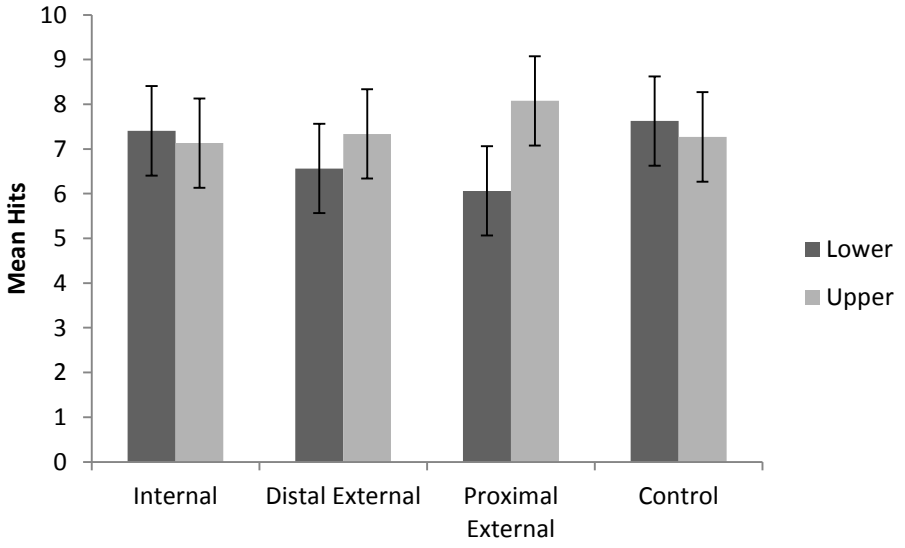

Figure 1. Mean Hits Observed by Class Level. Error bars represent standard errors.

Additionally, a trend toward significance was indicated between instruction and sex, $F(3, 57) = 2.483$, $p = .070$, $\eta^2_p = .116$, *power* = .587, with females outperforming males in all conditions. Consequently, a significant effect between males and females was indicated, with females demonstrating a greater number of hits per round, regardless of instruction administered, $F(1, 19) = 31.404$, $p < .000$, $\eta^2_p = .623$, *power* = 1.000 (see Figure 2).

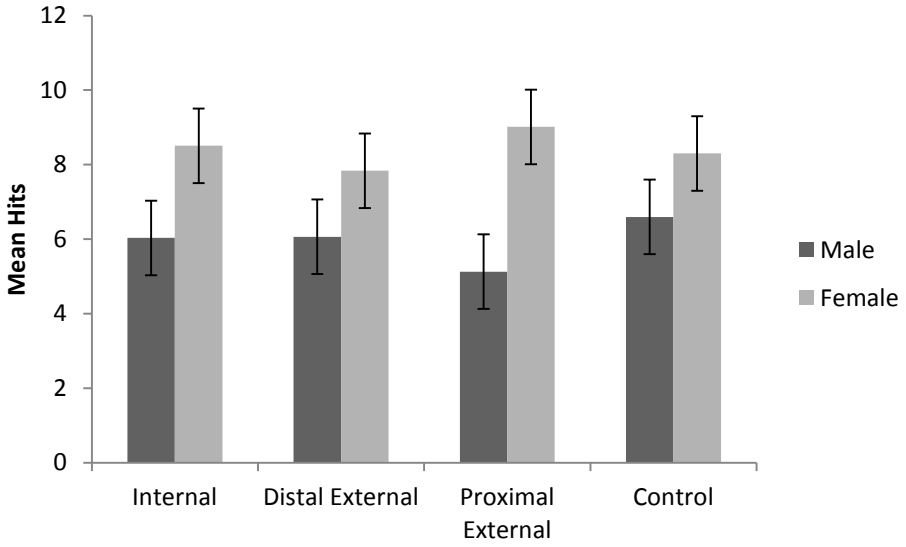

Figure 2. Mean Hits Observed by Gender. Error bars represent standard errors.

Manipulation Check and Focus in Control Condition

Only two participants indicated that they were unable to focus on shaking hands with the ball (however, their number of hits in the four conditions were in line with the respective average number of hits). All other participants indicated they were able to follow each instruction to a degree. Participants indicated high rates of focus for both the internal (*M*= 8.09, *SD*= 1.92) and distal external conditions (*M*= 7.57, *SD*= 2.64). However, the ratings for the proximal external condition were noticeably lower (*M*=4.0, *SD*= 2.59). In the control condition, most participants indicated that they focused on “hands in”, “head on the ball”, “weight back”, or “hands up”, which is internal in nature, as the focus was on their body movements during the action. However, several other participants reported their focus was directed at the goal of their actions

such as making solid contact, hitting between the cones and "squaring up on the ball" which is considered external in nature (see Appendix C).

Discussion

The hypothesis that external focused feedback would significantly increase the number of hits and increase batting performance was not supported. While the greatest number of hits was observed when the batter was given a metaphor as their instruction, this result was not significant. Likewise, since no significant difference was found between the mean number of hits between conditions and instruction, the hypothesis that adopting a distal external focus would result in significantly more hits than adopting a proximal external focus was not supported. However, there was a significant interaction found for instruction administered by class level, with junior and senior level players performing better when given external focused instructions. There was also a significant effect found for gender, with females outperforming males on all conditions, regardless of instruction administered.

A number of limitations could have influenced the results. The number of hits that landed in fair territory may have been too lenient of a dependent measure and therefore, may have resulted in a ceiling effect. Due to the setup of the study, batters were asked to hit the ball within fair territory on pitches delivered by a pitching machine where no defensive players are present. Given the high level of skill of the athletes, it is possible that each was able to achieve a high number of fair hits during each round, regardless of instruction given. However, it is difficult to discern which balls that landed in fair territory would have been classified as "hits" if a defensive team had been present. This is arguably a more important factor as batting average is determined by the number of hits that escape defensive players and allow the batter to reach a base safely or score runs, not solely by which balls land in fair territory.

The instruction given during the proximal external condition appeared to be confusing to batters and may have also contributed to the insignificant findings. As the results of the manipulation check indicate, a majority of the players gave a noticeably lower response to the question regarding their ability to "focus on shaking hands with the ball". This may have caused batters to instead rely on a previous instruction or not focus on anything during that round. Although this instruction round resulted in the greatest number of hits, perhaps findings would have been deemed significant if a more common reference such as "throw your hands at the ball" or "squish the bug when swinging" were administered due to players' familiarity with these phrases.

Finally, completing all four conditions during one testing session may have made it difficult to separate the content of the different instructions between rounds. Consequently, there may have been significant carryover of previous instructions to the current round. At the expert level of performance for a repetitive task, it is not uncommon for an athlete to shift focus during task execution despite instructions to maintain a particular focus. While results of this study show that players were able to focus on each instruction at least minimally, it may have been helpful to have more time in between rounds to observe maximum differentiation of instruction.

Future research should examine the effects of focused attention instructions on the number of hits accomplished off a live pitcher with a defensive team placed on the field. Although this study was conducted in a real-life setting as opposed to a simulated batting task, it is difficult to determine realistic effects if there is no defensive team present. Additionally, although this study's intent was to examine the effects of focused attention during a non-self-paced task, the present design allowed for participants to complete the rounds at their own pace due to pitches being delivered from a machine. Instead, effects need to be observed when batters

are required to adjust to the pace of a live pitcher. These changes would make the findings more realistic and more generalizable. Future studies may also benefit by obtaining baseline data from each participant and adding a separate control group to the study.

It is also important to address the effect found for gender in this study by conducting separate tests for baseball and softball teams. This will allow researchers the opportunity to see if there are underlying factors resulting in the sex differences found that were not detected during this study. While baseball and softball are considered to be complimentary in nature, perhaps there are crucial differences that are not being accounted for.

It is important that the effects of focused attention on the athletic performance of expert athletes continue to be examined. Ineffective instructions can result in degraded performance and increased frustration between coaches and players. Given that the National Collegiate Athletic Association (NCAA) is a multi-million dollar industry that is becoming increasingly competitive with each passing year, results of the present and future studies could benefit coaches in a number of ways, including enhanced relationships and a competitive edge. Additionally, sports related injuries could be significantly decreased if coaches administer external instructions that allow the expert level athlete to naturally regulate their movements during performance rather than constraining them through internal focus instructions. Overall, an athlete's focus of attention during the learning and performance of a skill is a variable that absolutely cannot be discounted.

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Appendix A

Player #: 1	Condition #: 2	Condition #: 1	Condition #: 4	Condition #: 3
Attempt # 1		X		
Attempt # 2	X	X	X	X
Attempt # 3		X	X	X
Attempt # 4	X		X	X
Attempt # 5		X	X	X
Attempt # 6	X	X		X
Attempt # 7	X		X	X
Attempt # 8	X	X	X	X
Attempt # 9	X	X	X	X
Attempt # 10	X	X	X	X
TOTAL:	7/10	8/10	8/10	9/10

Player #: 2	Condition #: 3	Condition #: 1	Condition #: 2	Condition #: 4
Attempt # 1			X	X
Attempt # 2	X			X
Attempt # 3	X	X	X	X
Attempt # 4	X	GAVE ADVICE BY COACH X	X	X
Attempt # 5	X	X	X	X
Attempt # 6	X	X	X	X
Attempt # 7	X		X	X
Attempt # 8	X	X	X	X
Attempt # 9	X	X	X	X
Attempt # 10	X	X	X	X
TOTAL:	9/10	7/10	9/10	10/10

Player #: 2	Condition #: 3	Condition #: 1	Condition #: 2	Condition #: 4
Attempt # 1			X	X
Attempt # 2	X			X
Attempt # 3	X	X	X	X
Attempt # 4	X	X	X	X
Attempt # 5	X	X	X	X
Attempt # 6	X		X	X
Attempt # 7	X	X	X	X
Attempt # 8	X	X	X	X
Attempt # 9	X	X	X	X
Attempt # 10	X	X	X	X
TOTAL:	9/10	7/10	9/10	10/10

Player #: 3	Condition #: 3	Condition #: 1	Condition #: 2	Condition #: 4
Attempt # 1	X	X		X
Attempt # 2				X
Attempt # 3		X		
Attempt # 4			X	X
Attempt # 5		X	X	X
Attempt # 6	X	X	X	X
Attempt # 7	X	X	X	X
Attempt # 8	X	X	X	
Attempt # 9	X	X		X
Attempt # 10	X	X	X	X
TOTAL:	6/10	8/10	6/10	8/10

Player #: 3	Condition #: 3	Condition #: 1	Condition #: 2	Condition #: 4
Attempt # 1	X	X		X
Attempt # 2		X		X
Attempt # 3				
Attempt # 4			X	X
Attempt # 5		X	X	X
Attempt # 6	X	X	X	X
Attempt # 7	X	X	X	X
Attempt # 8	X	X		
Attempt # 9	X	X	X	X
Attempt # 10	X	X	X	X
TOTAL:	6/10	2/10	6/10	8/10

Player #: 4	Condition #: 4	Condition #: 2	Condition #: 3	Condition #: 1
Attempt # 1		X	X	
Attempt # 2		X		X
Attempt # 3	X		X	X
Attempt # 4	X		X	
Attempt # 5	X	X	X	X
Attempt # 6	X	X	X	X
Attempt # 7	X		X	
Attempt # 8	X	X	X	X
Attempt # 9	X	X	X	
Attempt # 10	X	X	X	X
TOTAL:	8/10	7/10	9/10	4/10

Player #: 4	Condition #: 4	Condition #: 2	Condition #: 3	Condition #: 1
Attempt # 1		X	X	
Attempt # 2				X
Attempt # 3	X	X	X	X
Attempt # 4	X		X	
Attempt # 5	X	X	X	X
Attempt # 6	X	X	X	X
Attempt # 7	X	X	X	
Attempt # 8	X	X	X	X
Attempt # 9	X	X	X	
Attempt # 10	X	X	X	X
TOTAL:	8/10	8/10	9/10	6/10

Player #: 5	Condition #: 2	Condition #: 4	Condition #: 3	Condition #: 1
Attempt # 1	X	X	X	X
Attempt # 2		X	X	X
Attempt # 3	X	X	X	X
Attempt # 4	X	X	X	X
Attempt # 5	X	X	X	X
Attempt # 6	X	X	X	X
Attempt # 7	X	X	X	X
Attempt # 8	X		X	X
Attempt # 9	X	X	X	X
Attempt # 10	X	X	X	X
TOTAL:	9/10	9/10	10/10	10/10

Player #: 5	Condition #: 2	Condition #: 4	Condition #: 3	Condition #: 1
Attempt # 1	X	X	X	X
Attempt # 2		X	X	X
Attempt # 3	X	X	X	X
Attempt # 4	X	X	X	X
Attempt # 5	X	X	X	X
Attempt # 6	X	X	X	X
Attempt # 7	X	X	X	X
Attempt # 8	X		X	X
Attempt # 9	X	X	X	X
Attempt # 10	X	X	X	X
TOTAL:	9/10	9/10	10/10	10/10

Player #: 6	Condition #: 4	Condition #: 1	Condition #: 3	Condition #: 2
Attempt # 1	X	X	X	X
Attempt # 2	X	X	X	X
Attempt # 3		X	X	X
Attempt # 4	X	X	X	X
Attempt # 5	X	X	X	X
Attempt # 6	X	X	X	X
Attempt # 7	X	X		X
Attempt # 8	X	X	X	X
Attempt # 9	X	X	X	X
Attempt # 10		X	X	X
TOTAL:	8/10	10/10	9/10	10/10

Player #: 6	Condition #: 4	Condition #: 1	Condition #: 3	Condition #: 2
Attempt # 1	X	X	X	X
Attempt # 2	X	X	X	X
Attempt # 3		X	X	X
Attempt # 4	X	X	X	X
Attempt # 5	X	X	X	X
Attempt # 6	X	X	X	X
Attempt # 7	X	X		X
Attempt # 8	X	X	X	X
Attempt # 9	X	X	X	X
Attempt # 10		?	X	X
TOTAL:	8/10	2. 9/10	9/10	10/10

Player #: 7	Condition #: 1	Condition #: 4	Condition #: 2	Condition #: 3
Attempt # 1		X	X	X
Attempt # 2		X	X	X
Attempt # 3	X	X		X
Attempt # 4		X	X	X
Attempt # 5	X	X	X	X
Attempt # 6	X			X
Attempt # 7	X	X		X
Attempt # 8	X	X	X	X
Attempt # 9	X			X
Attempt # 10		X		
TOTAL:	6/10	8/10	5/10	9/10

Player #: 7	Condition #: 1	Condition #: 4	Condition #: 2	Condition #: 3
Attempt # 1		X		X
Attempt # 2		X	X	X
Attempt # 3	X	X		X
Attempt # 4	X	X	X	X
Attempt # 5	X	X	X	X
Attempt # 6	X			X
Attempt # 7	X	X		X
Attempt # 8	X	X	X	X
Attempt # 9				X
Attempt # 10		X		
TOTAL:	6/10	8/10	4/10	9/10

Player #: 8	Condition #: 1	Condition #: 3	Condition #: 2	Condition #: 4
Attempt # 1	X	X		X
Attempt # 2	X	X	X	X
Attempt # 3	X	X	X	X
Attempt # 4	X	X	X	X
Attempt # 5	X	X		X
Attempt # 6	X	X	X	X
Attempt # 7	X	X	X	X
Attempt # 8	X	X	X	
Attempt # 9	X	X	X	X
Attempt # 10	X	X	X	X
TOTAL:	10/10	10/10	8/10	9/10

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Player #: 8	Condition #: 1	Condition #: 3	Condition #: 2	Condition #: 4
Attempt # 1	X	X		X
Attempt # 2	X	X	X	X
Attempt # 3	X	X	X	X
Attempt # 4	X	X	X	X
Attempt # 5	X	X	X	X
Attempt # 6	X	X	X	X
Attempt # 7	X	X	X	X
Attempt # 8	X	X		
Attempt # 9	X	X	X	X
Attempt # 10	X	X	X	X
TOTAL:	10/10	10/10	8/10	9/10

Player #: 9	Condition #: 4	Condition #: 2	Condition #: 1	Condition #: 3
Attempt # 1			X	X
Attempt # 2	X	X	X	
Attempt # 3		X	X	X
Attempt # 4		X	X	X
Attempt # 5	X	X	X	X
Attempt # 6	X	X	X	X
Attempt # 7		X	X	X
Attempt # 8		X	X	X
Attempt # 9	X		X	X
Attempt # 10	X	X	X	X
TOTAL:	5/10	8/10	10/10	9/10

Player #: 9	Condition #: 4	Condition #: 2	Condition #: 1	Condition #: 3
Attempt # 1	X		X	X
Attempt # 2		X	X	
Attempt # 3		X	X	X
Attempt # 4	X	X	X	X
Attempt # 5	X	X	X	X
Attempt # 6		X	X	X
Attempt # 7		X	X	X
Attempt # 8		X	X	X
Attempt # 9	X		X	X
Attempt # 10	X	X	X	X
TOTAL:	5/10	8/10	10/10	9/10

Player #: 10	Condition #: 3	Condition #: 1	Condition #: 2	Condition #: 4
Attempt # 1		X	X	X
Attempt # 2	X	X	X	X
Attempt # 3	X	X	X	X
Attempt # 4			X	X
Attempt # 5	X	X	X	X
Attempt # 6	X	X	X	
Attempt # 7	X	X	X	X
Attempt # 8	X	X		X
Attempt # 9		X	X	X
Attempt # 10	X	X	X	X
TOTAL:	7/10	9/10	9/10	9/10

Player #: 10	Condition #: 3	Condition #: 1	Condition #: 2	Condition #: 4
Attempt # 1	X	X	X	X
Attempt # 2	X	X	X	X
Attempt # 3		X	X	X
Attempt # 4	X		X	X
Attempt # 5		X	X	X
Attempt # 6	X	X	X	
Attempt # 7	X	X	X	X
Attempt # 8	X	X		X
Attempt # 9		X	X	X
Attempt # 10	X	X	X	X
TOTAL:	7/10	9/10	9/10	9/10

Player #: 11	Condition #: 3	Condition #: 1	Condition #: 2	Condition #: 4
Attempt # 1	X		X	X
Attempt # 2	X	X	X	X
Attempt # 3	X	X	X ?	X
Attempt # 4	X	X	X	X
Attempt # 5	X	X		X
Attempt # 6	X	X	X	X
Attempt # 7	X	X	X	X
Attempt # 8	X	X	X	X
Attempt # 9	X	X		X
Attempt # 10	X	X		X
TOTAL:	10/10	9/10	7/10	10/10

7.

Player #: 11	Condition #: 3	Condition #: 1	Condition #: 2	Condition #: 4
Attempt # 1	X		X	X
Attempt # 2	X	X	X	X
Attempt # 3	X	X	?	X
Attempt # 4	X	X	X	X
Attempt # 5	X	X		X
Attempt # 6	X	X	X	X
Attempt # 7	X	X	X	X
Attempt # 8	X	X	X	X
Attempt # 9	X	X		X
Attempt # 10	X	X		X
TOTAL:	10/10	9/10	? 6/10	10/10

Player #: 12	Condition #: 2	Condition #: 1	Condition #: 4	Condition #: 3
Attempt # 1		X		X
Attempt # 2	X	X	X	X
Attempt # 3	X	X	X	X
Attempt # 4	X	X	X	X
Attempt # 5	X	X	X	X
Attempt # 6	X	X	X	X
Attempt # 7	X	X		X
Attempt # 8	X	X	X	X
Attempt # 9	X	X	X	X
Attempt # 10	X	X	X	X
TOTAL:	9/10	10/10	8/10	10/10

Player #: 12	Condition #: 2	Condition #: 1	Condition #: 4	Condition #: 3
Attempt # 1		X		X
Attempt # 2	X	X	X	X
Attempt # 3	X	X	X	X
Attempt # 4	X	X	X	X
Attempt # 5	X	X	X	X
Attempt # 6	X	X	X	X
Attempt # 7	X	X		X
Attempt # 8	X	X	X	X
Attempt # 9	X	X	X	X
Attempt # 10	X	X	X	X
TOTAL:	9/10	10/10	8/10	10/10

Player #: 13	Condition #: 3	Condition #: 4	Condition #: 2	Condition #: 1
Attempt # 1	X	X	X	
Attempt # 2	X	X	X	X
Attempt # 3	X	X		X
Attempt # 4	X	X	X	X
Attempt # 5	X		X	X
Attempt # 6			X	X
Attempt # 7	X	X		X
Attempt # 8	X	X	X	X
Attempt # 9	X	X		X
Attempt # 10	X		X	X
TOTAL:	9/10	7/10	7/10	9/10

Player #: 13	Condition #: 3	Condition #: 4	Condition #: 2	Condition #: 1
Attempt # 1	X	X	X	
Attempt # 2	X	X	X	X
Attempt # 3	X	X		X
Attempt # 4	X	X	X	X
Attempt # 5	X		X	X
Attempt # 6			X	X
Attempt # 7	X	X		X
Attempt # 8	X	X	X	X
Attempt # 9	X	X		X
Attempt # 10	X		X	X
TOTAL:	9/10	7/10	7/10	9/10

Player #: 14	Condition #: 2	Condition #: 1	Condition #: 4	Condition #: 3
Attempt # 1				X
Attempt # 2	X	X	X	X
Attempt # 3	X	X	X	X
Attempt # 4	X		X	X
Attempt # 5	X		X	X
Attempt # 6	X	X	X	X
Attempt # 7	X	X	X	X
Attempt # 8	X	X	X	
Attempt # 9		X	X	X
Attempt # 10		X		X
TOTAL:	7/10	7/10	8/10	9/10

MISSED

Player #: 14	Condition #: 2	Condition #: 1	Condition #: 4	Condition #: 3
Attempt # 1				1
Attempt # 2	1	[illegible]	1	1
Attempt # 3	1		1	1
Attempt # 4	1		1	1
Attempt # 5	1		1	1 N
Attempt # 6	1	[illegible]	1	1
Attempt # 7	1	[illegible]	1	1
Attempt # 8	1		1	N
Attempt # 9		[illegible]	1	1
Attempt # 10				1
TOTAL:	7/10	[illegible]	8/10	9/10

B.L. 7/10

Player #: 15	Condition #: 3	Condition #: 1	Condition #: 2	Condition #: 4
Attempt # 1		1	1	
Attempt # 2	1	1	N	1
Attempt # 3		N		1
Attempt # 4		N	1	1
Attempt # 5		1	1	1
Attempt # 6	1	1		1
Attempt # 7	1		1	
Attempt # 8		1	1	
Attempt # 9	1			1
Attempt # 10			1	1
TOTAL:	4/10	5/10	6/10	7/10

Player #: #15	Condition #: 3	Condition #: 1	Condition #: 2	Condition #: 4
Attempt # 1	X	X	X	
Attempt # 2		X	X	X
Attempt # 3				X
Attempt # 4			X	X
Attempt # 5	X	X	X	
Attempt # 6	X	X	X	X
Attempt # 7				
Attempt # 8	X	X	X	X
Attempt # 9			X	X
Attempt # 10			X	X
TOTAL:	4/10	5/10	8/10	7/10

Player #: 16	Condition #: 3	Condition #: 1	Condition #: 2	Condition #: 4
Attempt # 1				1
Attempt # 2	1	1		1
Attempt # 3		1	1	
Attempt # 4	1	1	1	1
Attempt # 5		1		1
Attempt # 6	1		1	1
Attempt # 7	1	1	1	1
Attempt # 8	1		1	1
Attempt # 9	1	1	1	1
Attempt # 10	1	1	1	1
TOTAL:	7/10	7/10	7/10	9/10

Player #: 16	Condition #: 3	Condition #: 1	Condition #: 2	Condition #: 4
Attempt # 1	X			X
Attempt # 2	X	X	X	X
Attempt # 3		X		
Attempt # 4	X	X	X	X
Attempt # 5	X	X	X	
Attempt # 6			X	X
Attempt # 7	X	X	X	X
Attempt # 8	X	X	X	X
Attempt # 9	X	X	X	X
Attempt # 10	X	X	X	X
TOTAL:	8/10	8/10	8/10	8/10

Player #: 17	Condition #: 4	Condition #: 2	Condition #: 3	Condition #: 1
Attempt # 1				
Attempt # 2				
Attempt # 3		1	1	1
Attempt # 4		1	1	
Attempt # 5	1	1	1	1
Attempt # 6	1	1	1	
Attempt # 7	1		1	1
Attempt # 8	1	1		1
Attempt # 9	1	1	1	1
Attempt # 10				1
TOTAL:	5/10	6/10	6/10	6/10

Player #: 17	Condition #: 4	Condition #: 2	Condition #: 3	Condition #: 1
Attempt # 1				
Attempt # 2				
Attempt # 3		X	X	X
Attempt # 4	X	X	X	
Attempt # 5	X	X	X	X
Attempt # 6	X	X	X	
Attempt # 7	X		X	X
Attempt # 8	X	X		X
Attempt # 9		X	X	X
Attempt # 10		X	X	X
TOTAL:	5/10	7/10	7/10	6/10

Player #: 18	Condition #: 2	Condition #: 4	Condition #: 3	Condition #: 1
Attempt # 1				
Attempt # 2		1	1	
Attempt # 3	N	1	1	1
Attempt # 4	1	1	1	
Attempt # 5	1		1 N	1
Attempt # 6	1	1	1	1
Attempt # 7	1	1 N	1	1
Attempt # 8	1		1	
Attempt # 9		1	1 N	1
Attempt # 10	1		1	1
TOTAL:	6/10	6/10	9/10	6/10

Player #: 18	Condition #: 2	Condition #: 4	Condition #: 3	Condition #: 1
Attempt # 1				
Attempt # 2		X	X	
Attempt # 3		X	X	X
Attempt # 4	X		X	
Attempt # 5	X		X	X
Attempt # 6	X	X		X
Attempt # 7	X	X	X	
Attempt # 8	X	X	X	X
Attempt # 9		X	X	X
Attempt # 10	X		X	X
TOTAL:	6/10	5/10	8/10	6/10

Player #: 19	Condition #: 4	Condition #: 1	Condition #: 3	Condition #: 2
Attempt # 1		1		
Attempt # 2			1	
Attempt # 3	1			
Attempt # 4		1	1	
Attempt # 5	1	1		
Attempt # 6	1	1	1	1
Attempt # 7		1		
Attempt # 8			1	
Attempt # 9		1	1	1
Attempt # 10		1	1	1
TOTAL:	3/10	7/10	6/10	3/10

Player #: 19	Condition #: 4	Condition #: 1	Condition #: 3	Condition #: 2
Attempt # 1	X	X		
Attempt # 2	X		X	
Attempt # 3		X	X	
Attempt # 4	X	X	X	
Attempt # 5	X	X	X	
Attempt # 6		X		X
Attempt # 7		X	X	
Attempt # 8		X	X	X
Attempt # 9		X	X	X
Attempt # 10		X	X	X
TOTAL:	4/10	9/10	8/10	4/10

Player #: 20	Condition #: 1	Condition #: 4	Condition #: 2	Condition #: 3
Attempt # 1				
Attempt # 2				
Attempt # 3			1	
Attempt # 4	1		1	1
Attempt # 5				1
Attempt # 6	1	1	1	1
Attempt # 7	N			1
Attempt # 8	1	1 N	1	
Attempt # 9	1	1		
Attempt # 10	1	1		1 N
TOTAL:	5/10	4/10	4/10	5/10

Player #: 20	Condition #: 1	Condition #: 4	Condition #: 2	Condition #: 3
Attempt # 1				
Attempt # 2			X	
Attempt # 3		X	X	
Attempt # 4	X		X	X
Attempt # 5	X	X		X
Attempt # 6		X	X	X
Attempt # 7	X			X
Attempt # 8	X	X	X	X
Attempt # 9	X	X		
Attempt # 10	X	X		
TOTAL:	6/10	6/10	5/10	5/10

Player #: 21	Condition #: 3	Condition #: 1	Condition #: 2	Condition #: 4
Attempt # 1				1
Attempt # 2	1			
Attempt # 3	2		1	1
Attempt # 4	1	1		1
Attempt # 5	2	1	1	
Attempt # 6	2		1	1
Attempt # 7		1	1	1
Attempt # 8	1		1	
Attempt # 9	1		1	1
Attempt # 10	1		1	
TOTAL:	5/10	3/10	7/10	6/10

Player #: 21	Condition #: 3	Condition #: 1	Condition #: 2	Condition #: 4
Attempt # 1				X
Attempt # 2	X		X	X
Attempt # 3			X	X
Attempt # 4	X	X	X	X
Attempt # 5	X	X	X	
Attempt # 6			X	X
Attempt # 7		X	X	X
Attempt # 8	X	X	X	
Attempt # 9	X		X	X
Attempt # 10	X		X	X
TOTAL:	6/10	4/10	9/10	8/10

Player #: 22	Condition #: 4	Condition #: 2	Condition #: 1	Condition #: 3
Attempt # 1				
Attempt # 2			1 N	
Attempt # 3	1	N	1	1
Attempt # 4	1	1		
Attempt # 5	N		1	1
Attempt # 6	1			
Attempt # 7	1	1	1	
Attempt # 8	1		1	1
Attempt # 9	1		1	
Attempt # 10	1	1	1	
TOTAL:	7/10	3/10	7/10	3/10

Player #: 22	Condition #: 4	Condition #: 2	Condition #: 1	Condition #: 3
Attempt # 1		X		
Attempt # 2			X	
Attempt # 3	X	X	X	X
Attempt # 4	X	X		
Attempt # 5	X	X	X	X
Attempt # 6	X	X		
Attempt # 7	X		X	
Attempt # 8	X		X	X
Attempt # 9	X		X	
Attempt # 10	X	X	X	
TOTAL:	8/10	6/10	7/10	3/10

Player #: 23	Condition #: 3	Condition #: 1	Condition #: 2	Condition #: 4
Attempt # 1	1			1
Attempt # 2	1		1	1
Attempt # 3			1	
Attempt # 4			1	
Attempt # 5	1	1	1	
Attempt # 6	1	1	1	
Attempt # 7	N		1	1
Attempt # 8		1	1	
Attempt # 9		1		
Attempt # 10	1	1	1	1
TOTAL:	5/10	5/10	8/10	4/10

Player #: 23	Condition #: 3	Condition #: 1	Condition #: 2	Condition #: 4
Attempt # 1				X
Attempt # 2	X		X	X
Attempt # 3	X		X	X
Attempt # 4			X	X
Attempt # 5	X	X	X	
Attempt # 6	X	X	X	X
Attempt # 7			X	
Attempt # 8		X	X	
Attempt # 9		X		
Attempt # 10	X	X	X	X
TOTAL:	5/10	5/10	8/10	6/10

Appendix B

Demographic Information

Participant ID Number: _____
Age: _____
Sex: Male Female
Do you wear contact lenses? Y/N (Circle one) Do you wear glasses? Y/N (Circle one)
Current Year in School: Freshman Sophomore Junior Senior
Current Year of Eligibility: First Second Third Fourth Fifth
Have you been "redshirted' at any point? Yes No
Position(s) that you play: _____
How many years of total competitive experience do you have playing baseball/softball? _____
(Example: If you are 18, and began playing when you were 10, answer 8 years)
How many times per week do you complete batting practice? Offseason: _____ During Season: _____
Approximately how many repetitions (swings) do you complete during each batting practice? _____

For the following questions, please rate how much you were able to focus on the instructions given to you during each round of batting practice on a scale of 0-10, where 0 = I was completely unable to focus on the instructions given to me, 5= I was able to focus on the instructions given to me for some of the pitches during each round, 10= I was able to focus completely on the instructions given to me.

1. Were you able to "focus on keeping your hands in and your swing level?"
   0 1 2 3 4 5 6 7 8 9 10
2. Were you able to "focus on shaking hands with the ball?"
   0 1 2 3 4 5 6 7 8 9 10
3. Were you able to "focus on hitting the ball between the two cones?"
   0 1 2 3 4 5 6 7 8 9 10
4. What did you focus on when you were not given instructions?
   _____
   _____
   _____
   _____
   _____

Appendix C

Participant	*Metaphor*			*Focus During Control Condition*
	Hands		*Cones*	
1	8	3	8	Hands in, level swing
2	5	5	6	Make contact, keep head on the ball
3	7	3	5	Foot down, weight back
4	9	4	4	Weight back meet the ball
5	7	2	8	Wait on the ball, keep hands up
6	10	5	10	Correct footwork, throw hands at the ball
7	10	9	8	See the ball, just swing
8	10	6	10	Hit ball between cones
9	10	3	4	Use lower half and see the ball
10	8	6	8	Level swing
11	5	5	5	Nothing
12	9	2	10	Nothing
13	4	9	1	Hit it perfectly
14	10	0	10	Hit the ball
15	10	1	7	Let the ball get deep and hit opposite field
16	10	2	7	Put the barrel on the ball
17	8	6	9	Hit the ball solid off the barrel
18	10	2	10	Take good swings, Hands through the ball
19	8	2	4	Hit the ball hard
20	5	7	10	Square up on the ball
21	7	3	10	Just swing
22	9	7	10	Make solid contact
23	7	0	10	Good solid contact