2014

The creation and validation of a youth fundamental hitting scale: The assessment of youth baseball and softball hitting fundamentals and the perceived psychological barriers to hitting a pitched ball

Andrew Walsh
Edith Cowan University

2014

The creation and validation of a youth fundamental hitting scale: The assessment of youth baseball and softball hitting fundamentals and the perceived psychological barriers to hitting a pitched ball

Andrew Walsh
Edith Cowan University

Edith Cowan University

Copyright Warning

Masters Thesis

The creation and validation of a youth fundamental hitting scale: The assessment of youth baseball and softball hitting fundamentals and the perceived psychological barriers to hitting a pitched ball

Andrew Walsh
BSc(ExSpSc)

Supervisors:
Dr. G. Gregory Haff
Mrs. Barbara Howard
Dr. Sophia Nimphius

Submitted to
Edith Cowan University
in fulfilment of the degree of
Masters of Science

July, 2014
School of Exercise and Health Sciences

USE OF THESIS

The Use of Thesis statement is not included in this version of the thesis.

Declaration

I certify that this thesis does not to the best of my knowledge and belief:

1.1 Incorporate without acknowledgement, any material previously submitted for a degree or diploma in any institution of higher education;

1.1 Contain any material previously published or written by another person except where due references made in the text; or

1.1 Contain any defamatory material.

I also grant permission for the Library at Edith Cowan University to make duplicate copies of my thesis as required.

Date 30/07/14

Acknowledgements

There are numerous people I would like to thank for helping me get through this process by supporting me and encouraging me to continue better myself.

To the fellow post grads, I would like to thank you for all the advice and motivation you have given me. In particular the regular lunch group I was apart of. The entertaining lunch breaks and our very engaging topics of conversation never failed to produce laughter and at times very weird looks.

To my supervisors, Dr Greg Haff, Dr Sophia Nimphius and Mrs Barbara Howard- Thank you all for the help and guidance you have given me. I appreciate your honesty and patience with me and my project as I know at times, I found it hard to understand some concepts and aiding me with my writing. To Greg, I would like to thank you for putting you hand up to become my primary supervisor early on in the project, and helping me through the writing process of my thesis. Helping me out, especially in a field that is not native to your interests, having you on my panel was greatly beneficial. To Barb, thank you for putting up with me and helping with all the concerns I approached you about. I really enjoyed the variety of talks we have had, which most times were not thesis based but did help me through such a project.

My friends, thank you for the constant support and encouragement you have given me through the duration of my studies. In particular, to my best mate Adamn Knight, a huge thank you. You have always been there to help me with issues over the years, even happy to help me with anything I needed with my project. A giant thank you for getting me into climbing. It has saved my sanity many times and helped me clear my mind. If it weren't for your influence, I would hate to think where I would be.

Last but certainly not least, to my family, I cannot thank you enough for being there for me, emotionally and financially. To my brothers, thank you for listening to me and putting up with the constant talks about my thesis. Finally, to my mum, a massive thank you. Without you, I would not have got into uni and started my thesis. All this has been made possible because of you, all of the success I have had can be attributed to you. Additionally, thanks for keeping me motivated and fed throughout this project, especially when I wasn't living at home.

Table of Contents

List of Figures

List of Tables

Chapter 1: Introduction

1 Background

For most children, the process of learning to hit a ball begins in tee ball, where hitting a ball off of a stationary tee is used to develop fundamental batting skills (Landers & Fine, 1996). Globally, the primary role of tee ball is the development of the fundamental skills central to the sport of baseball, which include fielding, hitting, throwing and catching (Little League, 2013c). As children become more proficient at these fundamental skills and get older, the difficulty of the game is increased by placing longer distances between the bases and through the introduction of pitching (Little League, 2013a). The introduction of pitching to the game makes hitting more difficult because the child has to face a projectile instead of a stationary object. When introduced to hitting a pitched ball in many countries, all children are encouraged to hit a ball thrown to them from a machine (machine pitch) or a coach (coach pitch) before moving onto opposition pitching (player pitch) (Little League, 2013b). The linear progression associated with the various stages of hitting development allows the child to develop hitting competency while increasing hitting abilities. Unfortunately, this program is not offered in Australia and baseball players are moved from tee ball directly into player pitch scenarios.

Hitting is considered a fundamental skill in baseball, as it makes up a significant proportion of the offensive tactics seen in the sport. Situations in baseball can dictate what hitting strategies the batter needs to adopt. For example, a batter might need to hit the ball to right field in order to move a runner to second or third base (known as scoring position) or if the coach puts on a hit and run, the batter must hit the ball to the right side of the field on the ground (D. R. McIntyre & Pfautsch, 1982)

Therefore, it is important for a batter, no matter their age, to feel comfortable hitting a pitched ball in order for them to be successful in the sport. To achieve such familiarity with hitting a moving ball, a player needs to develop confidence in the batting skill, which is attained through sequential skills development, deliberate practice, and positive feedback from a qualified instructor or coach (Hebert & Landin, 1994). While feeling comfortable around a pitched ball is an important

component of the hitting process it does not guarantee success in baseball unless proper swing mechanics are also developed.

While the hitting action is a complex movement that involves the interactions of many body segments, it isn't until the end portion of the swing when power is transferred to the ball via the bat. The swing utilizes the kinetic chain to develop and transfer energy into the ball (Welch, Banks, Cook, & Draovitch, 1995) that is initiated by the front foot lifting off the ground (Escamilla et al., 2009; Welch et al., 1995) and is concluded when the bat makes contact with the ball and arms have followed through to the front shoulder. A myriad of steps are taken between front foot off ground and follow through, like the coiling process where the hips rotate anti-clockwise and the shoulders begin to rotate clockwise (for a right handed batter), and uncoiling of the shoulders to follow direction of hips (Welch et al., 1995). Additionally, the arms start to rotate against the movement of the arms and hips, to extend the coiling activity, until they reach maximal rotation, and too start to uncoil (Escamilla et al., 2009; Welch et al., 1995). This allows the bat to move around the axis of rotation, the trunk, towards the ball (Welch et al., 1995). There are notable contributions in the swing phase from specific muscle groups. In the pre-swing phase the lower-gluteus maximus and hamstrings aid in hip stabilization and power generation (Shaffer, Jobe, Pink, & Perry, 1993). Throughout the swing phase, the erector spinae and oblique activity is high; and in the follow through the back and abdominal activation is also high, allowing for rotation and stabilization of the trunk (Shaffer et al., 1993). With the variety of body segments moving at any moment in time, and muscles contributing to multiple activities, it can be hard for an inexperienced coach to correctly teach batting mechanics.

The mechanics of a baseball swing have been well established in the scientific literature (D. R. McIntyre & Pfautsch, 1982; Messier & Owen, 1985, 1986; Welch et al., 1995); With studies looking into how batters predict placement and time of ball arrival (Bahill & Karnavas, 1993), motor control and muscle activation (Bahill & LaRitz, 1984; Shaffer et al., 1993), and how a batter differentiates pitches (Gray, 2002). In addition, what visual cues batters should focus on (Castaneda & Gray, 2007), and how they aid hitting (Kato & Fukuda, 2002), batting slumps and there role on hitting strategy (Gray, 2004) have also been studied. Despite the extensive amounts of scientific literature on baseball hitting and its mechanics, there is a

paucity of research that has been conducted on youth hitting (DeRenne, Morgan, Hetzler, & Taura, 2008). Additionally, there is to the author's knowledge, no published research that has determined if the anecdotal observation that children perceive hitting to be difficult is actually valid. The Education Department of Western Australia (Education Department of Western Australia, 2001), along with the Victorian Education Department (NSW Department of Education and Communities, 2011) have independently developed a fundamental movement skill (FMS) manual which is developed primarily for school environments. The FMS manual is used to assess the presence of different components within a skill, with skills being broken up into body management, locomotor and object control skills. In the manual, a hand strike skill is present which is broken up into eight components but there is no normative data by which to compare performance. Additionally, there is no known research, which has reported an answer to why some children find hitting difficult or when the hitting skills should be been taught during tee ball.

To conduct such research, there is a need for a valid and reliable scale to assess hitting. To date, there is a scale to measure an overhead throw in the scientific literature (F. McIntyre, 2009) but to the authors knowledge a scale to assess a players' swing mechanics has yet to be developed. Extensive research has been conducted on hitting mechanics but this information has yet to be translated in to an easy to understand hitting scale that can be easily used with any age group. Teaching children correct hitting mechanics at an early stage can be difficult, particularly when most youth coaches are parent-volunteers and do not possess any formal coaching experience or knowledge (DeRenne et al., 2008). Having a simple easy to understand hitting scale could serve as a guideline for coaches to monitor the progression of players hitting fundamentals. Since swing mechanics should be the same across tee ball, baseball and softball, this would allow for a scale to be beneficial to three sporting populations. The hitting scale could serve as an educational tool for 1) players to learn correct fundamentals, 2) coaches formulate drills that emphasize correct mechanics, and 3) strength and conditioning professionals to train the appropriate muscles that will result in strength gains in the players.

These proposed benefits only outline a few options available to the general public, which can be facilitated by specific professionals (e.g. strength and conditioning coach

training a baseball batter). There is a high importance in the in the scientific and practical populations to understand the stressors youth baseball players face when hitting a pitched ball so the players can be better trained.

1.1.1 Purpose of this research

The primary purpose of the thesis was to create a hitting scale for youth players that assess the fundamentals of a baseball swing. Secondly, the purpose of this thesis was to determine the interactions between the changes in anxiety, perceived competence and fear variables have with actual hitting competence over a four-week sport specific training program.

1.1.2 Significance of this research

With most of the baseball literature focusing on senior to professional hitting mechanics, there appears to be a paucity of literature exploring hitting in youth populations. Examination of the baseball literature has outlined the phases that are important components of the swing. Further, there are references in the scientific literature that have stated there is a need for batting instructions to be easy to understand, particularly for inexperienced coaches, but no studies have been successful in this endeavour. As a result, this thesis serves to create a scale that can translate baseball literature to baseball coaches for practical application and to extend the scientific literature and on the stressors that youth baseball hitter's encounter that may influence their hitting ability.

1.1.3 Research Questions

1. How reliable and valid will a new proposed hitting scale be?
2. Will there be any significant changes in fear of failure over the course of the 4-week training schedule?
3. Will there be any significant changes in anxiety over the course of the 4-week training schedule?
4. Will there be any significant changes in perceived competence over the course of the 4-week training schedule?
5. Will there be any significant changes in actual competence over the course of the 4-week training schedule?

6. Will there be any relationship between changes in psychological measures and hitting scores obtained over the course of the 4-week training schedule?

1.1.4 Limitations

1. Even though a minimum of 1 year playing experience was required, no further playing history was taken (e.g. total years played, previous grades played and how many hours they practice) and such data may have influenced the results.
2. All research took place in Western Australia, and such data might not represent populations that are not familiar with the Australian tee ball, baseball-hitting program.
3. Honesty of responses from subjects on the questionnaires.
4. Small sample size used throughout the studies may have influenced the results attained.

Chapter 2: Literature Review

2. Literature Review

This literature review is comprised of six sections that will examine items related to the key components necessary for the development of an effective hitting scale. The first part of the review critiques and reports on reliable testing procedures related to creating a new performance scale. The second section of the present review examines psychological performance measures, specifically focusing on fear of failure, sport anxiety and physical self-perception. The third part of this review will report on what motives underpin why children participate and/or cease participation in sport. The fourth section of the review will examine the theories and stages of skill acquisition and explain how integration of such knowledge into coaching could enhance player learning. The fifth part of the review will examine possible reasons for fear of injury in children and discuss how fear may impede sporting performance. The final section will report on relevant literature related to how a baseball swing is best performed.

It is the aim of this literature review to critique relevant research regarding the creation of a performance scale, how factors like fear of failure and injury, anxiety, and perception of competence may influence sporting performance and how to optimally assess hitting competence.

2.1 Reliability and Validity

Reliability of a measure is used to describe the consistency or reproducibility of a measure (Hopkins, 2000). To determine if a measure is reliable, the investigator must perform the test multiple times on their study's population (Hopkins, 2000). This protocol assists with collecting meaningful data, while limiting the amount of meaningless or 'noisy' data gathered by the tested measure. Additionally when determining the reliability of a scale, the validity is also important as it is used to describe if a measure examines what it intends to examine (Hopkins, 2011).

Reliability and the appropriate statistical techniques for its assessment are challenging issues for most performance analysts (O'Donoghue, 2007). Reliability denotes the repeatability or the consistency of a specific measure (Hopkins, 2000); in contrast

validity measures the degree to which a test measures what it is expected of it (Thomas, Nelson, & Silverman, 2011). A common methodology for determining the validity of a scale is to look at its content. Content validity is defined as the amount of agreement there is between a sample of items, which establish an satisfactory definition for the construct (Polit & Beck, 2006). For new testing protocols and screenings, the accuracy of such tools depends on the transparency of the testing and measurement or procedures (Bahr & Holme, 2003). As precision is fundamental for reliable results (Gabbe, Bennell, Wajswelner, & Finch, 2004) all measures and results must be replicated by different testers over different time periods, in addition to being reproducible with comparable testing populations (Hayen, Dennis, & Finch, 2007). Much of the improved agreement seen in robust studies is due to testers becoming familiar with the performance test rather than through improvement in reliability of observations (O'Donoghue, 2007). Poor reproducibility is a barrier to drawing conclusions on whether the variable is being measured properly, because the source of the variation is uncertain and statistical power is reduced (Haas, 1995; Hayen et al., 2007).

To examine the reliability of a scale or a test, Hopkins (2000) argues that at least 50 participants are needed across at least three trials. Many studies do fail to meet this requirement (Askling, Nilsson, & Thorstensson, 2010; Bennell et al., 1998; Fenter, Bellew, Pitts, & Kay, 2003; Gabbe et al., 2004; Scott, Bond, Sisto, & Nadler, 2004; Shultz et al., 2006). However, smaller sample size reliability studies, such as pilot or hypothesis generating studies, have potential benefits as they elucidate potential issues related to the ease of use for a measurement scale or procedural problems associated with the testing process (van Teijlingen & Hundley, 2001). With a small cohort of participants taking part in these investigations, it should be considered a limitation (Askling et al., 2010; Dennis, Finch, Elliott, & Farhart, 2008; Gabbe et al., 2004). However, Hopkins (2000) states that studies with smaller sample sizes should be considered pilot or hypothesis generating studies upon which future research can be built. It is noteworthy that conclusions from studies that rely on a very limited age distribution can only be applied to that specific age group in the testing population and not to the wider public (Gabbe et al., 2004).

These issues are relevant to the emerging field of performance analysis, which involves assessing essential movements that can provide detailed information to coaches and players seeking to improve performances (Hughes & Bartlett, 2002; Thomson, Lamb, &

Nicholas, 2013). This strategy has also been used to assess physical, tactical and technical abilities of individual players (Hughes, 2004). It has been used widely with team sports such as soccer (Bloomfield, Polman, & O'Donoghue, 2007; Clark, 2010; Tenga, Kanstad, Ronglan, & Bahr, 2009), rugby (Sykes, Twist, Hall, Nicholas, & Lamb, 2009; Vaz, Mouchet, Carreras, & Morente, 2011), and volleyball (Drikos & Vagenas, 2011; Hughes & Daniel, 2003) but also individual sports like athletics (Brown, 2005; Brown & O'Donoghue, 2007), racket sports (O'Donoghue, 2002; O'Donoghue & Ingram, 2001) and combat sports (Atan & Imamoglu, 2005). Performance analysis is a developing field when compared to more traditional sport science based research methods like physiology and biomechanics (Glazier, 2010). The studies in performance analysis have included psychological measures to help understand what the performer is doing and the broader influences on performance, such as have looked into the role of anxiety (Burton, 1988; Martens, Burton, Vealey, Bump, & Smith, 1990; Swain & Jones, 1996), and self-confidence (Kais & Raudsepp, 2004).

A study by Cooper, Hughes, O'Donoghue, and Nevill (2007) examined various performance indicators and found that a less experienced analyst was less reliable in scoring performance indicators than expert analysts. Such limitations are a frequent problem in performance analysis, especially when character definitions were not clear, situations share many common characteristics to differentiate between two or more movements are difficult (Hughes, Cooper, Nevill, & Brown, 2003). With researchers calling for simplifying quantified data, making the relevant information accessible for coaches to implement in their sport (Escamilla et al., 2009), important experienced and inexperienced analysts can score the skill consistently.

2.2 Psychological Performance Measures

2.2.1 Physical Self-Perception Profile/Physical Importance Profile

The Physical Self-Perception Profile was developed by Fox and Corbin (1989) through their work examining physical self-esteem (Eklund, Whitehead, & Welk, 1997). The Physical Self-Perception Profile was comprised of 24 questions, measuring five sub domains: physical conditioning, physical strength, sport competence and body

attractiveness, and physical self worth; and were represented equally and in sequential order (Fox & Corbin, 1989). The physical self worth serves to give a general representation of physical conditioning, physical strength, sport competence and body attractiveness sub-domains (Fox & Corbin, 1989). The final factor that is measured by the Physical Self-Perception Profile is global self worth (Eklund et al., 1997). The Physical Self Perception Profile is often administered with the Physical Importance Profile (PIP). The Physical Importance Profile permits the individuals to subjectively rate the importance of self-perception to themselves in the sub domains of sport, strength, condition and body (Page, Fox, Biddle, & Ashford, 1993). The questions were open-ended and were comprised of two statements of opposing nature (e.g. Some kids feel uneasy when it comes to doing vigorous physical exercise *but* other kids feel confident when it comes to doing vigorous physical exercise), and required the participant to read both statements and decide which best applied to them, before selecting whether it was either sort of true or very true for them.

The Physical Self-Perception Profile has been shown to be reliable for both males and females college students using Cronbach's alpha coefficient, with scores ranging between 0.81 and 0.92 (Fox & Corbin, 1989). Additionally, the test-retest reliability ranged from 0.74 and 0.92 for a 16-day period, and 0.81 to 0.88 for a 23-day lapse period (Fox & Corbin, 1989). The overall estimate for good fit for the four sub categories; body, sport, conditioning and strength were analysed by using chi-squared test. With an acceptable score for good fit set at 2.0 or below in the study, both males, 1.95, and females 1.79, fell into the acceptable range (Fox & Corbin, 1989). The Physical Self-Perception Profile was initially tested on male and female college students before being adapted to test children and youth by Whitehead (1995). The Children-Youth Physical Self-Perception Profile was then found reliable and valid by Eklund et al. (1997) and Hagger, Ashford, and Stambulova (1998). The non-normative fit index (NNFI) and comparative fit index (CFI) both exceeded the 0.90 criterion set in the study, which suggests the measures of the physical self-perception profile construct is highly reliable in measuring the nature of the physical self-perception inventory. The profile was later shown to be valid and reliable with children from as young as nine years (Welk, Corbin, Dowell, & Harris, 1997); but it was shown that the children may find it hard to distinguish between the sub domains of physical self worth, which serves as a general representation of physical conditioning, physical strength, sport

competence and body attractiveness (Raustorp, Ståhle, Gudasic, Kinnunen, & Mattsson, 2005).

2.2.2 Fear of Failure

The fear of failure inventory was originally developed as a 27-item measure developed by Herman (1990b); with the shorter 9-item measure was developed by Thrash and Elliot (2003). Fear of failure was originally described as a need to avoid failure among college-aged males and was later described to be a motive to avoid failure (Conroy, 2003). The fear of failure measure was based on the cognitive-motivational-relational theory of emotion (Lazarus, 1991) that fundamentally states that the individual must believe likely or possible, or perceive they are failing, or that failing in the situation they are currently in, and will result in one or more aversive consequences (Conroy, Metzler, & Hofer, 2003). Such aversive consequences can be experiencing shame or embarrassment, devaluating ones self-esteem, having uncertain future, having important others lose interest, and, upsetting important others (Conroy, 2001b; Conroy et al., 2003; Conroy, Willow, & Metzler, 2002). Fear of failure has been shown to impact areas such as achievement, physical and mental health (Conroy, 2001a).

The full fear of failure measure was shown to have internal consistency with a score of 0.74 based on the Kuder-Richardson 21 estimate, which examines consistency reliability of a measure (Herman, 1990b). The 9-item questionnaire reliability was examined by Thrash and Elliot (2003), in which they administered six questionnaires, one of which was the short version of fear of failure, to 161 undergraduate students. In the study, the fear of failure inventory was shown to be reliable, achieving a Cronbach alpha score of 0.85. The 9-item measure covers the same content demographic, correlates strongly with and displays internal consistency and predictive validity as the full 27-item measure (Thrash & Elliot, 2003).

2.2.3 Sports Anxiety Scale-2

The sport anxiety scale (R. E. Smith, Smoll, & Schutz, 1990) was originally created in 1990, after empirical data concerning differential consequences and origins of cognitive and somatic anxiety (R. E. Smith, Smoll, Cumming, & Grossbard, 2006). The sport

anxiety scale consisted of 21-items measuring somatic anxiety and two forms of cognitive anxiety, worry and concentration disruption (Dunn, Dunn, Wilson, & Syrotuik, 2000; R. E. Smith et al., 1990). Since the inception, the sport anxiety scale has been used across a variety of sporting contexts and has appeared to be a reliable and valid means of measuring cognitive and somatic sport anxiety (Giacobbi Jr & Weinberg, 2000; R. E. Smith et al., 1990). However, the sport anxiety scale was found to not be applicable to children below the 10th grade, therefore the sport anxiety scale-2 was created to target the younger population (R. E. Smith et al., 2006).

The sport anxiety scale-2 is a 15-item measure, designed to represent the sport anxiety scales subscale construct (R. E. Smith et al., 2006). The inventory was tested on 1,038 nine to 14 year old athletes (R. E. Smith et al., 2006). To measure internal consistency, the Cronbach alpha coefficients were calculated and for all three (somatic anxiety, worry and concentration disruption) variables exceeded 0.89 for all age groups. The 15 item measure showed reliability with an alpha score of 0.91 (95% CI= 0.90- 0.92). Test-retest reliability of the whole scale was 0.87, which fell into the study's acceptable stability range (R. E. Smith et al., 2006). Comparing the correlations between the sport anxiety scale, and the sport anxiety scale-2 tested validity, with the two scales achieving correlation at 0.90 (R. E. Smith et al., 2006). The correlations were high enough to draw the conclusion that the 15-item sport anxiety scale-2 was tapping into the same constructs as the original 21-item sport anxiety scale measure (R. E. Smith et al., 2006)

2.3 Youth Sports

Participating in sports offers a wide range of benefits, from development of respect and self-confidence, to understanding aerobic and anaerobic capacitates and increased academic achievements (Bailey, 2006). Additionally, sport participating encourages teamwork, working by the rules and respecting authority (Stuart & Ebbeck, 1995), which are all important qualities for adult life.

For many youth, participating in organized sports is seen as a significant cultural event (Berryman, 1996) and a rite of passage (Martens & Seefeldt, 1979). In Australia, between the ages of five to 14, 60% participated in at least one sport out of school hours (Australian Bureau of Statistics, 2012b). The three most popular sports and baseball are

shown in Table 1. Frequently cited motives for children playing sport were having fun, learning skills, testing one's abilities and experiencing excitement and personal accomplishments (M. R. Weiss, 1993) The most frequently cited methods for withdrawal from sports were lack of fun, skill development and playing time, excessive parental pressure and emphasis on winning and negativistic coaching (Petlichkoff, 1996).

Table 1. Participation and the percentage of the top three sports and baseball in Australia

Sport	Participants (n)	Percentage (%)
Swimming	502,900	19
Soccer	360,400	13
Australian Rules Football	235,100	9
Baseball	19,000	0.7

Note: Adapted from data presented by the Australian Bureau of Australian Bureau of Statistics (2012a)

Participating in developmental sports can often be the first exposure a child has to organized sport. Sport can offer the participant a chance to have fun, learn new skills, test their own abilities, excitement and personal accomplishments, which are the most frequently cited motives for young children's participation (M. Weiss, 1993). For coaches of young athletes, it is important to promote self worth and fun over such principals as competition, pushing activities that are far too advanced and comparing athletes to those who are more advanced developmentally (Martens, 1996). Self-worth concept embodies the feeling of being competent and worthy and to experience success (Martens, 1996). Positive experiences and feeling of competence was important for the feeling of accomplishment, recognition for success and feeling of worthiness (Martens, 1996). Participating in youth sport programs have also shown to have positive developments outside of the sporting arena, like social development, higher academic and occupational achievement and psychological well being (Barber, Eccles, & Stone, 2001; Brunelle, Danish, & Forneris, 2007; Gore, Farrell, & Gordon, 2001). The benefits of sport are numerous however children's participation peaks early (11 years of age) and has a steady decline in the remaining teen years (Ewing & Seefeldt, 1996).

People who cease to play sport can be placed into two categories, drop out and burnout. A drop out is classified as a person who prematurely ended their career before they have reached the peak of their performance (Cervelló, Escartí, & Guzmán, 2007); where a burnout is defined as a maladaptive psychological outcome associated with sport participation (R. E. Smith, 2007) and is characterized by emotional and physical exhaustion, sport devaluation and reduced sense of accomplishment (Cresswell & Eklund, 2006; Raedeke, Lunney, & Venables, 2002). There is limited published research on the barriers preventing young children from participation in sport (Allender, Cowburn, & Foster, 2006) even though it has been identified that the key risk period for a dropout is the transition from childhood to adulthood (Coakley & White, 1992). Some possible reasons why children cease participation in sport can be due to the structure of sport taking the focus off the child and moving it toward the parents, with the parents forcing their values and expectations onto their children (Rowland, 1997). This is termed as achievement by proxy, whereby the parents are vicariously living through the success of their child (Beilock, Wierenga, & Carr, 2002). Such attitudes can then influence the parents self worth (Smoll, 2001) and can lead to such feelings of increased competitive anxiety, lowered enjoyment and enthusiasm, guilt about the cost of participation, overuse injuries in the children and in some cases child abuse (Bennell et al., 1998). Some of these symptoms can lead to the athlete burning out and no longer enjoying sport.

Athletes suffering from burnout usually experience intensive participation and considerable success (Brady, 2004). Additionally, the athlete will indulge in, but not limited to, high training volumes, demanding self- or other-imposed expectations, continuous intensive competition and excessive parental involvement (Coakley, 1992). Furthermore, encouraging athletes to specialize in a sport or position early can cause burnout (Brady, 2004). Highly talented athletes can often cultivate a one-dimensional notion of self-concept, which can result in a narrow set of life experiences that are based around their specialized athletic role (Coakley, 1992). This is a result of their intensive training program, which can result in socially restricting the athletes (Rowland, 1997). The athletic identity can be so consuming that it can lead to the absence of a normal childhood, which has been labelled as a disappearance or erosion of childhood (Joseph Baker, 2003). Engaging in such an athletic quest can result in the athlete developing psychological, emotional and physical consequences (Bennell et al., 1998).

Early specialization in a sport is defined as an intense year-round training in a single sport (Malina, 2010). This single focus sport training with aims to improve skill and performance can be termed as deliberate practice (Côté, Lidor, & Hackfort, 2009). The role deliberate practice plays in improving a skill is highly contested amongst researchers (J Baker, Cote, & Abernethy, 2003; Dalton, 1992; Ericsson, Krampe, & Tesch-Römer, 1993; Wiersma, 2000). The absence of enjoyment is of greatest concern for advocates of deliberate practice, as lack of enjoyment is one of the main reasons cited for youth drop out (Ewing & Seefeldt, 1996; Gould, 1987; Weiss & Petlichkoff, 1989). Some researchers have recommended that child athletes should participate in a variety of sporting activities and focus on sport specialization after adolescence (Magill & Anderson, 1988; Rowland, 1997). Parents and coaches of child athletes need to understand that there is generally very little relationship between early specialization and later achievement in a specific sport (Rowland, 1997) and that intensive specialization may hinder normal childhood development and impede the cultivation of additional competencies (Wooten, 1994).

2.4 Skill Acquisition

Throughout life, we complete a variety of tasks, like driving a car or how to catch and throw a ball, which all require us to be taught the appropriate actions; and experienced professionals often teach these skills to us (Ericsson, 2006). Under this guidance, which can take months, the individual learns the fundamentals of the job until they become proficient (Ericsson, 2006). This process is no different for sport; with the notable difference is that proficiency can often take years to obtain.

Achieving proficiency in a sporting skill typically takes approximately 10,000 hours of deliberate practice and learning, with more challenging tasks requiring a greater time commitment (Anderson, 1982). The process of skill acquisition involves three phases: initial, elementary and mature (Gallahue & Cleland-Donnelly, 2003). In the first stage, the skill gets broken down into small phases by the performer to make it easier to learn (Davids, Lees, & Burwitz, 2000; Handford, Davids, Bennett, & Button, 1997) in a procedure called freezing (Bernstein, 1967; Vereijken, van Emmerik, Whiting, & Newell, 1992; Williams, Davids, & Williams, 1999), while progression through to the second and third stages there are fewer errors and increasing skill proficiency (Davids et al., 2000).

As performers become more successful in skill completion, they should execute the skill without applying much focus to the skill. This facilitates a focus on other sensory information that is superfluous to the skill achievement, but not necessarily the broader goal, for example hitting a ball through or over the opposition team (Gray, 2004). To test this theory, researchers have compared novice to expert performers by manipulating visual (Leavitt, 1979; M. D. Smith & Chamberlin, 1992) or auditory (Abernethy, 1988; Castiello & Umiltà, 1992; D. J. Rose & Christina, 1990) stimuli. All studies showed that expert performers achieved better results than their novice counterparts. Variances found in the visual stimuli studies (Leavitt, 1979; M. D. Smith & Chamberlin, 1992), could be explained by the difference visual processing ability between the groups (Gray, 2004), as novice performers rely heavily on visual cues (Williams, Davids, Burwitz, & Williams, 1992). Other studies (Abernethy, 1988; Castiello & Umiltà, 1992; D. J. Rose & Christina, 1990) have examined the manipulation of auditory cues it is effect of reaction times, with one study noting that, simple stimulus detection may not place sufficient demands on the performers attention processing (Gray, 2004). To test this theory, researchers have analysed the effects of introducing a second task, including auditory cues as it impacted on golf putting, and it increased putting errors (Beilock, Wierenga, et al., 2002). Ultimately the decrement in putting performance arose from novice performers not having sufficient attentional focus to complete the putting task, and attend to the auditory cues (Beilock, Wierenga, et al., 2002). Similarly, Beilock, Carr, MacMahon, and Starkes (2002) examined dribbling ability with both dominant and non-dominant foot with both novice and expert soccer players. These results appear to suggest that novice learners require more attention to be focused on the process of the skill they are learning, than their more advanced sporting counterparts. This effect could apply to youth baseball players learning to hit and may require being in an environment that is conducive to learning.

Skill focus attention is directed at any specific section of a motor action (e.g the movement of the bat), while environmentally focused attention focuses on anything in the environment that does not relate directly to the skill (e.g. placement of fielders) (Castaneda & Gray, 2007). A study analysing the two different attentional focus programs in both novice and expert baseball players, revealed that the novice group's hitting competence diminished when using an environment focus but improved with the use of skill-focused attention (Gray, 2004). Optimum hitting competence was achieved when batters' attention was focused on the ball leaving the bat (Castaneda & Gray,

2007) or on distant markers during balancing exercises (McNevin, Shea, & Wulf, 2003). Conversely, novice performers benefitted greater from focusing on a more proximal motor effector (Wulf, McNevin, Fuchs, Ritter, & Toole, 2000). Conversely to the Gray (2004) study, expert performance improved when asked to focus on how their actions effected the environment they were playing in. A similar result was found in golfers, where expert golfers performed better when instructed to putt at higher velocities instead of paying attention to cues that promoted accuracy, which was better suited to novice golfers (Beilock, Bertenthal, McCoy, & Carr, 2004). These findings support the current theory in skill acquisition, namely that novice performers should place more attention on each stage of a motor act unlike expert performers who are able to focus on fast, efficient control of the procedures and do not rely on the working memory or attention to execute the skill successfully (Anderson, 1982; Castaneda & Gray, 2007).

For a coach, breaking down a complex task, like kicking a soccer ball or hitting a pitched baseball and providing timely feedback, are crucial skills for developing their athletes (Davids, Bennett, Handford, & Jones, 1999). Feedback is an important variable, because it can inform and motivate to the performer (Hebert & Landin, 1994). Feedback is generally divided into knowledge of results and knowledge of performance. While knowledge of result is the most readily source of information to the performer, through visual means, knowledge of performance is more commonly used on the field but has not been as intensively researched (Hebert & Landin, 1994).

The field of sport pedagogy has provided another source of data to help examine the role of verbal feedback (Lee, Keh, & Magill, 1993). Two tendencies have emerged which are: 1) verbal persuasion enhances learning when examining movement patterns and 2) the length of the practice influences the impact of the teachers' feedback when the outcome score is being assessed (Hebert & Landin, 1994). Similarly, Hebert and Landin (1994), examined the role of augmented verbal feedback, learning model trials and feedback play on learning a complex motor skill. They concluded that teacher feedback did not provide instant improvement or influence, but it did aid with development of movement patterns. Furthermore, among the four treatment groups, augmented feedback, learning model trials, learning model and augmented feedback and control, the group that received both treatments demonstrated the best improvement. From a practical standpoint this means that teachers and coaches should explain the skill, show a few demonstrations and then let the students perform the skill

(Hebert & Landin, 1994). Following such protocol, could allow for better technique present in the students, as they have been exposed to both visual and verbal demonstrations of the skill.

Being able to determine the placement of a baseball, in time and space, is a key skill for every successful batter (Bahill & Karnavas, 1993). Furthermore, understanding how a baseball batter employs different attention focus programs, specifically internal versus external and skill focused versus environmental, could make skill acquisition easier (Castaneda & Gray, 2007). One skill acquisition theory posits that influences on an athletes attention focus depend largely on their expertise (Anderson, 1982). Comparing highly skilled to novice hitters, Castaneda and Gray (2007) examined how differing attention foci programs helped in predicting hitting competence. They found that skilled batters' performances were better predicted by the internal versus external parameter, while novice batters performances were better accounted for by skill focused versus environmental perimeter. Similarly a study examining golf pitch shots, revealed that expert performers executed the skill better when they focused on where the ball should land instead of how much force to apply during the swing (Perkins-Ceccato, Passmore, & Lee, 2003). This effect has been explained by a theory stating that getting expert performers to focus on skill execution would circumvent the advanced motor programs for a skill that has been developed through extensive practice and experience (Castaneda & Gray, 2007). Field notes from a study by French, Spurgeon, and Nevett (1995) showed that children in the 11- 12 age group used more advanced strategy than the 8 - 9 year old age group. It was noted that very few advanced strategies were used in the 7 - 10 year old age group. While this result is to be expected, this study was completed in America where baseball is started at an early age, and therefore the results seen in these age groups would not be reflective of what is seen in Australia in the same population. No such study like French et al. (1995), has been conducted on Australian baseball players, therefore comparison amongst the age groups with regards to the strategies employed by the players would be difficult, and therefore such research should be conducted.

2.5 Fear of Injury

Participating in a sport is frequently accompanied by an inherent risk of injury, with a study revealing sports (18%) are the second highest mechanism of injury, only behind falls (24%) for children and adolescents (Gallagher, Finison, Guyer, & Goodenough, 1984). Returning from injury can be a difficult time for the athlete, with research showing that if the athlete is not ready, both physically and mentally, they can experience higher fear of failure or re-injury (Heil, 1993). Returning injured athletes may not be the only population that can experience fear of injury. Fear of injury in sport is defined as "the unpleasant feeling apprehension or distress caused by the anticipation of physical damage to the body or part of the body" (Short, Reuter, Brandt, Short, and Kontos (2004), p. 39); and that fear exists when the performer does not possess confidence in their ability to perform in a threatening or strenuous situation (Magyar & Chase, 1996). Additionally, there has been links drawn between self-efficacy and fear of injury (Short et al., 2004). For example, a player returning from injury may possess lower self-efficacy than they did pre-injury and upon returning to sport the player may opt to perform activities at a lower performance rate to accommodate the injury (Doyle, Gleeson, & Rees, 1998), play at low risk sporting events, or stop performing altogether (Snyder, 1990).

Baseball in the developmental grades, like many youth sports, can be a place where injuries are common. It has been reported that between the ages of five to fourteen, many injuries sustained in baseball are from overuse (particularly in pitching), sliding, batters being hit by the baseball, players being struck by the bat and blunt chest wall injuries, with direct contact by the ball as the most common mechanism of serious injury (Risser et al., 1994). A survey conducted in 1994, concluded that 68% of ball-related injuries occurred during the act of fielding a ball, specifically catching (Pasternack, Veenema, & Callahan, 1996), and a common site of injury is the face (Risser et al., 1994). Reasons cited for such common occurrence of injuries in this age group is that the children are often less coordinated, slower to react and have a fear of being struck by the ball, and experiencing such injuries could make the player more timid, which could impede the players development (Risser et al., 1994). Field notes by Martens, Rivkin, and Bump (1984) have noted that possible reasons why development may be slowed in youth age groups is that often pitchers are very erratic, and this unpredictability can cause fear in the batter. Concern has been raised about injuries to

the face, specifically the eye region (Grin, Nelson, & Jeffers, 1987; Nelson, Wilson, & Jeffers, 1989). It has been reported that approximately one third of baseball-related eye injuries have resulted from the batter being struck by a pitched ball (Risser et al., 1994). To aid with reducing such injuries, it has been recommended to use an adult pitcher or pitching machine, or a tee and safety baseballs (Risser et al., 1994). Critics argue the use of soft safety baseballs would change the nature of the game and development of players (Yamamoto, Inaba, Okamura, Yamamoto, & Yamamoto, 2001); though it has been shown the use of safety baseballs is a safer option, as a safety ball would need to travel at 36 $m.s^{-1}$, compared to 25-27 $m.s^{-1}$ for a standard baseball, to cause a skull fracture (Vinger, Duma, & Crandall, 1999). Additionally, Vinger et al. (1999) demonstrated that a safety baseball travelling at 33.5 $m.s^{-1}$ caused significantly less damage to the eye, than a regular baseball travelling at 24.6 $m.s^{-1}$. By introducing safety measures like the safety baseball, through the transitional period from tee ball to baseball, it could help to minimise injury to the players; and it could better aid in skill development, as the children are less likely to be fearful of being struck and injured by the ball.

2.6 The Baseball Swing

Hitting in baseball is a difficult task, but plays an important part of the game. Hitting a baseball has been described as one of hardest sporting skills to learn (Escamilla et al., 2009), as it requires the hitter to use a round bat to hit a round ball (D. R. McIntyre & Pfautsch, 1982). With the inherent difficulty of hitting a round baseball, it is important that players are taught the correct mechanics at a young age.

Baseball hitting has been extensively research with most studies focusing on how batters predict placement and time of ball arrival (Bahill & Karnavas, 1993), hitting mechanics, motor control and muscle activation (Bahill & LaRitz, 1984; D. R. McIntyre & Pfautsch, 1982; Messier & Owen, 1986; Shaffer et al., 1993; Welch et al., 1995), how a batter differentiates pitches (Gray, 2002), how batting slumps affect batting strategy (Gray, 2004), how batters use visual strategies to assist hitting (Kato & Fukuda, 2002) and determining appropriate focus when batting (Castaneda & Gray, 2007). Baseball hitting is a particularly challenging sporting task for everyone who attempts it (DeRenne et al., 2008; Race, 1961). When examining the scientific literature the typical

main research focus has been centred on the adult or professional hitter, with little attention directed at the youth hitter (DeRenne et al., 2008).

Many youth sports focus on developing the necessary skills to play the game at a proficient level, but often it is the case that coaches are not trained sufficiently for the task. Baseball is no different, with most youth coaches are parent-volunteers who lack any education on hitting (DeRenne et al., 2008). Limited knowledge possessed by coaches can make teaching complex skills to the players difficult, and may hinder their development. Much of the information on hitting has been subjected to rigorous scientific studies (Bahill & Karnavas, 1993; Bahill & LaRitz, 1984; Shaffer et al., 1993; Welch et al., 1995) and the scientific community can address the qualitative information on youth hitting so that it can be understood by the average citizen (Escamilla et al., 2009). Providing coaches with important scientific information that is simple to understand and breaks the skill down into phases, like an objective scale does, could be one solution.

Creating an objective scale to assess the hitting skill, the examination biomechanical data is important, but as coaches are often the means of which children learn the skills, it is important that such scientific data is tailored towards the coaching population. Biomechanically the baseball swing can be divided into three discrete phases; 1) front foot off ground, 2) front foot making full contact on ground, and 3) ball contact with the bat (Welch et al., 1995). Using these phases as guidelines for their study, Escamilla et al. (2009) proposed a 4th factor, labelled 'hands started to move forward', which took place between front foot making contact and the ball making contact with the bat. The two studies (Escamilla et al., 2009; Welch et al., 1995) examined youth and adult, and adult populations respectively, both studies demonstrated many similarities in their data. Welch et al. (1995) and Escamilla et al. (2009) reported similarities in stride phase (0.40s), transition and bat acceleration phase (0.18s and 0.21s, respectively), knee flexion, pelvis and upper torso rotation and flexion of lead elbow in comparison to back elbow. This data highlights that the characteristics of both youth and adult swings are very similar and this result is supported by Shaffer et al. (1993) study which concluded that, baseball batting is a series of coordinated muscle activation that starts with the lower extremities, continues up through the trunk and concludes in the upper extremities.

Comparisons of biomechanical properties between youth and professional baseball players have revealed that although the swing across both age groups were functionally similar, the older age group swung faster (Escamilla et al., 2009). Both youth and professional hitters shared many similarities in their swings, for example, transition from lead foot off ground to bat-ball contact and bat acceleration phases but the stride phase was approximately 40% greater in duration in the adult population (Escamilla et al., 2009). In this phase the batter "loads" or "cocks" ready to hit, in which the energy created by the lower body is then transferred to the ball, via the trunk and upper body (Messier & Owen, 1986; Milburn, 1982). Similarly, Welch et al. (1995) reported differences being shown in the absolute time spent in transition and bat acceleration phases, 0.18 seconds in their study, against 0.21 seconds for Escamilla et al. (2009). The differing ball delivery method, tee (Welch et al., 1995) versus pitching machine (Escamilla et al., 2009) could explain this, as one hitting drill may influence the time spent in the stride phase.

2.7 Summary

The hitting action is a critical skill in the sports of tee ball, baseball and softball. Therefore, the ability to execute the skill properly is important for athletes to possess and for coaches to be able to teach. Unfortunately, while the batting swing has been extensively researched, many studies have focused on adult and professional athletes and have not examined the transitional period where children graduate from tee ball to baseball or softball, especially in Australia.

An apparent theme with this literature review illustrates a great lack of understanding on whether young baseball or softball players do exhibit proper batting mechanics that are entering their respective sports and how this may affect their future participation. While there is research that demonstrates what a swing should look like, there is an absence of conveying such information to the coaches. The focus of this thesis was to provide a detailed account of hitting literature, which helped create a baseball hitting scale for youth. Additionally, to explore the psychological factors which may influence a youth's hitting competence.

References:

Abernethy, B. (1988). Dual-task methodology and motor skills research: Some applications and methodological constraints. *Journal of Human Movement Studies, 14*(3), 101-132.

Allender, S, Cowburn, G, & Foster, C. (2006). Understanding participation in sport and physical activity among children and adults: A review of qualitative studies. *Health Education Research, 21*(6), 826-835.

Anderson, J. R. (1982). Acquisition of cognitive skill. *Psychological Review, 89*(4), 369-406.

Askling, C. M, Nilsson, J, & Thorstensson, A. (2010). A new hamstring test to complement the common clinical examination before return to sport after injury. *Knee Surgery, Sports Traumatology, Arthroscopy, 18*(12), 1798-1803.

Atan, T, & Imamoglu, O. (2005). Competition analysis of world greco-roman and world free-style wrestling championships. *International Journal of Performance Analysis in Sport, 5*(1), 31-40.

Australian Bureau of Statistics. (2012a). *Children's Participation in Cultural and Leisure Activities, Australia, Apr 2012*. Canberra, Australia.

Australian Bureau of Statistics. (2012b). *Children's Participation in Cultural and Leisure Activities, Australia, Apr 2012*. Retrieved from http://www.abs.gov.au/ausstats/abs@.nsf/Products/4901.0~Apr+2012~Main+Features~Sports+participation?OpenDocument.

Bahill, A. T, & Karnavas, W. J. (1993). The perceptual illusion of baseball's rising fastball and breaking curveball. *Journal of Experimental Psychology: Human Perception and Performance, 19*(1), 3.

Bahill, A. T, & LaRitz, T. (1984). Why can't batters keep their eyes on the ball? *American Scientist, 72*(3), 249-253.

Bahr, R, & Holme, I. (2003). Risk factors for sports injuries- A methodological approach. *British Journal of Sports Medicine, 37*(5), 384-392.

Bailey, Richard. (2006). Physical education and sport in schools: A review of benefits and outcomes. *Journal of School Health, 76*(8), 397-401.

Baker, J, Cote, J, & Abernethy, B. (2003). Sport-specific practice and the development of expert decision-making in team ball sports. *Journal of Applied Sport Psychology, 15*(1), 12-25.

Baker, Joseph. (2003). Early specialization in youth sport: A requirement for adult expertise? *High Ability Studies, 14*(1), 85-94.

Barber, B. L, Eccles, J. S, & Stone, M. R. (2001). Whatever happened to the jock, the brain, and the princess? Young adult pathways linked to adolescent activity involvement and social identity. *Journal of Adolescent Research, 16*(5), 429-455.

Beilock, S. L, Bertenthal, B. I, McCoy, A. M, & Carr, T. H. (2004). Haste does not always make waste: Expertise, direction of attention, and speed versus accuracy in performing sensorimotor skills. *Psychonomic Bulletin & Review, 11*(2), 373-379.

Beilock, S. L, Carr, T. H, MacMahon, C, & Starkes, J. L. (2002). When paying attention becomes counterproductive: Impact of divided versus skill-focused attention on novice and experienced performance of sensorimotor skills. *Journal of Experimental Psychology: Applied, 8*(1), 6.

Beilock, S. L, Wierenga, S. A, & Carr, T. H. (2002). Expertise, attention, and memory in sensorimotor skill execution: Impact of novel task constraints on dual-task performance and episodic memory. *The Quarterly Journal of Experimental Psychology: Section A, 55*(4), 1211-1240.

Bennell, K, Talbot, R, Wajswelner, H, Techovanich, W, Kelly, D, & Hall, A. J. (1998). Intra-rater and inter-rater reliability of a weight-bearing lunge measure of ankle dorsiflexion. *Australian Journal of Physiotherapy, 44*(3), 175-180.

Bernstein, N. A. (1967). *The control and regulation of movements*. London: Pergamon Press.

Berryman, J. (1996). The rise of boys' sports in the United States, 1900 to 1970. In F. L. Smoll & R. F. Smith (Eds.), *Children and youth in sports: A biopsychosocial perspective.* Dubuque, IA: Brown and Benchmark.

Bloomfield, J, Polman, R, & O'Donoghue, P. (2007). Reliability of the Bloomfield movement classification. *International Journal of Performance Analysis in Sport, 7*(1), 20-27.

Brady, F. (2004). Children's organized sports: A developmental perspective. *Journal of Physical Education, Recreation & Dance, 75*(2), 35-41.

Brown, E. (2005). Running strategy of female middle distance runners attempting the 800m and 1500m" Double" at a major championship: A performance analysis

and qualitative investigation. *International Journal of Performance Analysis in Sport, 5*(3), 73-88.

Brown, E, & O'Donoghue, P. (2007). Relating reliability to analytical goals in performance analysis. *International Journal of Performance Analysis in Sport, 7*(1), 28-34.

Brunelle, J, Danish, S. J, & Forneris, T. (2007). The impact of a sport-based life skill program on adolescent prosocial values. *Applied Developmental Science, 11*(1), 43-55.

Burton, D. (1988). Do anxious swimmers swim slower? Reexamining the elusive anxiety-performance relationship. *Journal of Sport & Exercise Psychology, 10*(1), 45-61.

Castaneda, B, & Gray, R. (2007). Effects of focus of attention on baseball batting performance in players of differing skill levels. *Journal of Sport and Exercise Psychology, 29*(1), 60.

Castiello, U, & Umiltà, C. (1992). Orienting of attention in volleyball players. *International Journal of Sport Psychology, 23*(4), 301-310.

Cervelló, E. M, Escartí, A, & Guzmán, J. F. (2007). Youth sport dropout from the achievement goal theory. *Psicothema, 19*(1), 65-71.

Clark, P. (2010). Intermittent high intensity activity in English FA premier league soccer. *International Journal of Performance Analysis in Sport, 10*(2), 139-151.

Coakley, J. (1992). Burnout among adolescent athletes: A personal failure or social problem. *Sociology of Sport Journal, 9*(3), 271-285.

Coakley, J, & White, A. (1992). Making decisions: Gender and sport participation among British adolescents. *Sociology of Sport Journal, 9*(1), 20-35.

Conroy, D. E. (2001a). Fear of failure: An exemplar for social development research in sport. *Quest, 53*(2), 165-183.

Conroy, D. E. (2001b). Progress in the development of a multidimensional measure of fear of failure: The Performance Failure Appraisal Inventory (PFAI). *Anxiety, Stress and Coping, 14*(4), 431-452.

Conroy, D. E. (2003). Representational models associated with fear of failure in adolescents and young adults. *Journal of Personality, 71*(5), 757-784.

Conroy, D. E, Metzler, J. N, & Hofer, S. M. (2003). Factorial invariance and latent mean stability of performance failure appraisals. *Structural Equation Modeling, 10*(3), 401-422.

Conroy, D. E, Willow, J. P, & Metzler, J. N. (2002). Multidimensional fear of failure measurement: The performance failure appraisal inventory. *Journal of Applied Sport Psychology, 14*(2), 76-90.

Cooper, S. M, Hughes, M, O'Donoghue, P, & Nevill, A. M (2007). A simple statistical method for assessing the reliability of data entered into sport performance analysis systems. *International Journal of Performance Analysis in Sport, 7*(1), 87-109.

Côté, J, Lidor, R, & Hackfort, D. (2009). ISSP position stand: To sample or to specialize? Seven postulates about youth sport activities that lead to continued participation and elite performance. *International Journal of Sport and Exercise Psychology, 7*(1), 7-17.

Cresswell, S. L, & Eklund, R. C. (2006). The convergent and discriminant validity of burnout measures in sport: A multi-trait/multi-method analysis. *Journal of Sports Sciences, 24*(2), 209-220.

Dalton, S. E. (1992). Overuse injuries in adolescent athletes. *Sports Medicine, 13*(1), 58-70.

Davids, K, Bennett, S, Handford, C, & Jones, B. (1999). Acquiring coordination in self-paced, extrinsic timing tasks: A constraints-led perspective. *International Journal of Sport Psychology, 30*(4), 437-461.

Davids, K, Lees, A, & Burwitz, L. (2000). Understanding and measuring coordination and control in kicking skills in soccer: Implications for talent identification and skill acquisition. *Journal of Sports Sciences, 18*(9), 703-714.

Dennis, R. J, Finch, C. F, Elliott, B. C, & Farhart, P. J. (2008). The reliability of musculoskeletal screening tests used in cricket. *Physical Therapy in Sport, 9*(1), 25-33.

DeRenne, C, Morgan, C, Hetzler, R. K, & Taura, B. T. (2008). National and state youth baseball coaching requirements: A state case study. *The Sport Journal, 11*(2), 1-17.

Doyle, J, Gleeson, N. P, & Rees, D. (1998). Psychobiology and the athlete with anterior cruciate ligament (ACL) injury. *Sports Medicine, 26*(6), 379-393.

Drikos, S, & Vagenas, G. (2011). Multivariate assessment of selected performance indicators in relation to the type and result of a typical set in men's elite volleyball. *International Journal of Performance Analysis in Sport, 11*(1), 85-95.

Dunn, J. G. H, Dunn, J. C, Wilson, P, & Syrotuik, D. G. (2000). Reexamining the factorial composition and factor structure of the sport anxiety scale. *Journal of Sport & Exercise Psychology, 22*(2), 183-193.

Education Department of Western Australia. (2001). Fundament Movement Skills. Retrieved 24th June, 2014, from http://det.wa.edu.au/stepsresources/detcms/navigation/fundamental-movement-skills/

Eklund, R. C, Whitehead, J. R, & Welk, G. J. (1997). Validity of the children and youth physical self-perception profile: A confirmatory factor analysis. *Research Quarterly for Exercise and Sport, 68*(3), 249-256.

Ericsson, K. A. (2006). *The influence of experience and deliberate practice on the development of superior expert performance*. New York, NY: Cambridge University Press.

Ericsson, K. A, Krampe, R. T, & Tesch-Römer, C. (1993). The role of deliberate practice in the acquisition of expert performance. *Psychological Review, 100*(3), 363-406.

Escamilla, R. F, Fleisig, G. S, DeRenne, C, Taylor, M. K, Moorman III, C. T, Imamura, R, . . . Andrews, J. R. (2009). A comparison of age level on baseball hitting kinematics. *Journal of Applied Biomechanics, 25*(3), 210-218.

Ewing, M. E, & Seefeldt, V. (1996). Patterns of participation and attrition in American agency-sponsored youth sports. In F. L. Smoll & R. E. Smith (Eds.), *Children and youth in sport: A biopsychosocial perspective* (pp. 31-45). Madison, WI: Brown and Benchmark.

Fenter, P. C, Bellew, J. W, Pitts, T. A, & Kay, R. E. (2003). Reliability of stabilised commercial dynamometers for measuring hip abduction strength: A pilot study. *British Journal of Sports Medicine, 37*(4), 331-334.

Fox, K. R, & Corbin, C. B. (1989). The physical self-perception profile: Development and preliminary validation. *Journal of Sport & Exercise Psychology, 11*(4), 408-430.

French, K. E, Spurgeon, J. H, & Nevett, M. E. (1995). Expert-novice differences in cognitive and skill execution components of youth baseball performance. *Research Quarterly for Exercise and Sport, 66*(3), 194-201.

Gabbe, B. J, Bennell, K. L, Wajswelner, H, & Finch, C. F. (2004). Reliability of common lower extremity musculoskeletal screening tests. *Physical Therapy in Sport, 5*(2), 90-97.

Gallagher, S. S, Finison, K, Guyer, B, & Goodenough, S. (1984). The incidence of injuries among 87,000 Massachusetts children and adolescents: Results of the 1980-81 Statewide Childhood Injury Prevention Program Surveillance System. *American Journal of Public Health, 74*(12), 1340-1347.

Gallahue, D. L, & Cleland-Donnelly, F. (2003). Movement Skill Acquisition *Developmental physical education for all children* (pp. 50-77). Champaign, IL: Human Kinetics.

Giacobbi Jr, P. R, & Weinberg, R. S. (2000). An examination of coping in sport: Individual trait anxiety differences and situational consistency. *Sport Psychologist, 14*(1), 42-62.

Glazier, P. S. (2010). Game, set and match? Substantive issues and future directions in performance analysis. *Sports Medicine, 40*(8), 625-634.

Gore, S, Farrell, F, & Gordon, J. (2001). Sports involvement as protection against depressed mood. *Journal of Research on Adolescence, 11*(1), 119-130.

Gould, D. (1987). Understanding attrition in children's sport. In D. Gould & L. W. Weiss (Eds.), *Advances in Pediatric Sport Sciences* (Vol. 2, pp. 61-85). Champaign, IL: Human Kinetics.

Gray, R. (2002). "Markov at the bat": A model of cognitive processing in baseball batters. *Psychological Science, 13*(6), 542-547.

Gray, R. (2004). Attending to the execution of a complex sensorimotor skill: Expertise differences, choking, and slumps. *Journal of Experimental Psychology: Applied, 10*(1), 42.

Grin, T. R, Nelson, L. B, & Jeffers, J. B. (1987). Eye injuries in childhood. *Pediatrics, 80*(1), 13-17.

Haas, M. (1995). How to evaluate intraexaminer reliability using an interexaminer reliability study design. *Journal of Manipulative and Physiological Therapeutics, 18*(1), 10-15.

Hagger, M, Ashford, B, & Stambulova, N. (1998). Russian and British children's physical self-perceptions and physical activity participation. *Pediatric Exercise Science, 10*(2), 137-152.

Handford, C, Davids, K, Bennett, S, & Button, C. (1997). Skill acquisition in sport: Some applications of an evolving practice ecology. *Journal of Sports Sciences, 15*(6), 621-640.

Hayen, A, Dennis, R. J, & Finch, C. F. (2007). Determining the intra-and inter-observer reliability of screening tools used in sports injury research. *Journal of Science and Medicine in Sport, 10*(4), 201-210.

Hebert, E. P, & Landin, D. (1994). Effects of a learning model and augmented feedback on tennis skill acquisition. *Research Quarterly for Exercise and Sport, 65*(3), 250-257.

Heil, John. (1993). *Psychology of sport injury*. Champaign, IL: Human Kinetics Publishers.

Herman, W. E. (1990b). Fear of failure as a distinctive personality trait measure of test anxiety. *Journal of Research & Development in Education, 23*(3), 180-185.

Hopkins, W. G. (2000). Measures of reliability in sports medicine and science. *Sports Medicine, 30*(1), 1-15.

Hughes, M. (2004). Performance analysis- A 2004 perspective. *International Journal of Performance Analysis in Sport, 4*(1), 103-109.

Hughes, M, & Bartlett, R. M. (2002). The use of performance indicators in performance analysis. *Journal of Sports Sciences, 20*(10), 739-754.

Hughes, M, Cooper, S, Nevill, A, & Brown, S. (2003). An example of reliability testing and establishing performance profiles for non-parametric data from performance analysis. *International Journal of Computer Science in Sport, 2*(1), 34-56.

Hughes, M, & Daniel, R. (2003). Playing patterns of elite and non-elite volleyball. *International Journal of Performance Analysis in Sport, 3*(1), 50-56.

Kais, K, & Raudsepp, L. (2004). Cognitive and somatic anxiety and self-confidence in athletic performance of beach volleyball *Perceptual and Motor Skills, 98*(2), 439-449.

Kato, T, & Fukuda, T. (2002). Visual search strategies of baseball batters: Eye movements during the preparatory phase of batting. *Perceptual and Motor Skills, 94*(2), 380-386.

Landers, M. A, & Fine, G. A. (1996). Learning life's lessons in tee ball: The reinforcement of gender and status in kindergarten sport. *Sociology of Sport Journal, 13*(1), 87-93.

Lazarus, R. S. (1991). *Emotion and adaptation*. New York: Oxford University Press.

Leavitt, J. L. (1979). Cognitive demands of skating and stickhandling in ice hockey. *Canadian Journal of Applied Sport Sciences, 4*(1), 46-55.

Lee, A. M, Keh, N. C, & Magill, R. A. (1993). Instructional Effects of Teacher Feedback in Physical Education. *Journal of Teaching in Physical Education, 12*(3), 228-243.

Little League. (2013a). Intermediate (50/70) Baseball Division. Retrieved 5th September, 2013, from http://www.littleleague.org/learn/about/divisions/baseball/llint5070bb.htm

Little League. (2013b). Minor League Baseball Division. Retrieved 7th June, 2013, from http://www.littleleague.org/learn/about/divisions/baseball/mlbb.htm

Little League. (2013c). Tee Ball Division. Retrieved 7th June, 2013, from http://www.littleleague.org/learn/about/divisions/TeeBallDivision.htm

Magill, V, & Anderson, D. (1988). Critical periods as optimal readiness for learning sport skills. In F. L. Smoll & R. E. Smith (Eds.), *Children and youth in sport: A biopsychosocial perspective* (pp. 57-72). Dubuque, IA: Brown & Benchmark.

Magyar, T. M, & Chase, M. A. (1996). Psychological strategies used by competitive gymnasts to overcome the fear of injury. *Technique, 16*(10), 1-5.

Malina, R. M. (2010). Early sport specialization: Roots, effectiveness, risks. *Current Sports Medicine Reports, 9*(6), 364-371.

Martens, R. (1996). Turning kids on to physical activity for a lifetime. *Quest, 48*(3), 303-310.

Martens, R, Burton, D, Vealey, R. S, Bump, L. A, & Smith, D. E. (1990). Development and validation of the competitive state anxiety inventory-2. *Competitive Anxiety in Sport*, 117-190.

Martens, R, Rivkin, F, & Bump, L. A. (1984). A field study of traditional and nontraditional children's baseball. *Research Quarterly for Exercise and Sport, 55*(4), 351-355.

Martens, R, & Seefeldt, V. (1979). *Guidelines for children's sports*. Washington, DC: American Alliance for Health, Physical Education, Recreation and Dance.

McIntyre, D. R, & Pfautsch, E. W. (1982). A kinematic analysis of the baseball batting swings involved in opposite-field and same-field hitting. *Research Quarterly for Exercise and Sport, 53*(3), 206-213.

McIntyre, F. (2009). *A Longitudinal Examination of the Contribution of Perceived Motor Competence and Actual Motor Competence to Physical Activity in 6 to 9 Year Old Children.* (PhD Doctoral dissertation), University of Notre Dame.

McNevin, N. H, Shea, C. H, & Wulf, G. (2003). Increasing the distance of an external focus of attention enhances learning. *Psychological Research, 67*(1), 22-29.

Messier, S. P, & Owen, M. G. (1985). The mechanics of batting: Analysis of ground reaction forces and selected lower extremity kinematics. *Research Quarterly for Exercise and Sport, 56*(2), 138-143.

Messier, S. P, & Owen, M. G. (1986). Mechanics of batting: Effect of stride technique on ground reaction forces and bat velocities. *Research Quarterly for Exercise and Sport, 57*(4), 329-333.

Milburn, P. D. (1982). Summation of segmental velocities in the golf swing. *Medicine and Science in Sports and Exercise, 14*(1), 60-64.

NSW Department of Education and Communities. (2011). Fundamental Movement Skills. Retrieved 24th June, 2014, from http://www.curriculumsupport.education.nsw.gov.au/primary/pdhpe/gamessport/fms001.htm

Nelson, L. B, Wilson, T. W, & Jeffers, J. B. (1989). Eye injuries in childhood: Demography, etiology, and prevention. *Pediatrics, 84*(3), 438-441.

O'Donoghue, P. (2002). Performance models of ladies and mens singles tennis at the Australian Open. *International Journal of Performance Analysis in Sport, 2*(1), 73-84.

O'Donoghue, P. (2007). Reliability issues in performance analysis. *International Journal of Performance Analysis in Sport, 7*(1), 35-48.

O'Donoghue, P, & Ingram, B. (2001). A notational analysis of elite tennis strategy. *Journal of Sports Sciences, 19*(2), 107-115.

Pasternack, J. S, Veenema, K. R, & Callahan, C. M. (1996). Baseball injuries: A Little League survey. *Pediatrics, 98*(3), 445-448.

Perkins-Ceccato, N, Passmore, S. R, & Lee, T. D. (2003). Effects of focus of attention depend on golfers' skill. *Journal of Sports Sciences, 21*(8), 593-600.

Petlichkoff, L. M. (1996). The drop-out dilemma in youth sports. In O. Bar-Or (Ed.), *The child and adolescent athlete* (pp. 418-430). Oxford, UK: Blackwell Science.

Race, D. E. (1961). A cinematographic and mechanical analysis of the external movements involved in hitting a baseball effectively. *Research Quarterly, 32*(3), 394-404.

Raedeke, T. D, Lunney, K, & Venables, K. (2002). Understanding athlete burnout: Coach perspectives. *Journal of Sport Behavior, 25*(1), 181-206.

Raustorp, A, Ståhle, A, Gudasic, H, Kinnunen, A, & Mattsson, E. (2005). Physical activity and self‐perception in school children assessed with the Children and

Youth–Physical Self‐Perception Profile. *Scandinavian Journal of Medicine & Science in Sports, 15*(2), 126-134.

Risser, W. L, Anderson, S. J, Bolduc, S. P, Harris, S. S, Landry, G. L, Orenstein, D. M, & Smith, A. D. (1994). Risk of injury from baseball and softball in children 5 to 14 years of age. *Pediatrics, 93*(4), 690-692.

Rose, D. J, & Christina, R. W. (1990). Attention demands of precision pistol-shooting as a function of skill level. *Research Quarterly for Exercise and Sport, 61*(1), 111-113.

Rowland, T. W. (1997). Counseling the young athlete: Where do we draw the line? *Pediatric Exercise Science, 9*(1), 197-201.

Scott, D. A, Bond, E. Q, Sisto, S. A, & Nadler, S. F. (2004). The intra-and interrater reliability of hip muscle strength assessments using a handheld versus a portable dynamometer anchoring station. *Archives of Physical Medicine and Rehabilitation, 85*(4), 598-603.

Shaffer, B, Jobe, F. W, Pink, M, & Perry, J. (1993). Phases of a baseball swing. In B. b. A. e. study (Ed.).

Short, S. E, Reuter, J, Brandt, J, Short, M. W, & Kontos, A. P. (2004). The relationships among three components of perceived risk of injury, previous injuries and gender in contact sport athletes. *Athletic Insight, 6*(3), 78-85.

Shultz, S. J, Nguyen, A, Windley, T. C, Kulas, A. S, Botic, T. L, & Beynnon, B. D. (2006). Intratester and intertester reliability of clinical measures of lower extremity anatomic characteristics: Implications for multicenter studies. *Clinical Journal of Sport Medicine, 16*(2), 155-161.

Smith, M. D, & Chamberlin, C. J. (1992). Effect of adding cognitively demanding tasks on soccer skill performance. *Perceptual and Motor Skills, 75*(3), 955-961.

Smith, R. E. (2007). Toward a cognitive-affective model of athletic burnout. *Journal of Sport Psychology, 8*(1), 36-50.

Smith, R. E, Smoll, F. L, Cumming, S. P, & Grossbard, J. R. (2006). Measurement of multidimensional sport performance anxiety in children and adults: The Sport Anxiety Scale-2. *Journal of Sport and Exercise Psychology, 28*(4), 479.

Smith, R. E, Smoll, F. L, & Schutz, R. W. (1990). Measurement and correlates of sport-specific cognitive and somatic trait anxiety: The sport anxiety scale. *Anxiety Research, 2*(4), 263-280.

Smoll, F. L. (2001). Coach-parent relationships in youth sports: Increasing harmony and minimizing hassle. In J. M. Williams (Ed.), *Applied sport psychology: Personal*

growth to peak performance (Vol. 4, pp. 150-161). Mountain View, CA: Mayfield.

Snyder, E. E. (1990). Emotion and sport: A case study of collegiate women gymnasts. *Sociology of Sport Journal, 7*(3), 254-270.

Stuart, M. E, & Ebbeck, V. (1995). The influence of perceived social approval on moral development in youth sport. *Pediatric Exercise Science, 7*(3), 270-280.

Swain, A, & Jones, G. (1996). Explaining performance variance: The relative contribution of intensity and direction dimensions of competitive state anxiety. *Anxiety, Stress, and Coping, 9*(1), 1-18.

Sykes, D, Twist, C, Hall, S, Nicholas, C, & Lamb, K. (2009). Semi-automated time-motion analysis of senior elite rugby league. *International Journal of Performance Analysis in Sport, 9*(1), 47-59.

Tenga, A, Kanstad, D, Ronglan, L. T, & Bahr, R. (2009). Developing a new method for team match performance analysis in professional soccer and testing its reliability. *International Journal of Performance Analysis in Sport, 9*(1), 8-25.

Thomas, J. R, Nelson, J. K, & Silverman, S. J. (2011). *Research Methods in Physical Activity*. Champaign, USA: Human Kinetics.

Thomson, E, Lamb, K, & Nicholas, C. (2013). The development of a reliable amateur boxing performance analysis template. *Journal of Sports Sciences, 31*(5), 516-528.

Thrash, T. M, & Elliot, A. J. (2003). Inspiration as a psychological construct. *Journal of Personality and Social Psychology, 84*(4), 871.

van Teijlingen, E, & Hundley, V. (2001). The importance of pilot studies. *Social Research Update, 1*(35), 1-4.

Vaz, L, Mouchet, A, Carreras, D, & Morente, H. (2011). The importance of rugby game-related statistics to discriminate winners and losers at the elite level competitions in close and balanced games. *International Journal of Performance Analysis in Sport, 11*(1), 130-141.

Vereijken, B, van Emmerik, R. E. A, Whiting, H. T. A, & Newell, K. M. (1992). Free(z)ing degrees of freedom in skill acquisition. *Journal of Motor Behavior, 24*(1), 133-142.

Vinger, P. F, Duma, S. M, & Crandall, J. (1999). Baseball hardness as a risk factor for eye injuries. *Archives of Ophthalmology, 117*(3), 354.

Weiss, M. R. (1993). Psychological effects of intensive sport participation on children and youth: Self-esteem and motivation. In B. R. Cahill & A. J. Pearl (Eds.),

Intensive participation in children's sports (pp. 39-69). Champaign, IL: Human Kinetics.

Weiss, M. R, & Petlichkoff, L. M. (1989). Children's motivation for participation in and withdrawal from sport: Identifying the missing links. *Pediatric Exercise Science, 1*(3), 195-211.

Weiss, MR. (1993). Psychological effects of intensive sport participation on children and youth: Self-esteem and motivation. In B. R. Cahill & A. J. Pearl (Eds.), *Intensive participation in children's sports* (pp. 39-69). Champaign, IL: Human Kinetics.

Welch, C. M, Banks, S. A, Cook, F. F, & Draovitch, P. (1995). Hitting a baseball: A biomechanical description. *Journal of Orthopaedic and Sports Physical Therapy, 22*(5), 193-201.

Welk, G. J, Corbin, C. B, Dowell, M. N, & Harris, H. (1997). The validity and reliability of two different versions of the children and youth physical self-perception profile. *Measurement in Physical Education and Exercise Science, 1*(3), 163-177.

Whitehead, J. R. (1995). A study of children's physical self-perceptions using an adapted physical self-perception profile questionnaire. *Pediatric Exercise Science, 7*(2), 132-151.

Wiersma, L. (2000). Risks and benefits of youth sport specialization: Perspectives and recommendations. *Pediatric Exercise Science, 12*(1), 13-22.

Williams, A. M, Davids, K, Burwitz, L, & Williams, J. G. (1992). Perception and action in sport. *Journal of Human Movement Studies, 22*(4), 147-204.

Williams, A. M, Davids, K, & Williams, J. G. (1999). *Visual perception and action in sport*. New York, NY: Taylor & Francis.

Wooten, H. (1994). Cutting losses for student‐athletes in transition: An integrative transition model. *Journal of Employment Counseling, 31*(1), 2-9.

Wulf, G, McNevin, N. H, Fuchs, T, Ritter, F, & Toole, T. (2000). Attentional focus in complex skill learning. *Research Quarterly for Exercise and Sport, 71*(3), 229-239.

Yamamoto, L. G, Inaba, A. S, Okamura, D. M, Yamamoto, J. A, & Yamamoto, J. B. (2001). Injury reduction and bounce characteristics of safety baseballs and acceptability by youth leagues. *Clinical Pediatrics, 40*(4), 197-203.

CHAPTER THREE

Study 1- Reliability of a youth baseball and tee ball hitting scale

Andrew S. Walsh, G. Gregory Haff, Barbara Howard, Sophia Nimphius

Abstract

In Australian tee ball, it is common to see inexperienced and unqualified parent tee ball coaches, and as a consequence such inexperience can lead to developmental issues related to key baseball skills. In particular, the development of poor hitting mechanics seems to be the most prevalent. In order to assess and critique motor competence, a hitting scale comprised of 6 criteria addressing key hitting fundamentals was tested on youth tee ball and baseball players. A total of ten male participants (age: 11.1 ± 2.02 years) with at least one year of prior tee ball or baseball experience participated in three testing sessions. Intraclass correlation coefficient and the coefficient of variation with 90% confidence intervals (90%CI) were calculated to determine inter and intra rater reliability. The method presented in this study produced very high intra tester reliability (CV = 6.6%; 90%CI: 5.6-8.3%)(ICC = 0.98; 90%CI: 0.95-0.99) and inter tester reliability (CV=3.5%, CI: 2.9-4.4%)(ICC=0.98; 90%CI: 0.94-0.99). Collectively this data demonstrates very high methodological reproducibility across testing sessions, assessors and hitting drills. Based upon these findings the proposed hitting scale appears to be a reliable tool for evaluating hitting competence.

Key words: Swing, performance, analysis, template

3.1 Introduction

The positive effects of sports participation are well documented in the scientific literature. Such benefits are, but not limited to, increased self-confidence (Eyler, Brownson, Bacak, & Housemann, 2003), reduced health problems (G. Rose, 1969) increased self-perception (Stein, Fisher, Berkey, & Colditz, 2007), better school behaviour (Stuntz & Weiss, 2009) and increased self-efficacy (Ayotte, Margrett, & Hicks-Patrick, 2010; Neissaar & Raudsepp, 2011). Of particular interest is self-efficacy, which relates to an individual's beliefs about their ability to carry out a task (Bandura, 1978), with vicarious experiences, emotional arousal, verbal persuasion and successful performances making up the 4 factors. Generally, successful performances are considered to be the most important elements for self-efficacy (Bandura, 1986, 1997; Feltz, Short, & Sullivan, 2008). It has been reported that if an individual is not experiencing success in their chosen sport, then there is an increased likelihood that they will withdraw from the sport (Chase, 2001). There have been numerous studies, which examine and support the positive relationship between self-efficacy and exercise adherence (McAuley, 1992, 1993; McAuley, Lox, & Duncan, 1993) and increased athletic performance (Bandura, 1997; Beauchamp, Bray, & Albinson, 2002; Mills, Munroe, & Hall, 2001; Moritz, Feltz, Fahrbach, & Mack, 2000). Sports and physical activities are important for many age groups, in particular youth, as sport offers a suitable environment for developing personal and team skills. While the health benefits of sport and physical activity have been heavily reported, there are still cases of people dropping out of their sport due to an inability or perceived inability to achieve a performance level required to be successful. The time frame that exists between childhood and adulthood has been identified as a high risk time for an increase in drop-out rates to occur (Coakley & White, 1992). For example, during this time frame tee ball participation ceases and baseball or softball participation commences. Fundamentally, this transition period between sports can be challenging to young athletes.

In America, tee ball is generally played from the ages of four to six (Little League, 2013c), with children aged seven to eleven participating in baseball. These two age groups comprise the minor league division, and in 2012 there were nearly 1,580,000 participants (Little League, 2013c). In the seven to eleven year old age group, they are offered the chance to hit a ball that is pitched by a machine (machine pitch) or by their coach (coach pitch), before transitioning to a player pitched ball (Little League, 2013b).

Conversely, tee ball in Australia is played from 5 to 12 years of age (Tee ball Association of Western Australia, 2011) with player pitch baseball and softball commencing for all athletes aged 13 and upwards. Unlike the American system, there is an absence of a transitional phase in which coach or machine pitch is used to develop the fundamental batting skills required to engage in the player pitch program. To understand if competence factors are related to an apparent lack of skill progression in Australia, firstly the participation records should be analysed. The last updated figures on tee ball participation in Western Australia were recorded in the 2002/2003 season in which there were 12,000 recorded players (Tee ball Association of Western Australia, 2011). In the 2002/2003 season, baseball and softball reported junior participation in Western Australia at approximately 1,500 and 1,000 players respectively (P. Gregson, personal communication, December 21, 2011). While the numbers for all three sports are absolute participants in their respective age groups, the records of players exiting tee ball and entering baseball or softball are not known. The absence of hitting development in Western Australia, could lead to a less successful development of hitting performances which in-turn could lower self-efficacy in the children resulting in a potential increase in dropout rate for youth baseball players.

While research into sport dropout rates has been extensive (Boiché & Sarrazin, 2009; Cervelló et al., 2007; Fraser-Thomas, Côté, & Deakin, 2008; Molinero, del Valle, Álvarez, & Rosa, 2009; Slater & Tiggemann, 2010; Weiss & Petlichkoff, 1989), it is important to understand the potential underling mechanism for sport withdrawal (Weiss & Petlichkoff, 1989), particularly when competence factors are being cited. Reasons regularly cited in the scientific literature for youth dropout from sports participation are associated with a conflict of interests (Boiché & Sarrazin, 2009; Molinero et al., 2009), lack of enjoyment (Helsen, Starkes, & Hodges, 1998), low perception of ability or competence (Boiché & Sarrazin, 2009; Cervelló et al., 2007) or too much focus on competition (Slater & Tiggemann, 2010). For children and youth, a possible source of competency information is gathered from significant others including coaches, parents and team mates (Nicholls, 1989). In this age group, many coaches are parent-volunteers, who can lack the ability and training to create a healthy psychological environment for children participating in sport (R. E. Smith & Smoll, 1997).

In order to improve in a sporting skill, the coach often delivers feedback to the athlete (Lees, 2002). Some sporting movements like a baseball swing can be hard for an

untrained eye to determine technical deficiencies and relate these to adequate coaching cues. Professionals like biomechanists and notational analysts are better suited than a untrained coach for such analysis and often employ video recording technologies to aid their analysis (Hughes & Bartlett, 2002). One issue does arise from such a process, and that is how to optimize the feedback to both athlete and coach in order to improve the athletes' performance (Liebermann et al., 2002; R. M. Smith & Loschner, 2002). To help with the analysis a biomechanist and notational analyst will look for performance indicators, which are a selection or body of action variables that help describe the characteristics of a successful performance. Similarly, coaches use comparable methods of looking for performance indicators to improve their athlete's skills (Hughes & Bartlett, 2002). The division of a skill into its functional portions is the first step in the analysis process, with the next step being the creation of the performance model (Lees, 2002). The use of visual templates, often called model templates, have been used extensively and with much success in coaching manuals for skill breakdown and analysis (Lees, 2002). It must be noted that, the athlete being technically proficient, will not guarantee the athlete being highly successful (Lees, 2002). Conducting and creating such an analytic tool, does require a wealth of knowledge and experience in both biomechanical principals that underpin the skill and the performance skill as whole (Lees, 2002).

A study examining the baseball swing identified three separate but crucial phases that are associated with hitting fundamentals. These phases include; 1) front foot off ground, 2) front foot making full contact on ground, and 3) ball contact with the bat (Welch et al., 1995). Furthermore, research comparing the swings of youth (12-17 years) and college/professional (20-26 years) baseball players' swings proposed the introduction on a 4th factor, labelled 'hands started to move forward', which took place between front foot making contact and ball contact with bat (Escamilla et al., 2009). The role of the hands play a vital part of the swing; any movement undertaken by the hands that is not directly towards the ball can reduce the success rate of the swing. Additionally, the swing mechanics across the age groups were functionally similar; however high swing velocities were significantly greater in the advanced age group (Escamilla et al., 2009). To generate bat speed, the hitter must effectively utilize the appropriate muscles in the correct order to form a kinetic chain (Welch et al., 1995).

Hitting a baseball is considered to be a difficult task, no matter the baseball players' skill level. There has been research conducted on hitting, but compared to pitching, this field is quite minimal (Linter, Noonan, & Kibler, 2008; Welch et al., 1995) with a lack of baseball research coming from Australia. If youth baseball players are able to learn proper hitting mechanics at a young age it could help reinforce correct hitting technique later in their baseball careers (Escamilla et al., 2009). To understand the demands of hitting, building a fundamental knowledge of the skill is important (Welch et al., 1995). Teaching proper hitting mechanics to youth players can be difficult, if the coach is a parent that may lack any formal education on hitting or appropriate pedagogical processes (Escamilla et al., 2009). This problem highlights the need for further education of youth baseball coaches, and the need for a hitting assessment tool that is easy for parent coaches and teachers to understand and administer (Escamilla et al., 2009).

The purpose of the present study was to evaluate the reliability of a proposed hitting scale, and to determine if it is sensitive enough to detect any technique changes across a differing ball delivery method.

3.1.1 Experimental Approach to the Problem

A within subject study design was utilized to determine the test re-test reliability of a proposed hitting fundamentals scale. The proposed scale was evaluated over a three-week period to allow for the determination of the scales reliability. Once testing was completed, the reliability of the scale was evaluated by assessing the video data taken throughout the study. The data were assessed by examining the clips of the subject's swings. Video data was analysed by two different assessors to help determine inter-rater reliability. The lead investigator completed their secondary analysis after the second judge examined video data. A mandatory one-week break was taken between initial and secondary assessments for intra-rater reliability.

3.2 Methodology

3.2.1 Subjects

A sample of convenience consisting of ten male participants (n= 10) between the ages of nine and fourteen (age: 11.1 ± 2.0 years) with at least 1-year of playing experience in baseball or tee ball were recruited through a transitional baseball camp, which took place in the Perth Metropolitan area. There were 3 separate testing sessions, separated by one week. If participants missed more than one training session, they were excluded from the study. The University Human Ethics Committee provided approval for the project, with all subjects and their parents providing written consent before any testing commenced. Medical questionnaires were obtained before any physical activity was undertaken and participants were informed of what was required of them, ensured and explained how confidentiality of their identity or individual performance would be maintained. Additionally, the participants were free of any injuries to either upper or lower body, and had no history of major upper and lower body injuries, or significant visual impairments.

3.2.2 Procedures

All subjects had their hitting mechanics assessed during the two hitting drills. The two hitting drills were administered by order of difficulty (i.e. tee ball and then soft toss) and not randomized throughout the study. The administration of drills in order of difficulty and not randomising them does pose one concern, which is that the predictability can interfere with internal validity of the study. The tee drill was completed before soft toss, as tee work allows for deliberate movement from the batter by excluding movement of the ball, pitch type, and reaction to the pitched ball. Additionally, it was important to mimic the progression of the hitting task from tee ball to baseball. The first drill (tee) required the participants to hit a ball off a standard tee 10 times and the second drill (soft toss) required the participants to hit a ball that was tossed softly to them 10 times. The same ball type was used throughout the study. Participants were asked to stand next to a tee, which was placed directly 1.5 metres in front of a portable hitting net (Skillz, California, USA). The middle of the net was marked by a '+' sign, to give the participants a reference point. Two cameras (HDR-

HC9, Sony Australia Limited, NSW) were set up three metres away from the tee in two directions, behind and in front of the hitter. Figure 1, shows a set up for a right-handed hitter. For a left-handed hitter, camera one would be placed on the other side of the tee. Figure 2 shows the set up from both behind and side on to a right handed hitter.

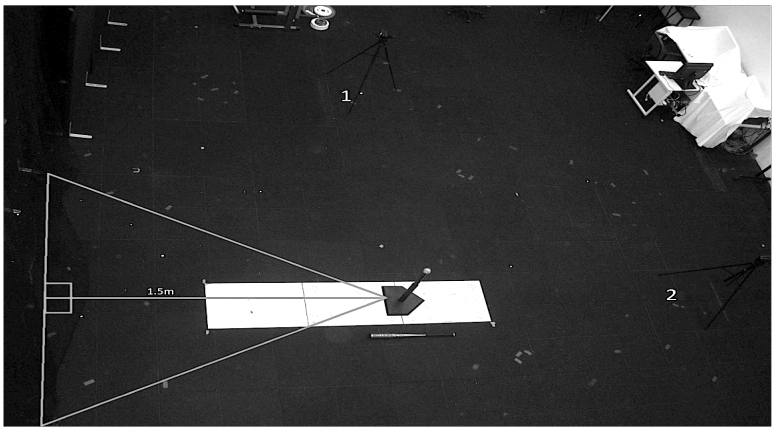


Figure 1. Test design layout for right handed hitter

Figure 2. Hitting protocol set up, with the athlete attempting to hit a ball off a tee that is place 5m away from net

The participants were given an 81.3 cm (32 inch) bat (Easton Magnum, California, USA), with a weight of 623g and were instructed to hit tee balls (Huksey, Tower Sport, Western Australia, Australia) up the middle, into a batting net (SKLZ, San Diego, California). At the start of the study participants were instructed on what constituted a successful hit. For this study, the ball striking the net without hitting the ground or

missing the net entirely with a deliberate force was deemed a hit. If the participant missed the ball, the ball did not hit the net or the ball hit the net but with very little force (a mishit), the participant was required to take that swing again after the usual 30-second rest period.

Each participant took 5 warm up swings off the tee, followed by 5 warm up swings from “soft toss” and was instructed to hit the ball “up the middle”. This served to familiarise the participant with the rest protocols and spacing between the tee and themselves. After completion of the warm up swings, the participants were required to make 10 successful hits off both the tee and soft toss drills. This resulted in 30 swings taken by the participant each session (5 tee and 5 soft toss warm up and 10 tee and 10 soft toss for assessment). The two hitting methods were not randomized throughout the study. For the soft toss drill, the tee was removed and a plate was placed 1.5 metres away from the middle of the net. The investigator positioned himself next to the net to administer the soft toss drill. The hitting scale was by two reviewers who have experience in baseball coaching. The first reviewer has coached at the highest domestic club level in Australia for multiple years, while the second reviewer has coached a junior team for two years.

3.2.3 Hitting Scale

A hitting scale was developed in order to examine the six important criteria associated with the fundamentals of correct hitting technique. Specifically, the hitting scale items were developed based upon the research conducted by Welch et al. (1995) and Lund and Heefner (2005). The hitting skill was broken into small segments, with the appropriate segments being included in the hitting scale (Table 2 and Figure 3). The six items: 1) hands back, feet shoulder width apart and weight on back leg, 2) rotation of hips followed by shoulders, 3) hips drive forward (shift of weight) 4) line of hands directly towards pitcher, 5) head still and focused on contact, and 6) follow through towards the shoulders; were selected for their contribution to form the fundamentals of a baseball swing. Examining and breaking down of the baseball swings in conjunction with an experienced baseball player and coach established content validity.

Table 2. Description of actions that are present in hitting scale

Types of movement	Definition
Hands back, feet shoulder width apart and weight on back leg	*Player positioning*- The player is required to be facing side on to the pitcher/ball direction (e.g. for a right hand batter, the batters front left shoulder would be facing the direction the ball is coming from) *Hands back*- The hands are to be placed around should to head height with the hands being positioned behind or in line with the batters back shoulder and slightly away from the body *Feet*- To be placed about shoulder width apart with the knees slightly bent to be in athletic position *Weight distribution*- To be equally distributed between both feet. Acceptable to have slightly more weight on back leg.
Rotation of hips followed by shoulders	*Rotation of hips*- Following the kinetic chain, hips will start to open up towards the ball Followed by shoulders- Shoulders will follow same path as hips on a slight delay.
Hips driving forward	Hips will slightly move towards the line of the ball path in the act of rotation
Line of hands directly to the ball	Line between ball and hands should be a straight line. No rounded path should be taken to get to ball. Hands between first phase in this phase might have moved back a little as the player may 'cock' ready to hit
Head still and focused on contact	Head remains still at point of contact. No movement back and forward or up and down
Follow through towards the shoulders'	Hands fully extend all the way through the ball and continue to meet the back shoulder, which should be inline with front shoulder. Must be inline or above shoulders

Note: *Examples given are for right hand batter, at some points throughout the swing the shoulders may be in line but left shoulder will still be considered as the back shoulder and right shoulder be considered the front shoulder. For left hand batter, reverse terminology.

Video recordings taken during the study were analysed for swing mechanics using the guidelines previously outlined. Swings were broken down into the drills, tee and soft toss. If the hitting fundamental was present in at least three of the five swings, the subject was awarded a point, similar to a yes/no scale format. This format was adopted as the scale is being targeted to inexperienced coaches, and the yes/no format provides a solid baseline of what is expected to be present during a swing. After all swings were analysed, the points were tallied and the final score was given. The maximum score a subject could receive was six points per drill. The use of the type of motor assessment scale that has been used in this study has been used in other Australian research previously (Harten, Olds, & Dollman, 2008; McIntyre, 2009; Okely, Booth, & Patterson, 2001). It must be acknowledged though while this type of assessment has been used in previous studies in Australia, specific protocols have not been validated.

Criterion Code	Hands back, feet shoulder width apart and weight on back leg	Rotation hips followed by shoulders	Hips drive forward (shift of weight)	Line of hands directly towards pitcher	Head still and focused on contact	Follow through towards the shoulders

Figure 3. Layout of hitting scale criteria. Scoring was based on yes/no format where one point (1) was awarded if the participant successfully demonstrated a criterion of the skill in three out of the five swings analysed

To investigate the test re-test reliability of both hitting drills, the five middle swings from both tee and soft toss were taken from each of the three sessions, totalling 30 trials per participant per session and 90 trials over the course of the study. Between the completion of tee work and commencement of soft toss drill, the participants were given a 5-minute recovery period.

All swings were tested for inter and intra day reliability. Intra day reliability was determined by comparing results gained by two judges, who were familiar with appropriate swing technique and mechanics. To determine whether the segments of the swing were correct or not, both judges were given a document outlining what a proficient swing was to look like (highlighted previously). All videos were analysed by

two reviewers. Both reviewers were required to follow the swing mechanics document for assessing the swing.

Table 3. Actual hitting scores attained by subjects from both assessors for tee

Subjects	assess1_ session1	assess2_ session1	assess1_ session2	assess2_ session2	assess1_ session3	assess2_ session3
1	4	4	4	4	4	4
2	5	5	5	5	5	5
3	5	5	5	5	5	5
4	1	1	1	1	1	1
5	1	1	1	1	1	1
6	1	0	1	0	1	0
7	3	3	2	3	2	3
8	6	6	6	6	6	6
9	2	1	2	1	2	1
10	2	2	2	2	2	2

Table 4. Actual hitting scores attained by subjects from both assessors for soft toss

Subjects	assess1_ session1	assess2_ session1	assess1_ session2	assess2_ session2	assess1_ session3	assess2_ session3
1	4	4	4	4	4	4
2	5	5	5	5	5	5
3	5	5	5	5	5	5
4	1	1	1	1	1	1
5	0	1	0	1	0	1
6	0	0	0	0	0	0
7	2	2	2	2	1	2
8	6	6	6	6	6	6
9	1	1	1	1	1	1
10	2	2	2	2	2	2

3.2.4 Statistical Analysis

A repeated measures analysis of variance (ANOVA) was used to compare the scores attained on the different testing sessions with a significance set at 0.05. For inter rater reliability, the lead investigators final assessment scores and the second investigators assessment scores were used. Test-retest reliability of the dependent variable was

calculated using intra-class correlation (ICC) and coefficient of variation (CV) between the 3 testing sessions and two drills. ICC was used to determine the reliability of the youth baseball hitting scale. To assess the typical error of those performing the test, the coefficient of variation (CV) was calculated. All reliability statistical procedures were calculated at 90% confidence intervals. Intra-class correlation coefficient values (r) were interpreted as follows $r \leq 0.20$ considered poor, r: $021 \leq 0.40$ fair, r: $0.41 \leq 0.60$ was considered moderate, r: $0.61 \leq 0.80$ substantial and r: $0.81 \leq 1.00$ considered almost perfect (Hopkins, 2011b). ICC and CV were calculated at 90% confidence interval for both inter and intra rater reliability. A minimum lower limit for the 90% confidence interval was set at ICC as being >0.70 in order to be considered reliable (Baumgartner & Chung, 2001). As a general rule the smaller the CV the more reliable the measure (Hopkins, 2001). However, for most biological research a CV < 15% is considered as having acceptable reproducibility (Ashley & Weiss, 1994). Therefore, the upper limit for reliability for the tests performed in this investigation is a CV of 15%. All statistical analyses were performed a preformatted excel spreadsheet that is available online (Hopkins, 2011a) and SPSS software (v19.0, Chicago, IL), with significance set at $p \leq 0.05$ for the ANOVA.

3.3 Results

3.3.1 Inter-rater and Intra-day Reliability

Analysis of scores obtained from the test re-test set up of the proposed scale showed reliability, with the coefficient of variation for tee and soft toss drills were low for both inter and intra-rater reliability (3.5% and 6.6%, respectively). Intra-class correlation coefficient was almost perfect for both tee and soft toss drills for both inter and intra rater reliability (0.98 and 0.99, respectively). Both of the tee and soft toss drills had high intra-class correlation and low coefficient of variation. Reliability statistics for intra-day and inter-rater for both drills (tee and soft toss) are presented in Table 2.

Table 5. Inter-rater, and intra-day reliability coefficients for newly proposed hitting scale for both tee and soft toss drills

Drill	Inter-rater		Intra-day	
	ICC (90% CI)	%CV (90% CI)	ICC (90% CI)	%CV (90% CI)
Tee	0.98 (0.94-0.99)	3.5 (2.9-4.4)	0.98 (0.95-0.99)	6.6 (5.6-8.3)
Soft toss	0.99 (0.97-1.0)	2.5 (2.1-3.1)	0.99 (0.98-1.0)	4.5 (3.7-5.6)

Swing analysis scores between testers proved reliable with CV scores for tee and soft toss being 3.5% and 2.5% respectively; with the CV confidence interval scores ranging from 2.9 to 4.4% and 2.1 to 3.1%, for tee and soft toss respectively. Nearly perfect scores were recorded with ICC scores with 0.98 and 0.99 being recorded for tee and soft toss respectively, with the ICC confidence interval scores for tee and soft toss ranging from 0.94 to 0.99 and 0.97 to 1.00 respectively. This demonstrates high levels of reproducibility between testers. Between day, swing analysis/reanalysis for both drills were high ICC for intra tester reliability for both tee and soft toss drills ranked high, with all CV scores for tee and soft toss being 6.6% and 4.5% respectively; with the CV confidence interval percentage scores ranging from 5.6 to 8.3% and 3.7 to 5.6%, respectively. Nearly perfect ICC scores with 0.98 and 0.99 being recorded for tee and soft toss respectively, with the ICC confidence interval scores were recorded for drills, with scores ranging from 0.95 to 0.99 and 0.98 to 1.00 for tee and soft toss respectively. Additionally there were no significant differences ($p=0.33$) between session scores and between raters when using the scale.

3.4 Discussion

Based upon the present study, a unique performance assessment tool for youth baseball and softball players was developed. The proposed instrument, designed for use by inexperienced youth coaches, has been found to have reliability for both intra-day and inter-rater comparisons. The content-validity of the performance criteria, which formed the basis for the scale, were selected from reviewing the relevant literature on baseball hitting (Escamilla et al., 2009; Shaffer et al., 1993; Welch et al., 1995) and was further

refined by working out the contributing factors from the selected criteria with an expert in the field. Further changes to the proposed scale may be necessary, but any omissions could impact the integrity of the scale to assess hitting fundamentals and serve as a tool to educate either coaches or players. One of the issues in assessing competence in skills is the lack of normative data, which is of particular concern for children and youth. The use of this tool is a great way for coaches to instruct and inform the players about hitting ability. With the construction of any skill-based scale there needs to be guidelines for proficiency levels between age levels and gender, unfortunately our study did not look into such aspects.

Currently, most of the sport performance scales have focused on performance and closed skill technique based sports like jumping, throwing, trampolining, and gymnastics (Hughes & Bartlett, 2002). Not much attention has been paid to team sports, as it is suggested that biomechanical interventions are less important than fitness, tactics and psychological preparation (Hughes & Bartlett, 2002). Two team sports that have undergone skills analysis are cricket (Bartlett, Stockill, Elliott, & Burnett, 1996) and soccer (Lees & Nolan, 1998). A review of literature on the two sports showed that, both sports have received extensive attention of the skills in literature, which appear to be focused on injury reduction (Bartlett et al., 1996; Lees & Nolan, 1998). Baseball pitching has benefitted from such an approach to skill improvement (Dun, Loftice, Fleisig, Kingsley, & Andrews, 2008; Lyman, Fleisig, Andrews, & Osinski, 2002), but unfortunately baseball batting has not. Though baseball hitting has been reviewed, and there have been biomechanical reviews of the skill (Escamilla et al., 2009; Welch et al., 1995), little attention have focused on the youth, with most attention focused on the adult hitter (DeRenne et al., 2008)

With most youth coaches being parent-volunteers who are inexperienced and inadequately trained to coach a team how to hit (Escamilla et al., 2009), it is important that the coaches possess the resources to aid the players development. Providing a hitting scale, can help to educate the coach and be used to help judge players hitting mechanics, given the player has enough opportunities to practice their swing. The differences in ball delivery method from tee ball to baseball can often present a new challenge with the introduction of a strike zone, a player pitching the ball and timing of when to strike the ball. It has been noted that when children move into baseball, the best player will usually pitch but pitching at a young age is often wild, with velocities above

what the hitter is capable of hitting (Martens et al., 1984). These two factors can often develop fear in the batter (Martens et al., 1984), and this may limit the opportunities the player has to practice the correct hitting technique.

It is possible the method of assessing the swings from video, made it easier for the assessors to slow down and watch a specific section to make a correct consistent decision. Given the small population tested it may be warranted to assess a bigger cohort of baseball players. A bigger sample is needed in order to determine if the proposed scale is effective to a variety of populations. Furthermore, a comparison of video analysis against live observation on the hitting scale and determining the reliability of the scale using live scoring only, would be recommended for further study. The present findings suggest the proposed hitting scale is a reliable means of assessing youth hitting ability in youth baseball or softball. Because of its reliability it is possible that it will remain useful even when there is a change in coaching staff, which is commonly seen when a tee ball player moves into baseball or softball. The advantages of tracking the skill of hitting over this period of time are three-fold: 1) being able to determine if any changes in hitting are present over the course of the season; 2) provides the new coach with information about the players' past hitting ability, so the appropriate drills can be utilized to elicit the desired change; and 3) serve as an educational tool for teachers and inexperienced coaches to help understand the correct procedures and demands placed on the hitter. Having the ability to track the players' skills in youth baseball or softball, could lead to better skill development in the player. This could help to reduce drop out faced by baseball and softball communities in Western Australia.

In conclusion, this study provides coaches and physical education teachers with the ability to objectively assess a players' fundamental hitting ability. It is recommended that any assessment using this tool is to follow the hitting criteria guidelines provided in this paper. It is also further recommended that future research focus on using a larger experimental group and to create a scale that can objectively assess adults' hitting technique. This will help to further develop skills in players and help to identify any flaws in hitting technique.

3.5 Practical Applications

This scale provides coaches and physical education teachers with a clear and concise description of the fundamentals of a baseball swing. The scale has an easy-to-administer format that provides assessors with a reliable way to grade and track players hitting technique. Coaches may use this as a guide to understand the body segments used in a swing and the correct sequence of events during the swing. Additionally, coaches may wish to use this as a guideline for building the base of a swing and applying more advanced training (like bat grip) to further expand their players hitting expertise.

References:

Ashley, C. D, & Weiss, L. W. (1994). Vertical jump performance and selected physiological characteristics of women. *Journal of Strength and Conditioning Research, 8*(1), 5-11.

Ayotte, B. J, Margrett, J. A, & Hicks-Patrick, J. (2010). Physical activity in middle-aged and young-old adults: The roles of self-efficacy, barriers, outcome expectancies, self-regulatory behaviors and social support. *Journal of Health Psychology, 15*(2), 173-185.

Bandura, Albert. (1978). Self-efficacy: Toward a unifying theory of behavioral change. *Advances in Behaviour Research and Therapy, 1*(4), 139-161.

Bandura, Albert. (1986). *Social foundations of thought and action: A social cognitive theory*. Englewood Cliffs, NJ: Prentice-Hall.

Bandura, Albert. (1997). *Self-efficacy: The exercise of control*. San Francisco, CA: Freeman.

Bartlett, R. M, Stockill, N. P, Elliott, B. C, & Burnett, A. F. (1996). The biomechanics of fast bowling in men's cricket: A review. *Journal of Sports Sciences, 14*(5), 403-424.

Baumgartner, T. A, & Chung, H. (2001). Confidence limits for intraclass reliability coefficients. *Measurement in Physical Education and Exercise Science, 5*(3), 179-188.

Beauchamp, M. R, Bray, S. R, & Albinson, J. G. (2002). Pre-competition imagery, self-efficacy and performance in collegiate golfers. *Journal of Sports Sciences, 20*(9), 697-705.

Boiché, J, & Sarrazin, P. (2009). Proximal and distal factors associated with dropout out versus maintained participation in organized sport. *Journal of Sports Science and Medicine, 8*(1), 9-16.

Cervelló, E. M, Escartí, A, & Guzmán, J. F. (2007). Youth sport dropout from the achievement goal theory. *Psicothema, 19*(1), 65-71.

Chase, M. A. (2001). Children's self-efficacy, motivational intentions, and attributions in physical education and sport. *Research Quarterly for Exercise and Sport, 72*(1), 47-54.

Coakley, J, & White, A. (1992). Making decisions: Gender and sport participation among British adolescents. *Sociology of sport journal, 9*(1), 20-35.

DeRenne, C, Morgan, C, Hetzler, R. K, & Taura, B. T. (2008). National and state youth baseball coaching requirements: A state case study. *The Sport Journal, 11*(2), 1-17.

Dun, S, Loftice, J, Fleisig, G. S, Kingsley, D, & Andrews, J. R. (2008). A biomechanical comparison of youth baseball pitches- Is the curveball potentially harmful? *The American Journal of Sports Medicine, 36*(4), 686-692.

Escamilla, R. F, Fleisig, G. S, DeRenne, C, Taylor, M. K, Moorman III, C. T, Imamura, R, . . . Andrews, J. R. (2009). A comparison of age level on baseball hitting kinematics. *Journal of Applied Biomechanics, 25*(3), 210-218.

Eyler, A. A, Brownson, R. C, Bacak, S. J, & Housemann, R. A. (2003). The epidemiology of walking for physical activity in the United States. *Medicine and Science in Sports and Exercise, 35*(9), 1529-1536.

Feltz, D, Short, S, & Sullivan, P. (2008). Self efficacy in sport: Research and strategies for working with athletes, teams and coaches. *International Journal of Sports Science and Coaching, 3*(2), 293-295.

Fraser-Thomas, J, Côté, J, & Deakin, J. (2008). Examining adolescent sport dropout and prolonged engagement from a developmental perspective. *Journal of applied sport psychology, 20*(3), 318-333.

Harten, Nathan, Olds, Tim, & Dollman, Jim. (2008). The effects of gender, motor skills and play area on the free play activities of 8–11 year old school children. *Health & place, 14*(3), 386-393.

Helsen, W. F, Starkes, J. L, & Hodges, N. J. (1998). Team sports and the theory of deliberate practice. *Journal of Sport & Exercise Psychology, 20*(1), 12-34.

Hopkins, W. G. (2001). Reliability of power in physical performance tests. *Sports Medicine, 31*(3), 211-234.

Hopkins, W. G. (2011a). Reliability from consecutive pairs of trials (Excel spreadsheet). *A new view of statistics.* Retrieved May 28, 2013, from http://www.sportsci.org/resource/stats/xrely.xls

Hopkins, W. G. (2011b). A scale of magnitudes for effect statistics. *A new view of statistics.* Retrieved May 28, 2013, from http://www.sportsci.org/resource/stats/

Hughes, M, & Bartlett, R. M. (2002). The use of performance indicators in performance analysis. *Journal of Sports Sciences, 20*(10), 739-754.

Lees, A. (2002). Technique analysis in sports: A critical review. *Journal of Sports Sciences, 20*(10), 813-828.

Lees, A, & Nolan, L. (1998). The biomechanics of soccer: A review. *Journal of Sports Sciences, 16*(3), 211-234.

Liebermann, D. G, Katz, L, Hughes, M. D, Bartlett, R. M, McClements, J, & Franks, I. M. (2002). Advances in the application of information technology to sport performance. *Journal of Sports Sciences, 20*(10), 755-769.

Linter, D, Noonan, T. J, & Kibler, B. (2008). Injury patterns and biomechanics of the athlete's shoulder. *Clinical Sports Medicine, 27*(4), 527-551.

Little League. (2013b). Minor League Baseball Division. Retrieved 7th June, 2013, from http://www.littleleague.org/learn/about/divisions/baseball/mlbb.htm

Little League. (2013c). Tee Ball Division. Retrieved 7th June, 2013, from http://www.littleleague.org/learn/about/divisions/TeeBallDivision.htm

Lund, R. J, & Heefner, D. (2005). Training the baseball hitter: What does research say? *Journal of Physical Education, Recreation & Dance, 76*(3), 27-33.

Lyman, S, Fleisig, G. S, Andrews, J. R, & Osinski, E. D. (2002). Effect of pitch type, pitch count, and pitching mechanics on risk of elbow and shoulder pain in youth baseball pitchers. *The American Journal of Sports Medicine, 30*(4), 463-468.

Martens, R, Rivkin, F, & Bump, L. A. (1984). A field study of traditional and nontraditional children's baseball. *Research Quarterly for Exercise and Sport, 55*(4), 351-355.

McAuley, E. (1992). The role of efficacy cognitions in the prediction of exercise behavior in middle-aged adults. *Journal of Behavioral Medicine, 15*(1), 65-88.

McAuley, E. (1993). Self-efficacy and the maintenance of exercise participation in older adults. *Journal of Behavioral Medicine, 16*(1), 103-113.

McAuley, E, Lox, C, & Duncan, T. E. (1993). Long-term maintenance of exercise, self-efficacy, and physiological change in older adults. *Journal of gerontology, 48*(4), P218-P224.

McIntyre, F. (2009). *A Longitudinal Examination of the Contribution of Perceived Motor Competence and Actual Motor Competence to Physical Activity in 6 to 9 Year Old Children.* (PhD Doctoral dissertation), University of Notre Dame.

Mills, K. D, Munroe, K. J, & Hall, C. R. (2001). The relationship between imagery and self-efficacy in competitive athletes. *Imagination Cognition and Personality, 20*(1), 33-40.

Molinero, O, del Valle, A. S, Álvarez, E, & Rosa, S. M. (2009). Reasons for dropout in youth soccer: A comparison with other team sports. *Motricidad. European Journal of Human Movement, 22*(1), 21-30.

Moritz, S. E, Feltz, D. L, Fahrbach, K. R, & Mack, D. E. (2000). The relation of self-efficacy measures to sport performance: A meta-analytic review. *Research Quarterly for Exercise and Sport, 71*(3), 280-294.

Neissaar, I, & Raudsepp, L. (2011). Changes in physical activity, self-efficacy and depressive symptoms in adolescent girls. *Pediatrics Exercise Science, 23*(3), 331-343.

Nicholls, J. G. (1989). *The competitive ethos and democratic education*. Cambridge, MA: Harvard University Press.

Okely, Anthony, Booth, Michael, & Patterson, John. (2001). Relationship of physical activity to fundamental movement skills among adolescents. *Medicine and Science in Sports and Exercise, 33*(11), 1899-1904.

Rose, G. (1969). Physical activity and coronary heart disease. *Proceedings of the Royal Society of Medicine, 62*(11), 1183.

Shaffer, B, Jobe, F. W, Pink, M, & Perry, J. (1993). Phases of a baseball swing. In B. b. A. e. study (Ed.).

Slater, A, & Tiggemann, M. (2010). "Uncool to do sport": A focus group study of adolescent girls' reasons for withdrawing from physical activity. *Psychology of Sport and Exercise, 11*(6), 619-626.

Smith, R. E, & Smoll, F. L. (1997). Coaching the coaches: Youth sports as a scientific and applied behavioral setting. *Current Directions in Psychological Science, 6*(1), 16-21.

Smith, R. M, & Loschner, C. (2002). Biomechanics feedback for rowing. *Journal of Sports Sciences, 20*(10), 783-791.

Stein, C, Fisher, L, Berkey, C, & Colditz, G. (2007). Adolescent physical activity and perceived competence: Does change in activity level impact self-perception? *Journal of Adolescent Health, 40*(5), 462. e461-462. e468.

Stuntz, C. P, & Weiss, M. R. (2009). Achievement goal orientations and motivational outcomes in youth sport: The role of social orientations. *Psychology of Sport and Exercise, 10*(2), 255-262.

Tee ball Association of Western Australia. (2011). The game of tee ball. Retrieved 9/04/2013, from http://www.tbawa.org.au/tbawa/thegame.html

Weiss, M. R, & Petlichkoff, L. M. (1989). Children's motivation for participation in and withdrawal from sport: Identifying the missing links. *Pediatric Exercise Science, 1*(3), 195-211.

Welch, C. M, Banks, S. A, Cook, F. F, & Draovitch, P. (1995). Hitting a baseball: A biomechanical description. *Journal of Orthopaedic and Sports Physical Therapy, 22*(5), 193-201.

CHAPTER FOUR

Study 2: The effect of a four week state team hitting training schedule on softball hitting mechanics and its influence on fear and competence

Andrew S. Walsh, G. Gregory Haff, Barbara Howard, Sophia Nimphius

Abstract

In Australia, many of the tee ball coaches are volunteers with limited coaching experience, which may result in an inability to effectively prepare athletes to face a pitched ball. Youth pitching can be inaccurate and may invoke fear in the hitter (Martens et al., 1984). Therefore, the aim of this study was to profile the changes of the fear of failure, sport anxiety, physical self-perception and physical importance and their interaction with the youth's ability to consistently demonstrate correct batting technique. Four psychological questionnaires were administered in identical order pre- and post- training schedule, the Physical Self Perception Profile-Child, Physical Importance Profile, Sport Anxiety Scale and Fear of Failure. Eleven female participants (age: 13.36 ± 0.81 y) with at least one year of playing experience in tee ball, baseball or softball attended a four-week training schedule. Participants completed five soft toss warm up swings and then each participant completed 20 swings with the instruction to "hit the ball up the middle" while hitting a ball tossed from five metres away. Following the testing criteria used by Escamilla et al., (2009) bats were self-selected by the participants. Swing competency was analysed using a baseball hitting scale (Walsh, 2013). Paired t-tests and regression analysis were used to analyse the data. Significance was set at a α level of $p \leq 0.05$. Significant differences were observed between hitting scores pre- and post-training ($p = 0.031$) demonstrating four weeks of training could significantly improve hitting competence. Regression analysis showed the best predictor of hitting competence was Physical Importance Profile ($R^2 = 0.38$; $p = 0.04$). Further, a key finding of this study was that hitting competence can be improved following four weeks of training which included, batting against live pitching and front side toss. Interaction between hitting scores and sports anxiety scale, physical importance profile and physical self-perception profile showed a negative trend, which suggests increased hitting technique resulted in lowering of anxiety, perception and importance of the hitting task, but increased the fear of failure experienced by the subjects. There was 38% shared variance between the Physical Importance Profile and hitting competence.

Key words: Swing, performance, psychology, injury

1.1 Introduction

Hitting a baseball has been extensively researched with most studies focusing on how batters predict placement and time of ball arrival (Bahill & Karnavas, 1993), hitting mechanics, motor control and muscle activation (Bahill & LaRitz, 1984; D. R. McIntyre & Pfautsch, 1982; Messier & Owen, 1986; Shaffer et al., 1993; Welch et al., 1995), how a batter differentiates pitches (Gray, 2002) and use of strategies to assist in hitting (Kato & Fukuda, 2002). Additionally, studies have also examined how batting slumps affect batting strategy (Gray, 2004), and determining appropriate focus when batting (Castaneda & Gray, 2007). Many of these studies focus on the adult and professional populations, with very minimal research examining youth players, especially in the transition from tee ball to baseball or softball.

A baseball game, like many team sports, is comprised of two separate tasks, fielding a ball (defence) and hitting a ball (offense). While both tasks are taught in tee ball, hitting competency is the common problem seen in youth baseball players. Acknowledging the change in ball delivery methods between tee ball (stationary) and baseball or softball (player projected) can often result in wild pitching (Martens et al., 1984) and do not allow for much promotion of hitting a tossed ball in a controlled environment. Adopting a program, like the one in America, that increases the exposure a child has to a coach or machine pitched ball, could be beneficial to the players both defensively and offensively. In America, children aged 7 to 11 years old are offered the chance to hit a ball that is pitched by a machine (machine pitch) or by their coach (coach pitch), before moving on to player pitch (Little League, 2013b). In Australia, tee ball is played from the age of 5 to 12 years of age (Tee ball Association of Western Australia, 2011), with player pitch baseball and softball commencing from ages 13 years and upwards (Little League Western Australia, 2013). On face value, the American system may offer a better opportunity for children to learn hitting against a pitched ball, due to better control mechanisms from machine and coach pitch. By breaking down the skills (e.g. from coach pitch to kid pitch) and creating motivational mastery climates, the coach can enhance the players learning (Valentini, Rudisill, & Goodway, 1999).

Biomechanical analyses of hitting skills suggest that the skill should be broken into three specific phases which include; 1) front foot off ground, 2) front foot making full contact on ground, and 3) ball contact with the bat (Welch et al., 1995). However, Escamilla et al. (2009) have proposed a 4th phase, labelled 'hands started to move forward', which takes place between the front foot making contact and bat making contact with the ball. The role the hands play is considered a vital part of swing mechanics, as this is where the delivery of all the force generated by the body will be transferred to the ball.

Understanding the biomechanical and motor control principals that apply to a baseball swing could assist coaches with structuring appropriate practice for skill development (Davids, Handford, & Williams, 1994), for example the role of the kinetic chain. Utilizing the kinetic chain the player transfers force developed by the legs, up through the trunk and upper extremities into the bat (Messier & Owen, 1985, 1986). For both coaches and teachers of youth baseball or softball athletes, it is important for them to posses the knowledge of the fundamentals of a swing, so they are able to correct any mechanical faults that are present. Subsequently, coaches and teachers should be trained in re-evaluating role movement variability, or different movement patterns that may be present when teaching a skill or role, specifically in the early stages of learning (Handford et al., 1997). In the early stages of skill development, young performers will break the skill into segments to help increase proficiency through protecting them i.e., freezing and unfreezing (Davids et al., 2000). Freezing is defined as minimalistic movements of segments of the body that are traditionally most distal from the trunk (Berthouze & Lungarella, 2004). A child learning to kick a soccer ball will often start off with just pushing/kicking the ball from a position where the child is stationary. The next progression would be the child incorporates a step and kick before advancing on to a run into the ball and kick. This highlights how learning a new skill in small section (freezing) and linking together the sections to create the complete skill (unfreezing) is important and characterizes skill progression (Temprado, Della-Grasta, Farrell, & Laurent, 1997; Vereijken et al., 1992).

Comparing highly skilled to novice hitters, Castaneda and Gray (2007) examined how differing attention foci programs aided in predicting batting performance. Skilled batters' performance was better predicted by the internal versus external

parameter, while novice batters' performances were better accounted for by skill-focused parameters. Similarly a study examining golf pitch shots, revealed that expert performers executed the skill better when they focused on where the ball should land instead of how much force to apply during the swing (Perkins-Ceccato et al., 2003). This effect has been explained by the idea of "dechunking" proposed by (Masters, 1992), which states that getting expert performers to focus on skill execution would circumvent the advanced motor programs for such a skill that has been developed through extensive practice and experience (Castaneda & Gray, 2007).

A comparison of the biomechanical properties between youth and professional baseball players revealed that the swing across both age groups are functionally similar with the older age group having significantly higher swing velocities (Escamilla et al., 2009). Demonstrating that both youth and professional hitters shared many similarities in their swings. For example, transition from lead foot off ground to bat-ball contact and bat acceleration phases however, stride phase was approximately 40% greater in the adult population (Escamilla et al., 2009). The stride phase is where the batter is "loading" or "cocking" ready to hit, which is important in generating energy and such energy can be transferred to the ball through the kinetic chain (Messier & Owen, 1986; Milburn, 1982). These results are consistent with the findings of Welch et al. (1995) were differences were noted in absolute time spent in these phases, 0.21 to 0.18 seconds respectively. The differing ball delivery method, tee (Welch et al., 1995) versus pitching machine (Escamilla et al., 2009) could explain these findings, as one hitting drill may influence the time spent in the stride phase.

For a coach, the ability to break down a complex task, like kicking a soccer ball or hitting a pitched baseball, and providing timely feedback about the skills assessment, are critical for the development of young athletes (Davids et al., 1999). Feedback is important because it can inform and motivate the performer (Hebert & Landin, 1994). Feedback has typically been divided into knowledge of results and knowledge of performance. While knowledge of results is the most easily accessible source of information to the performer, knowledge of performance is more commonly used on the field but has not been as intensively researched (Hebert & Landin, 1994). Highlighted previously, many youth coaches

are parents who lack any formal training and relevant information is often hard for such a layperson to understand (Escamilla et al., 2009). Therefore, providing novice or developmental coaches with a means of assessing the knowledge of performance and methods to relay this information to players is important for future hitting skills development.

The purpose of this study was two-fold: 1) determine how psychological measures, Fear of Failure (FF), Sport Anxiety Scale-2 (SAS), Physical Self-Perception Profile-Child (PSPP) and Youth and Physical Importance Profile (PIP), change over the course of a 4 week training schedule and 2) how such psychological measures interact with the youths ability to consistently reproduce correct batting technique.

4.1.1 Experimental Approach to the Problem

This study used a within-subject design, which was used to test the influence of hitting competence on youth softball players' psychological state. Testing took place over a four-week (8 sessions) training period to examine the role fear of failure, anxiety and self-perception and its possible influence on hitting competence. Hitting competence was evaluated by the youth baseball fundamentals hitting scale.

1.2 Methodology

4.2.1 Subjects

A sample of convenience consisting of eleven female participants (n=11) was recruited through a youth state team. All training took place at the Mirrabooka International Softball Complex, Perth, Western Australia. Fifteen subjects volunteered for the study, with only eleven satisfying all testing. The participants were required to be between the ages 8 to 14 (13.4 ± 0.8 y) with a minimum of one year playing experience (2.27 ± 0.7 y), in tee ball, baseball or softball and were required to turn up to 4 weeks of training as required by the team. If the participant missed more than one training session, they were excluded from the study. Additionally, the participants were free of any injuries to either upper or

lower body, had no history of major upper and lower body injuries, and had no significant visual impairments. The Edith Cowan University Human Ethics Committee provided approval for the project, with all subjects and their parents providing written consent before any testing commenced. Medical questionnaires were obtained before any physical activity was undertaken and participants were informed of what was required of them, ensured and explained how confidentiality of their identity or individual performance would be maintained.

4.2.2 Procedures

Subjects were required to attend 8 sessions, which comprised a four-week training schedule. The training was a part of their state team commitments, with the hitting drills on weeks one and six being administered by the lead investigator instead of the coach. During the first and eighth training sessions, participants were required to fill out three questionnaires and participate in a filmed soft toss hitting drill. Three questionnaires were administered included the Physical Self-Perception Profile-Child/Physical Importance Profile, Sports Anxiety Scale-2 and Fear of Failure.

The questionnaires were handed out and were completed by the athletes in a quiet area. The lead investigator supervised and answered any questions the athletes had. All participants had their hitting mechanics assessed during the soft toss hitting drill which took place in a hitting cage. The soft toss hitting drill required the participants to hit a ball that was tossed softly to them 20 times with a 30 second rest period, as to mimic a game situation. Participants were to stand at home plate, which was five metres directly in front of a hitting net, which was used as protection for the thrower. Two cameras (HDR-HC9, Sony Australia Limited, NSW Australia,) were set up three metres away from the tee in two directions, behind and facing the front of the hitter. Figure 4, below shows a set up for a right-handed hitter. For a left-handed hitter, camera one would be placed on the other side of the tee.

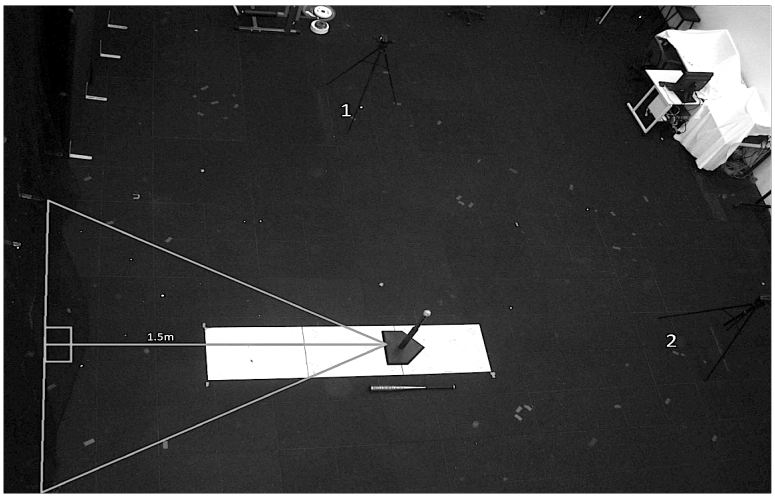


Figure 4. Test design layout for right handed hitter

The participants were required to use all safety equipment used during game conditions (e.g. batting helmet). Following procedures used by (Escamilla et al., 2009), the bats used by the participants were self-selected, which enabled players to swing bats they felt comfortable with and not be forced into using a bat they would not normally use.

Each participant took 5 warm up swings from the soft toss drill and was instructed to hit the softballs (Easton, California, USA) “up the middle”. This served to familiarize the participant with the soft toss protocol. After completion of the warm up protocol, the participants were required to take 20 swings for analysis purposes. The result of the swing was not taken into account, as the swing mechanics were the important factor. This resulted in 25 swings taken by the participant each session totalling 50 swings per participant across the study (2 sessions). A junior baseball coach, who has coached a junior team for two years, assessed the swings.

To investigate the swing mechanics of each participant, the five middle swings were selected from each testing session, as to create a consistent representation of the mechanics for every testing day. This led to a total of 10 swings being analysed over the course of the study. The score for each swing was determined by strictly adhering to the youth baseball hitting scale. Subjects were given a global score for their swing in each testing session. Each swing was graded on the presence of six specified hitting fundamentals. The highest score that could be achieved was six, with the lowest being zero. The weeks the subjects were not being assessed, they were instructed to follow

training protocol, which consisted of fielding ground and fly balls and facing live pitching (ball delivered by pitcher at game speed) and front side toss in the cage.

The results for the questionnaires were marked according to their grading sheet (appendices H-J). The scores for Physical Self-Perception Profile-Child [PSPP], Physical Importance Profile [PIP], Fear of Failure [FF] and Sports Anxiety Scale [SAS-2] were identified and exported to Microsoft Excel (Microsoft, Redmond, WA United States). To determine any changes in the swing grades and questionnaire results over the course of the four-week training schedule, a paired t-test was run. To determine exactly whether the significance lies, a line of best fit was used to determine if a positive or negative trend was present for the psychological variables, and the change in scores. The Physical Self-Perception Profile-Child and Physical Importance Profile were comprised of six and four sub domains respectively, if any significance was found a principal component analysis (PCA) was run.

4.2.3 Psychological Instruments

Physical Self-Perception Profile-Child and Physical Importance Profile (PSPP/PIP). A 36-item Physical Self-Perception Profile-Child scale was used to determine the perceived competence of the participants. In addition, the 8-item Physical Importance Profile (PIP) was administered. The Physical Importance Profile permits the individuals to subjectively rate the importance of self-perception to themselves in the sub domains of sport, strength, condition and body (Page, Fox, Biddle, & Ashford, 1993); with the Physical Self-Perception Profile measuring the sub-domains of general self-esteem, physical self-worth, body attractiveness, physical strength and physical condition. Each item on the scale consists of two statements. Both statements were required to be carefully read and then the participant was asked to pick which statement best represented them. The two statements per item were of opposing nature (e.g., Some kids feel uneasy when it comes to doing vigorous physical exercise *but* other kids feel confident when it comes to doing vigorous physical exercise.). Once the participant had decided which statement best fits them, the participant was then asked to mark one of the two boxes corresponding to that statement. The boxes represented the statement was really true for them or sort of true for them. The scoring system was the same for both Physical Self-Perception and Physical Importance Profile

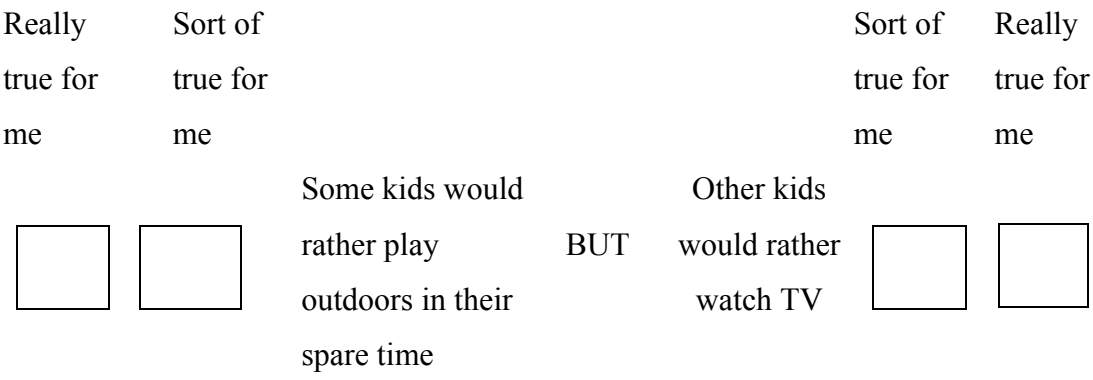


Figure 5. Sample question for Physical Self-Perception Profile-Children Youth

The questionnaire was administered to the participants to fill out by themselves and the participants were instructed that any questions they had were to be directed to only the lead researcher. Each item on the scale was given a score ranging from one to four, with four representing the highest self-perception score for that item. For the Physical Self-Perception Profile, the minimum score that could be achieved for the sub domain was 6 and maximum was 24. For the Physical Importance Profile, the minimum score that could be achieved for each sub-domain was 2 and maximum was 8. The higher the score in the sub-domains represented higher perceived competence/importance being placed in each of the sub-domains. The lead researcher kept the scale. This meant that no participant was aware of how the answers were going to be scored. During the construction of the PSPP, Fox and Corbin (1989) tested the measure for validity and reliability. They found that the profile was reliable with test-retest scores ranging from 0.74 to 0.92, with factor validity for the scale ranging from 0.982 for males to 0.997 for females.

Sports Anxiety Scale 2 (SAS-2). A 15-item scale was used to determine the anxiety felt when in a sporting situation. The SAS-2 measures 3 domains. These domains are Somatic Anxiety, Worry and Concentration Disruption. Each item has a condition. This condition was “before or while I compete in sports”. Each item is scored on a 4 point scale, with one being “Not At All”, two being “A Little Bit”, three being “Pretty Much, and four being “Very Much”. Scores for each domain ranges from 5 to 20, with the total score ranging from 15 to 60, with a higher score representing a higher anxiety level being felt by the participant. A study by R. E. Smith et al. (2006), examined the

reliability and validity of the newly proposed Sport Anxiety Scale on children as young as 8. The results obtained by (R. E. Smith et al., 2006) demonstrated the scale is a reliable measurement, with α =0.91 (95% CI=0.90-0.92) for the total score based on all 15 items, and valid, with the scores between the Sports Anxiety Scale-2 and the original Sports Anxiety Scale correlated at 0.90.

	Not at all	A little bit	Pretty Much	Very Much
1. It is hard to concentrate on the game	1	2	3	4

Figure 6. Sample question of the Sport Anxiety Scale-2

Fear of Failure- short version (FF). A 9-item scale was used to determine the fear of failure the participant feels during a sporting event. Each question was tailored to how the participant feels during a task (e.g., When I start doing poorly on a task, I feel like giving up.). The participant was required to read each item and assign a number corresponding to how they feel. There were five possible answers to each question. One represents "Strongly Agree", two "Disagree", three "Uncertain", four "Agree" and five "Strongly Agree", with a higher score representing a higher degree of fear of failure being present in the individual. As this questionnaire was administered with a sporting context, the participants were instructed to think of the questions in a sporting manner. The Fear of Failure (short) inventory strongly correlates with and covers the same content area as Herman (1990a) 25-item inventory (Thrash & Elliot, 2003). Additionally, the short version exhibits internal consistency and predictive validity that is comparable as the full 25-item inventory (Thrash & Elliot, 2003).

1	2	3	4	5
Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

1____When I start doing poorly on a task, I feel like giving up

Figure 7. Sample question for Fear of Failure Inventory

.

4.2.4 Statistical Analysis

Psychological outputs, Physical Self-Perception Profile-Child/Physical Importance Profile, Fear of Failure and Sports Anxiety Scale [PSPP/PIP, FF and SAS] were exported for analysis to Microsoft Excel (Microsoft, Redmond, WA) and analysed using SPSS software (v19.0, Chicago, IL). The PSPP/PIP, FF, SAS-2 and hitting grades were analysed by a dependent (paired) t-test to examine whether significant differences were observed between the scores obtained pre and post training study. The PSPP/PIP are made up of sub domains, 6 and 4 respectively, a PCA would be run if these questionnaires showed any significance in the paired t-test. Significance was set at $p \leq 0.05$. A linear stepwise multiple regression analysis was conducted to determine how the psychological measures influenced the change in hitting scores. Relationships were considered to be trivial (0-0.1), low (0.1-0.3), moderate (0.3-0.5), high (0.5-0.7), very high (0.7-0.9) and almost perfect (0.9-1) (Hopkins, 2002). All statistical analyses were performed using SPSS (v19.0, Chicago, IL), with significance set at $p \leq 0.05$.

1.3 Results

To determine if any significant differences were present between the variables (PSPP, PIP, FF, SAS and hitting) over the course of the four-week training camp, a paired t-test was completed. Results for all variables measured by paired t-test are outlined in Appendix N.

With regards to all variables measured, only hitting competence was significantly different ($p=0.031$) between assessment time points. This result appears to suggest that a four-week training schedule does have an influence on batting fundamentals as defined by the hitting competence scale used in the present investigation. To see the interaction between hitting scores and the psychological measures, the change in scores were graphed and the results are presented in Figures 8 to 11.

To see if any trends existed between the delta in hitting scores and psychological measures, the respective data was exported to Microsoft Excel (Microsoft, Redmond, WA United States). Once the data was analysed, a trend line was installed to clearly show whether the trend is either positive or negative.

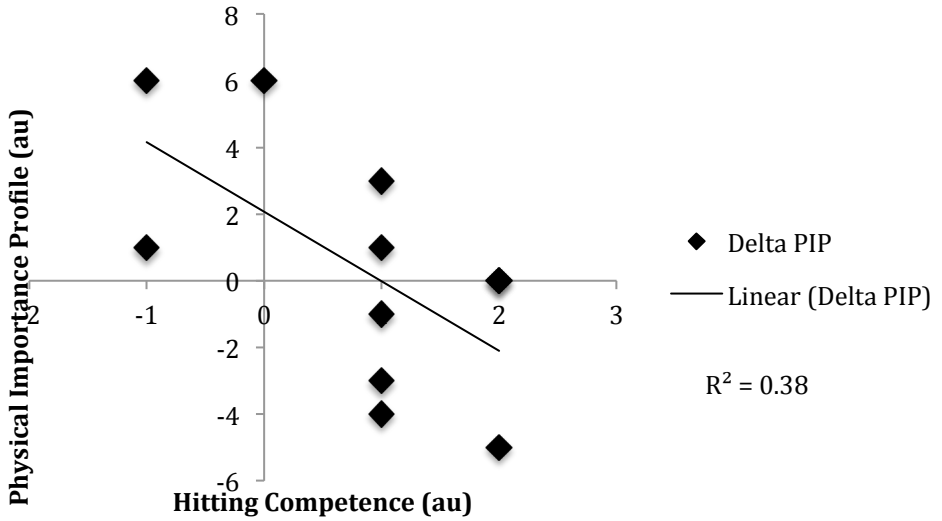


Figure 8. An overview of the results from the relationship between hitting and Physical Importance Profile scores

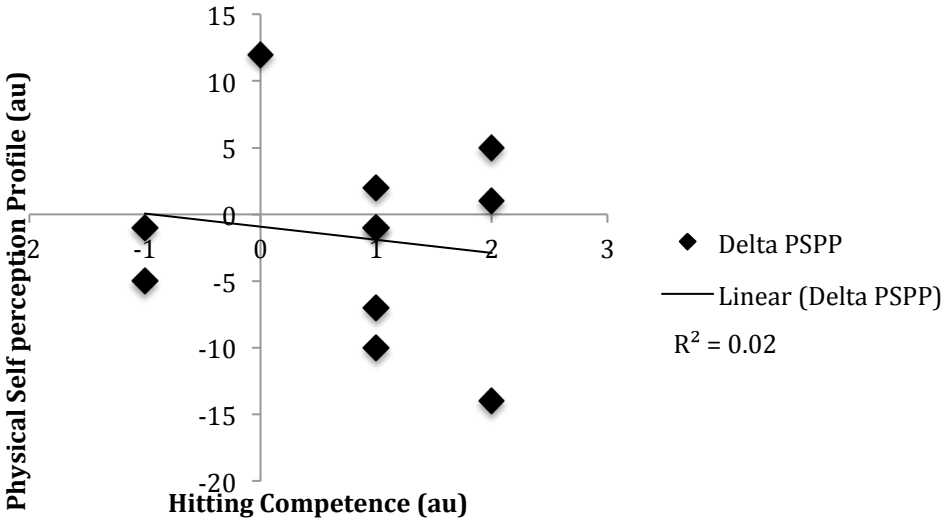


Figure 9. An overview of the results from the relationship between hitting and Physical Self-Perception Profile scores

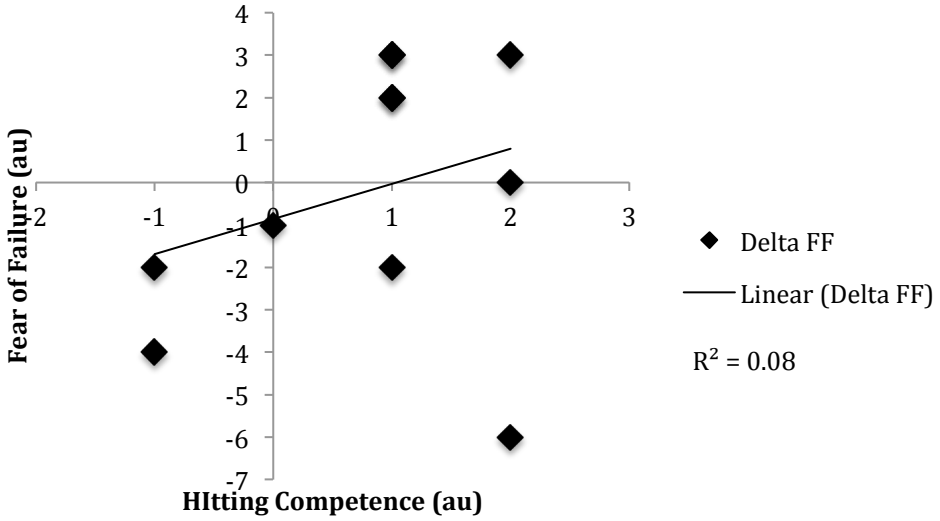


Figure 10. An overview of results from relationship between hitting and Fear of Failure scores

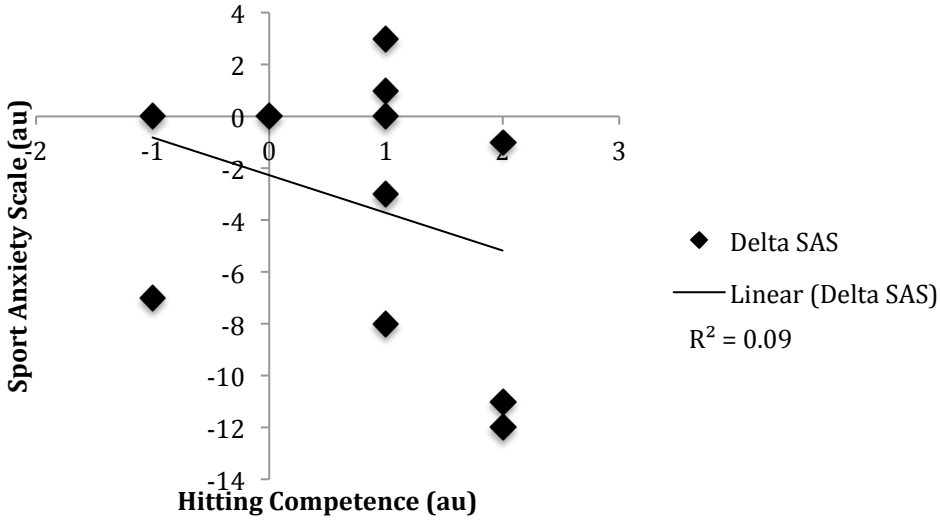


Figure 11. An overview from results of relationship between hitting and Sports Anxiety Scale scores

A stepwise multiple regression analysis revealed that the best predictor of change in hitting competence (independent) was the change in Physical Importance Profile (dependent), with an R^2 of 0.38; no other dependent variables proved to be a statistically significant predictor of change in hitting competency. The standardized beta weight for delta Physical Importance Profile was -0.618. This reveals that an inverse relationship exists between change in hitting competence and change in Physical Importance Profile scale. The relationship between the

change in hitting competence and change in Physical Importance Profile is significant ($p = 0.04$). All information is presented below in Table 5. The regression equation was calculated by using delta Physical Importance Profile, as this was the only significant value found with multiple regression analysis.

Table 6. Values of significant dependent predictors of change in hitting competence for a stepwise multiple regression analysis

Variable	R	R^2	Standardised Beta	Alpha
Physical Importance Profile	0.618	0.382	-0.618	0.043

Regression equation- $y = -0.183X + 0.885$

4.4 Discussion

The analysis of the changes in psychological measurements and batting competence over the four weeks revealed that hitting competence significantly improved. This key finding of the study indicates that 8 training sessions in which the participant is required to bat against live pitching and front side toss is sufficient to illicit changes in batting competence. It is worth noting that while changes in batting competence may change over a short period of training, changes in hitting competence (e.g. hit or out) were not recorded and conclusion on batting ability cannot be drawn from this investigation. Future investigations should also track hitting competence to determine how correct technique can influence hitting competence.

The psychological variables assessed were determined to be a significant predictor of hitting competence and the change in hitting competence was best associated with the change in the Physical Importance Profile, accounting for 38% of the variance. This outlines that 62% of the variance seen in hitting scores could not be explained by the remaining psychological measures used and is due to an external source like repetition of skill. The standardized beta weights between the hitting and Physical Importance Profile was -0.62 ($p=0.04$), meaning that every time there was an increase of hitting score, the Physical Importance Profile decreased by factor of the beta weight.

The interaction between hitting scores and psychological measures, provide interesting information on how the variables may be connected. Three out of the four graphs show a negative trend, which appears to suggest a change in hitting fundamentals is accompanied with a decrease in Sports Anxiety Scale, Physical Importance Profile and Physical Self-Perception Profile- Child scores. This means that a drop in hitting proficiency resulted in the participant placing less importance in the domains of self-perception, anxiety and physical importance. Conversely, Fear of Failure Scores show an increase with a change in hitting fundamentals. This would mean that the participant being more concerned with the fear of failing usually accompanied the lower hitting proficiency. While these results are interesting and some of these changes were expected, like a lower hitting proficiency would lead to a higher fear of failure, it cannot be stated that hitting fundamentals are the cause of such changes, as the actual reasons for such change were outside the scope of the study. Possible reasons for such change could be due to increased exposure to a pitched ball, or the pitch delivery method, selected for its ability to best represent a pitch without as much placement variability,

presented a safer environment for the subjects and such precautions may influence the data. The multiple regression analysis did reveal that the best predictor of hitting was the Physical Importance Profile. While the Physical Importance Profile was the best predictor, it is strongly suggested that a bigger population should be used for further study, as the minimum requirement of five times more cases than predictors was met but the ideal case of 20 times more cases than predictors was not (Coakes, Steed, & Ong, 2009).

While it is not absolutely clear on all the contributing factors that can influence hitting after a recent transition from tee ball, it is clear that after a small period of four weeks, the batters ability to reproduce correct batting mechanics improves with proper coaching. Having the ability to reproduce correct hitting mechanics is an important skill to possess early on but like most sporting skills, another equally important aspect to the skill is timing of hitting the ball. Timing of hitting the ball can be dependent on many factors but providing the players with a solid foundation for hitting, timing of hitting the ball is easier to work on due to the consistency of the swing mechanics. Providing the coaching staff with the knowledge and experience to teach the skill is the priority, but as (Escamilla et al., 2009) has stated most youth coaches are parent-volunteers who are inexperienced and inadequately trained. Providing the coaches with an tool that helps to educate and inform them on the fundamentals of baseball hitting is a practical and easy alternative to coaching clinics which can require big investments of time.

In conclusion, this study suggests that four weeks of training can improve hitting fundamentals and may be associated with physical self-perception. Future research should focus on trying to identify the precise reasons and relationships, if any, between hitting and psychological measurements. It is further recommended that researchers should increase the testing population and examine if any difference in hitting fundamentals exists between the changes of ball delivery method from soft toss to player pitch

4.5 Practical Applications

From a practical perspective, it can now be noted that changes can start to be seen in the participants swing mechanics after a relative small investment of time, after being taught by coaches who have an understanding of hitting. By giving coaches the

knowledge and understanding of how to teach and assess the hitting skill, a change hitting technique may be seen in their players.

References:

Bahill, A. T, & Karnavas, W. J. (1993). The perceptual illusion of baseball's rising fastball and breaking curveball. *Journal of Experimental Psychology: Human Perception and Performance, 19*(1), 3.

Bahill, A. T, & LaRitz, T. (1984). Why can't batters keep their eyes on the ball? *American Scientist, 72*(3), 249-253.

Berthouze, L, & Lungarella, M. (2004). Motor skill acquisition under environmental perturbations: On the necessity of alternate freezing and freeing of degrees of freedom. *Adaptive Behavior, 12*(1), 47-64.

Castaneda, B, & Gray, R. (2007). Effects of focus of attention on baseball batting performance in players of differing skill levels. *Journal of Sport and Exercise Psychology, 29*(1), 60.

Coakes, S, Steed, L, & Ong, C. (2009). *SPSS: Anlysis without Anguish. Version 16.0 for Windows*. Milton, Queensland: John Wiley & Sons Australia.

Davids, K, Bennett, S, Handford, C, & Jones, B. (1999). Acquiring coordination in self-paced, extrinsic timing tasks: A constraints-led perspective. *International Journal of Sport Psychology, 30*(4), 437-461.

Davids, K, Handford, C, & Williams, M. (1994). The natural physical alternative to cognitive theories of motor behaviour: An invitation for interdisciplinary research in sports science? *Journal of Sports Sciences, 12*(6), 495-528.

Davids, K, Lees, A, & Burwitz, L. (2000). Understanding and measuring coordination and control in kicking skills in soccer: Implications for talent identification and skill acquisition. *Journal of Sports Sciences, 18*(9), 703-714.

Escamilla, R. F, Fleisig, G. S, DeRenne, C, Taylor, M. K, Moorman III, C. T, Imamura, R, . . . Andrews, J. R. (2009). A comparison of age level on baseball hitting kinematics. *Journal of Applied Biomechanics, 25*(3), 210-218.

Fox, K. R, & Corbin, C. B. (1989). The physical self-perception profile: Development and preliminary validation. *Journal of Sport & Exercise Psychology, 11*(4), 408-430.

Gray, R. (2002). “Markov at the bat”: A model of cognitive processing in baseball batters. *Psychological Science, 13*(6), 542-547.

Gray, R. (2004). Attending to the execution of a complex sensorimotor skill: Expertise differences, choking, and slumps. *Journal of Experimental Psychology: Applied, 10*(1), 42.

Handford, C, Davids, K, Bennett, S, & Button, C. (1997). Skill acquisition in sport: Some applications of an evolving practice ecology. *Journal of Sports Sciences, 15*(6), 621-640.

Hebert, E. P, & Landin, D. (1994). Effects of a learning model and augmented feedback on tennis skill acquisition. *Research Quarterly for Exercise and Sport, 65*(3), 250-257.

Herman, W. E. (1990a). Fear of failure as a distinctive personality trait measure of test anxiety. *Journal of Research & Development in Education, 23*(1), 180-185.

Hopkins, W. G. (2002). A Scale of Magnitudes for Effect Statistics. Retrieved 7th Nov, 2013, from http://sportsci.org/resource/stats/effectmag.html

Kato, T, & Fukuda, T. (2002). Visual search strategies of baseball batters: Eye movements during the preparatory phase of batting. *Perceptual and motor skills, 94*(2), 380-386.

Little League. (2013b). Minor League Baseball Division. Retrieved 7th June, 2013, from http://www.littleleague.org/learn/about/divisions/baseball/mlbb.htm

Little League Western Australia. (2013). Baseball WA Little League / Junior League club-ball by-laws 2013 / 2014. Retrieved 14th October, 2013, from https://sitedesq.imgstg.com/index.cfm?fuseaction=Display_Page&PageID=661&OrgID=20476

Martens, R, Rivkin, F, & Bump, L. A. (1984). A field study of traditional and nontraditional children's baseball. *Research Quarterly for Exercise and Sport, 55*(4), 351-355.

Masters, R. S. W. (1992). Knowledge, knerves and know‐how: The role of explicit versus implicit knowledge in the breakdown of a complex motor skill under pressure. *British journal of psychology, 83*(3), 343-358.

McIntyre, D. R, & Pfautsch, E. W. (1982). A kinematic analysis of the baseball batting swings involved in opposite-field and same-field hitting. *Research Quarterly for Exercise and Sport, 53*(3), 206-213.

Messier, S. P, & Owen, M. G. (1985). The mechanics of batting: Analysis of ground reaction forces and selected lower extremity kinematics. *Research Quarterly for Exercise and Sport, 56*(2), 138-143.

Messier, S. P, & Owen, M. G. (1986). Mechanics of batting: Effect of stride technique on ground reaction forces and bat velocities. *Research Quarterly for Exercise and Sport, 57*(4), 329-333.

Milburn, P. D. (1982). Summation of segmental velocities in the golf swing. *Medicine and Science in Sports and Exercise, 14*(1), 60-64.

Perkins-Ceccato, N, Passmore, S. R, & Lee, T. D. (2003). Effects of focus of attention depend on golfers' skill. *Journal of Sports Sciences, 21*(8), 593-600.

Shaffer, B, Jobe, F. W, Pink, M, & Perry, J. (1993). Phases of a baseball swing. In B. b. A. e. study (Ed.).

Smith, R. E, Smoll, F. L, Cumming, S. P, & Grossbard, J. R. (2006). Measurement of multidimensional sport performance anxiety in children and adults: The Sport Anxiety Scale-2. *Journal of Sport and Exercise Psychology, 28*(4), 479.

Tee ball Association of Western Australia. (2011). The game of tee ball. Retrieved 9/04/2013, from http://www.tbawa.org.au/tbawa/thegame.html

Temprado, J, Della-Grasta, M, Farrell, M, & Laurent, M. (1997). A novice-expert comparison of (intra-limb) coordination subserving the volleyball serve. *Human Movement Science, 16*(5), 653-676.

Thrash, T. M, & Elliot, A. J. (2003). Inspiration as a psychological construct. *Journal of Personality and Social Psychology, 84*(4), 871.

Valentini, N. C, Rudisill, M. E, & Goodway, J. D. (1999). Incorporating a mastery climate into physical education: It's developmentally appropriate! *Journal of Physical Education, Recreation & Dance, 70*(7), 28-32.

Vereijken, B, van Emmerik, R. E. A, Whiting, H. T. A, & Newell, K. M. (1992). Free(z)ing degrees of freedom in skill acquisition. *Journal of Motor Behavior, 24*(1), 133-142.

Welch, C. M, Banks, S. A, Cook, F. F, & Draovitch, P. (1995). Hitting a baseball: A biomechanical description. *Journal of Orthopaedic and Sports Physical Therapy, 22*(5), 193-201.

Chapter 5: Conclusion

The purpose of this thesis was to create a hitting scale for youth players and to test the reliability and validity of the proposed hitting scale. Additionally, we aimed to successively quantify the psychological measurements of fear, anxiety, and perceived and actual competence and how it could influence youth hitting ability over a 4-week training program. The program resembled a realistic training scenario, which focused on all aspects of the game of baseball and softball.

The first study sought to establish a hitting scale that could be used to assess the hitting fundamental competence. With tests already existing to examine a variety of sporting movements and skills, there was a need to expand this field and have a scale that examines hitting ability in youth. Due to the paucity in the literature for hitting in youth, hitting studies on professional and collegiate populations were fused to form the basis of the hitting scale. This study established a reliable hitting scale to accurately assess fundaments of hitting, generating high inter-rater reliability for both tee (CV=3.5%; 90%CI: 2.9-4.4%); ICC=0.98; 90%CI: 0.94-0.99) and soft toss (CV = 2.5%; 90%CI: 2.1-3.1%; ICC = 0.99; 90%CI: 0.97-1.00) drills. Additionally, the scale produced high intra-day testing for tee (CV = 6.6%; 90%CI: 5.6-8.3%: ICC = 0.98; 90%CI: 0.95-0.99) and soft toss (CV = 4.5%; 90%CI: 3.7-5.6%: ICC = 0.99; 90%CI: 0.98-1.00) drills. The results of this study provide a new method to assess youth hitting ability. Furthermore, the hitting scale may be used by researchers and coaches to track any changes that may take place over the course of an investigation or season, or provide coaches with extra information on the skill of hitting, enabling correct technique to be taught.

The second study aimed to examine possible psychological reasons why youth baseball and softball players find it hard to hit a pitched ball, by examining the psychological measures of fear of failure, anxiety and perceived competence, and comparing that to actual competence in hitting (using the scale developed in study one) over a four week training schedule. Results of this study showed significant differences between pre and post hitting scores ($p= 0.031$). Changes in fear of failure, anxiety and perceived competence, were compared against changes in hitting scores. The line of best fit (R^2) ranged from 0.02 to 0.38, with the best predictor of hitting competence being the Physical Importance Profile. While the psychological measures may be related to the

change in hitting competence, there are likely to be many contributing factors. This study demonstrated that hitting fundamentals could be improved in a short four-week training study.

These finding highlight the potential benefit of having a hitting scale, as more consistent grading and feedback can be given to the players. Additionally, over the four-week period, anxiety and perception issues did decrease in the athletes. Furthermore, the scale is shown to be a valuable tool in detecting changes in hitting fundamentals after four weeks of hitting training. In order to maximize the players' chance of early success in hitting, an examination of the implementation of machine and coach pitch needs to be conducted.

In summary, the conclusions drawn from the pair of studies presented in this thesis implies that a four week intensive hitting program could be beneficial to improving hitting mechanics and the scale developed is sensitive enough to detect this change in transitional players but the programs effectiveness should be tested in future studies. Further examination of the psychological measures against hitting scores does appear to suggest that a link may exist, but to what degree is unclear. Future examination of the psychological measures would be recommended as the cause of the changes are not completely clear and there may be other variables that contribute to such changes. The results collectively appear to suggest that improving batting fundamentals may have a flow on to helping with anxiety and perception issues. What is unclear is whether fundamental batting skill competence influences perception issues and anxiety, vice versa, or they are unrelated.

Chapter 6: Future research

The following conclusions were made based on the findings from the research studies and literature review conducted, and has revealed potential areas for future investigations:

1. The reliability of the developed scale was tested on a very small population of youth baseball players. Hopkins states that for reliability to be accurately investigated three trials of approximately 50 tests each should be completed. To further investigate the reliability and validity of the proposed scale, future studies should employ the same methodology with a larger sample.

2. To follow the natural evolution of hitting, from hitting off a tee to a pitched ball, by steadily reducing the predictability of ball placement as to make game scenarios in baseball and softball. The progression of hitting drills followed the evolution of the hitting skill from hitting off a tee, to soft toss, to pitched ball. From a research design perspective, if one is only going to use the soft toss for analysis of batting competence it is recommended the warm up include tee hits prior to practice soft toss and then the soft toss assessment.

3. The ball delivery method used to simulate a pitched ball consisted of a soft toss for both studies. Currently in Australia, this ball delivery method is not used in game based scenarios. Therefore, future studies may wish to use a more conventional way of testing hitting by using a pitching machine or live pitcher to see if this ball delivery method used with the youth baseball or softball players does affect hitting fundamentals.

4. The population used for study two was recruited from a state softball team. This may mean that the population had a higher skill set for players at their age, and therefore may not be a correct representation of all junior softball players in their age group.

5. Given that the swings analysed for both studies were from both baseball and softball, it is stated that the swings across the sports should be exactly the same. From the review of literature, no research was found that examined the swing fundamentals between tee ball, baseball and softball. Therefore for future research, biomechanical

comparisons of the swings in professional baseball and softball that possess correct fundamentals should be assessed.

6. The coaching staff designed the training program used in study two and hitting was not considered to be the primary focus for the training program utilised. Future research looking at the demographic for baseball or softball should focus on the skill of batting in order to further assess if improvements in this skill result in a decrease in the potential fear of the ball associated with this population.

7. Future research may wish to explore the differing programs like machine pitch or coach pitch and whether any of the programs aids in reducing fear of a pitched ball.

8. Actual hitting performance (assessed by traditional baseball statistics of batting average) was not recorded in study two, as the focus was merely on swing competence or fundamental swing mechanics. Future studies should investigate if increasing proficiency or hitting fundamentals improves a batters chance of obtaining a hit.

Chapter 7: References

Abernethy, B. (1988). Dual-task methodology and motor skills research: Some applications and methodological constraints. *Journal of Human Movement Studies, 14*(3), 101-132.

Allender, S., Cowburn, G., & Foster, C. (2006). Understanding participation in sport and physical activity among children and adults: A review of qualitative studies. *Health Education Research, 21*(6), 826-835.

Anderson, J. R. (1982). Acquisition of cognitive skill. *Psychological Review, 89*(4), 369-406.

Ashley, C.D., & Weiss, L.W. (1994). Vertical jump performance and selected physiological characteristics of women. *Journal of Strength and Conditioning Research, 8*(1), 5-11.

Askling, C. M., Nilsson, J., & Thorstensson, A. (2010). A new hamstring test to complement the common clinical examination before return to sport after injury. *Knee Surgery, Sports Traumatology, Arthroscopy, 18*(12), 1798-1803.

Atan, T., & Imamoglu, O. (2005). Competition analysis of world greco-Rroman and world free-style wrestling championships. *International Journal of Performance Analysis in Sport, 5*(1), 31-40.

Australia, Tee ball Association of Western. (2011). The game of tee ball. Retrieved 9/04/2013, from http://www.tbawa.org.au/tbawa/thegame.html

Ayotte, B. J., Margrett, J. A., & Hicks-Patrick, J. (2010). Physical activity in middle-aged and young-old adults: The roles of self-efficacy, barriers, outcome expectancies, self-regulatory behaviors and social support. *Journal of Health Psychology, 15*(2), 173-185.

Bahill, A. T., & Karnavas, W. J. (1993). The perceptual illusion of baseball's rising fastball and breaking curveball. *Journal of Experimental Psychology: Human Perception and Performance, 19*(1), 3.

Bahill, A. T., & LaRitz, T. (1984). Why can't batters keep their eyes on the ball? *American Scientist, 72*(3), 249-253.

Bahr, R., & Holme, I. (2003). Risk factors for sports injuries- A methodological approach. *British Journal of Sports Medicine, 37*(5), 384-392.

Bailey, R. (2006). Physical education and sport in schools: A review of benefits and outcomes. *Journal of School Health, 76*(8), 397-401.

Baker, J. (2003). Early Specialization in Youth Sport: A requirement for adult expertise? *High Ability Studies, 14*(1), 85-94.

Baker, J., Cote, J., & Abernethy, B. (2003). Sport-specific practice and the development of expert decision-making in team ball sports. *Journal of Applied Sport Psychology, 15*(1), 12-25.

Bandura, A. (1978). Self-efficacy: Toward a unifying theory of behavioral change. *Advances in Behaviour Research and Therapy, 1*(4), 139-161.

Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory*. Englewood Cliffs, NJ: Prentice-Hall.

Bandura, A. (1997). *Self-efficacy: The exercise of control*. San Francisco, CA: Freeman.

Barber, B. L., Eccles, J. S., & Stone, M.R. (2001). Whatever happened to the jock, the brain, and the princess? Young adult pathways linked to adolescent activity involvement and social identity. *Journal of Adolescent Research, 16*(5), 429-455.

Bartlett, R.M., Stockill, N.P., Elliott, B.C., & Burnett, A.F. (1996). The biomechanics of fast bowling in men's cricket: A review. *Journal of Sports Sciences, 14*(5), 403-424.

Baumgartner, T. A., & Chung, H. (2001). Confidence limits for intraclass reliability coefficients. *Measurement in Physical Education and Exercise Science, 5*(3), 179-188.

Beauchamp, M. R., Bray, S. R., & Albinson, J. G. (2002). Pre-competition imagery, self-efficacy and performance in collegiate golfers. *Journal of Sports Sciences, 20*(9), 697-705.

Beilock, S. L., Bertenthal, B. I., McCoy, A. M., & Carr, T. H. (2004). Haste does not always make waste: Expertise, direction of attention, and speed versus accuracy in performing sensorimotor skills. *Psychonomic Bulletin & Review, 11*(2), 373-379.

Beilock, S. L., Carr, T. H., MacMahon, C., & Starkes, J. L. (2002). When paying attention becomes counterproductive: Impact of divided versus skill-focused attention on novice and experienced performance of sensorimotor skills. *Journal of Experimental Psychology: Applied, 8*(1), 6.

Beilock, S. L., Wierenga, S. A., & Carr, T. H. (2002). Expertise, attention, and memory in sensorimotor skill execution: Impact of novel task constraints on dual-task performance and episodic memory. *The Quarterly Journal of Experimental Psychology: Section A, 55*(4), 1211-1240.

Bennell, K., Talbot, R., Wajswelner, H., Techovanich, W., Kelly, D., & Hall, A.J. (1998). Intra-rater and inter-rater reliability of a weight-bearing lunge measure of ankle dorsiflexion. *Australian Journal of Physiotherapy, 44*(3), 175-180.

Bernstein, N.A. (1967). *The control and regulation of movements*. London: Pergamon Press.

Berryman, J. (1996). The rise of boys' sports in the United States, 1900 to 1970. In F. L. Smoll & R. F. Smith (Eds.), *Children and youth in sports: A biopsychosocial perspective.* Dubuque, IA: Brown and Benchmark.

Berthouze, L., & Lungarella, M. (2004). Motor skill acquisition under environmental perturbations: On the necessity of alternate freezing and freeing of degrees of freedom. *Adaptive Behavior, 12*(1), 47-64.

Bloomfield, J., Polman, Re., & O'Donoghue, P. (2007). Reliability of the Bloomfield movement classification. *International Journal of Performance Analysis in Sport, 7*(1), 20-27.

Boiché, J., & Sarrazin, P. (2009). Proximal and distal factors associated with dropout out versus maintained participation in organized sport. *Journal of Sports Science and Medicine, 8*(1), 9-16.

Brady, F. (2004). Children's organized sports: A developmental perspective. *Journal of Physical Education, Recreation & Dance, 75*(2), 35-41.

Brown, E. (2005). Running strategy of female middle distance runners attempting the 800m and 1500m" Double" at a major championship: A performance analysis and qualitative investigation. *International Journal of Performance Analysis in Sport, 5*(3), 73-88.

Brown, E., & O'Donoghue, P. (2007). Relating reliability to analytical goals in performance analysis. *International Journal of Performance Analysis in Sport, 7*(1), 28-34.

Brunelle, J., Danish, S. J., & Forneris, T.(2007). The impact of a sport-based life skill program on adolescent prosocial values. *Applied Developmental Science, 11*(1), 43-55.

Buraimo, B., Forrest, D., & Simmons, R.(2010). The 12th man?: Refereeing bias in English and German soccer. *Journal of the Royal Statistical Society: Series A (Statistics in Society), 173*(2), 431-449.

Burton, D.(1988). Do anxious swimmers swim slower? Reexamining the elusive anxiety-performance relationship. *Journal of Sport & Exercise Psychology, 10*(1), 45-61.

Carling, C., Wright, C, Nelson, L., & S Bradley, P.S. (2014). Comment on 'Performance analysis in football: A critical review and implications for future research'. *Journal of Sports Sciences*,32 (1) 1-6.

Castaneda, B., & Gray, R. (2007). Effects of focus of attention on baseball batting performance in players of differing skill levels. *Journal of Sport and Exercise Psychology, 29*(1), 60.

Castiello, U., & Umiltà, C. (1992). Orienting of attention in volleyball players. *International Journal of Sport Psychology, 23*(4), 301-310.

Cervelló, E. M., Escartí, A., & Guzmán, J. F. (2007). Youth sport dropout from the achievement goal theory. *Psicothema, 19*(1), 65-71.

Chase, M. A. (2001). Children's self-efficacy, motivational intentions, and attributions in physical education and sport. *Research Quarterly for Exercise and Sport, 72*(1), 47-54.

Clark, P. (2010). Intermittent high intensity activity in English FA premier league soccer. *International Journal of Performance Analysis in Sport, 10*(2), 139-151.

Coakley, J. (1992). Burnout among adolescent athletes: A personal failure or social problem. *Sociology of Sport Journal, 9*(3), 271-285.

Coakley, J., & White, A. (1992). Making decisions: Gender and sport participation among British adolescents. *Sociology of Sport Journal, 9*(1), 20-35.

Conroy, D. E. (2001a). Fear of failure: An exemplar for social development research in sport. *Quest, 53*(2), 165-183.

Conroy, D. E. (2001b). Progress in the development of a multidimensional measure of fear of failure: The Performance Failure Appraisal Inventory (PFAI). *Anxiety, Stress and Coping, 14*(4), 431-452.

Conroy, D. E. (2003). Representational models associated with fear of failure in adolescents and young adults. *Journal of Personality, 71*(5), 757-784.

Conroy, D. E., Metzler, J.N., & Hofer, S. M. (2003). Factorial invariance and latent mean stability of performance failure appraisals. *Structural Equation Modeling, 10*(3), 401-422.

Conroy, D. E., Poczwardowski, A., & Henschen, K. P. (2001). Evaluative criteria and consequences associated with failure and success for elite athletes and performing artists. *Journal of Applied Dport Psychology, 13*(3), 300-322.

Conroy, D. E., Willow, J. P., & Metzler, J. N. (2002). Multidimensional fear of failure measurement: The performance failure appraisal inventory. *Journal of Applied Sport Psychology, 14*(2), 76-90.

Cooper, S. Mark , Hughes, M. , O'Donoghue, P. , & Nevill, A. M (2007). A simple statistical method for assessing the reliability of data entered into sport performance analysis systems. *International Journal of Performance Analysis in Sport, 7*(1), 87-109.

Cresswell, S.cott L., & Eklund, R. C. (2006). The convergent and discriminant validity of burnout measures in sport: A multi-trait/multi-method analysis. *Journal of Sports Sciences, 24*(2), 209-220.

Dalton, S. E. (1992). Overuse injuries in adolescent athletes. *Sports Medicine, 13*(1), 58-70.

Davids, K., Bennett, S., Handford, C., & Jones, B. (1999). Acquiring coordination in self-paced, extrinsic timing tasks: A constraints-led perspective. *International Journal of Sport Psychology, 30*(4), 437-461.

Davids, K., Lees, A., & Burwitz, L. (2000). Understanding and measuring coordination and control in kicking skills in soccer: Implications for talent identification and skill acquisition. *Journal of Sports Sciences, 18*(9), 703-714.

Davids, K., Handford, C., & Williams, M. (1994). The natural physical alternative to cognitive theories of motor behaviour: An invitation for interdisciplinary research in sports science? *Journal of Sports Sciences, 12*(6), 495-528.

Dennis, R. J, Finch, C. F., Elliott, B. C., & Farhart, Patrick J. (2008). The reliability of musculoskeletal screening tests used in cricket. *Physical Therapy in Sport, 9*(1), 25-33.

DeRenne, C., Morgan, C., Hetzler, R.K., & Taura, B.T. (2008). National and state youth baseball coaching requirements: A state case study. *The Sport Journal, 11*(2), 1-17.

Downward, P., & Jones, M. (2007). Effects of crowd size on referee decisions: Analysis of the FA Cup. *Journal of Sports Sciences, 25*(14), 1541-1545.

Doyle, J., Gleeson, N. P., & Rees, D. (1998). Psychobiology and the athlete with anterior cruciate ligament (ACL) injury. *Sports Medicine, 26*(6), 379-393.

Drikos, S., & Vagenas, G. (2011). Multivariate assessment of selected performance indicators in relation to the type and result of a typical set in men's elite volleyball. *International Journal of Performance Analysis in Sport, 11*(1), 85-95.

Dun, S., Loftice, J., Fleisig, G. S., Kingsley, D., & Andrews, J. R. (2008). A biomechanical comparison of youth baseball pitches- Is the curveball potentially harmful? *The American Journal of Sports Medicine, 36*(4), 686-692.

Dunn, J. G.H., Dunn, J. C., Wilson, P., & Syrotuik, D.G. (2000). Reexamining the factorial composition and factor structure of the sport anxiety scale. *Journal of Sport & Exercise Psychology, 22*(2), 183-193.

Education Department of Western Australia. (2001). Fundament Movement Skills. Retrieved 24th June, 2014, from http://det.wa.edu.au/stepsresources/detcms/navigation/fundamental-movement-skills/

Eklund, R.C., Whitehead, J. R., & Welk, G. J. (1997). Validity of the children and youth physical self-perception profile: A confirmatory factor analysis. *Research Quarterly for Exercise and Sport, 68*(3), 249-256.

Ericsson, K. A.. (2006). *The influence of experience and deliberate practice on the development of superior expert performance*. New York, NY: Cambridge University Press.

Ericsson, K. A., Krampe, R. T., & Tesch-Römer, C. (1993). The role of deliberate practice in the acquisition of expert performance. *Psychological Review, 100*(3), 363-406.

Escamilla, R. F., Fleisig, G. S., DeRenne, C., Taylor, M. K., Moorman III, C. T., Imamura, R., Andrews, J. R. (2009). A comparison of age level on baseball hitting kinematics. *Journal of Applied Biomechanics, 25*(3), 210-218.

Ewing, M.E., & Seefeldt, V. (1996). Patterns of participation and attrition in American agency-sponsored youth sports. In F. L. Smoll & R. E. Smith (Eds.), *Children and youth in sport: A biopsychosocial perspective* (pp. 31-45). Madison, WI: Brown and Benchmark.

Eyler, A. A., Brownson, R. C., Bacak, S. J., & Housemann, R. A. (2003). The epidemiology of walking for physical activity in the United States. *Medicine and Science in Sports and Exercise, 35*(9), 1529-1536.

Feltz, D., Short, S., & Sullivan, P. (2008). Self efficacy in sport: Research and strategies for working with athletes, teams and coaches. *International Journal of Sports Science and Coaching, 3*(2), 293-295.

Fenter, P C., Bellew, J.W., Pitts, T.A., & Kay, R.E. (2003). Reliability of stabilised commercial dynamometers for measuring hip abduction strength: A pilot study. *British Journal of Sports Medicine, 37*(4), 331-334.

Fox, K. R., & Corbin, C. B. (1989). The physical self-perception profile: Development and preliminary validation. *Journal of Sport & Exercise Psychology, 11*(4), 408-430.

Fraser-Thomas, J., Côté, J., & Deakin, J. (2008). Examining adolescent sport dropout and prolonged engagement from a developmental perspective. *Journal of Applied Sport Psychology, 20*(3), 318-333.

French, K. E., Spurgeon, J. H., & Nevett, M. E. (1995). Expert-novice differences in cognitive and skill execution components of youth baseball performance. *Research Quarterly for Exercise and Sport, 66*(3), 194-201.

Gabbe, B. J., Bennell, K.L., Wajswelner, H., & Finch, C. F. (2004). Reliability of common lower extremity musculoskeletal screening tests. *Physical Therapy in Sport, 5*(2), 90-97.

Gallagher, S. S., Finison, K., Guyer, B., & Goodenough, S (1984). The incidence of injuries among 87,000 Massachusetts children and adolescents: Results of the 1980-81 Statewide Childhood Injury Prevention Program Surveillance System. *American Journal of Public Health, 74*(12), 1340-1347.

Gallahue, D. L., & Cleland-Donnelly, F. (2003). Movement Skill Acquisition *Developmental physical education for all children* (pp. 50-77). Champaign, IL: Human Kinetics.

Giacobbi Jr, P.R., & Weinberg, R.S. (2000). An examination of coping in sport: Individual trait anxiety differences and situational consistency. *Sport Psychologist, 14*(1), 42-62.

Glazier, P. S. (2010). Game, set and match? Substantive issues and future directions in performance analysis. *Sports Medicine, 40*(8), 625-634.

Gore, S., Farrell, F., & Gordon, J. (2001). Sports involvement as protection against depressed mood. *Journal of Research on Adolescence, 11*(1), 119-130.

Gould, D. (1987). Understanding attrition in children's sport. In D. Gould & L. W. Weiss (Eds.), *Advances in pediatric sport sciences* (Vol. 2, pp. 61-85). Champaign, IL: Human Kinetics.

Gray, R. (2002). "Markov at the bat": A model of cognitive processing in baseball batters. *Psychological Science, 13*(6), 542-547.

Gray, R. (2004). Attending to the execution of a complex sensorimotor skill: Expertise differences, choking, and slumps. *Journal of Experimental Psychology: Applied, 10*(1), 42.

Grin, T. R., Nelson, L.B., & Jeffers, J. B. (1987). Eye injuries in childhood. *Pediatrics, 80*(1), 13-17.

Haas, M. (1995). How to evaluate intraexaminer reliability using an interexaminer reliability study design. *Journal of Manipulative and Physiological Therapeutics, 18*(1), 10-15.

Hagger, M., Ashford, B., & Stambulova, N. (1998). Russian and British children's physical self-perceptions and physical activity participation. *Pediatric Exercise Science, 10*(2), 137-152.

Handford, C., Davids, K., Bennett, S., & Button, C. (1997). Skill acquisition in sport: Some applications of an evolving practice ecology. *Journal of Sports Sciences, 15*(6), 621-640.

Harten, Nathan, Olds, Tim, & Dollman, Jim. (2008). The effects of gender, motor skills and play area on the free play activities of 8–11 year old school children. *Health & place, 14*(3), 386-393.

Hayen, A., Dennis, R. J, & Finch, C. F. (2007). Determining the intra-and inter-observer reliability of screening tools used in sports injury research. *Journal of Science and Medicine in Sport, 10*(4), 201-210.

Hebert, E. P, & Landin, D. (1994). Effects of a learning model and augmented feedback on tennis skill acquisition. *Research Quarterly for Exercise and Sport, 65*(3), 250-257.

Heil, J. (1993). *Psychology of sport injury*. Champaign, IL: Human Kinetics Publishers.

Helsen, W.F., Starkes, J.L., & Hodges, N.J. (1998). Team sports and the theory of deliberate practice. *Journal of Sport & Exercise Psychology, 20*(1), 12-34.

Herman, W.E. (1990a). Fear of failure as a distinctive personality trait measure of test anxiety. *Journal of Research & Development in Education, 23*(1), 180-185.

Herman, W. E. (1990b). Fear of failure as a distinctive personality trait measure of test anxiety. *Journal of Research & Development in Education, 23*(3), 180-185.

Hopkins, W G. (2011). Measure of Validity. Retrieved 24th June, 2014, from http://sportsci.org/

Hopkins, W.G. (2001). Reliability of power in physical performance tests. *Sports Medicine, 31*(3), 211-234.

Hopkins, W.G. (2002). A Scale of Magnitudes for Effect Statistics. Retrieved 7th Nov, 2013, from http://sportsci.org/resource/stats/effectmag.html

Hopkins, W.G. (2011a). Reliability from consecutive pairs of trials (Excel spreadsheet). *A new view of statistics.* Retrieved May 28, 2013, from http://www.sportsci.org/resource/stats/xrely.xls

Hopkins, W.G. (2011b). A scale of magnitudes for effect statistics. *A new view of statistics.* Retrieved May 28, 2013, from http://www.sportsci.org/resource/stats/

Hopkins, W. G. (2000). Measures of reliability in sports medicine and science. *Sports Medicine, 30*(1), 1-15.

Hughes, M., & Franks, I.M. (2004). *Notational Analysis of Sport. Systems for beter coaching and performance in sport* (2 ed.). London: Routledge.

Hughes, M. (2004). Performance analysis- A 2004 perspective. *International Journal of Performance Analysis in Sport, 4*(1), 103-109.

Hughes, M., Cooper, S.M., Nevill, A., & Brown, S.. (2003). An example of reliability testing and establishing performance profiles for non-parametric data from performance analysis. *International Journal of Computer Science in Sport, 2*(1), 34-56.

Hughes, M. D., & Bartlett, R. M. (2002). The use of performance indicators in performance analysis. *Journal of Sports Sciences, 20*(10), 739-754.

Hughes, M., & Daniel, R.. (2003). Playing patterns of elite and non-elite volleyball. *International Journal of Performance Analysis in Sport, 3*(1), 50-56.

Kais, K., & Raudsepp, L. (2004). Cognitive and somatic anxiety and self-confidence in athletic performance of beach volleyball *Perceptual and Motor Skills, 98*(2), 439-449.

Kato, T., & Fukuda, T. (2002). Visual search strategies of baseball batters: Eye movements during the preparatory phase of batting. *Perceptual and Motor Skills, 94*(2), 380-386.

Lames, M., & McGarry, T. (2007). On the search for reliable performance indicators in game sports. *International Journal of Performance Analysis in Sport, 7*(1), 62-79.

Landers, M. A, & Fine, G. A. (1996). Learning life's lessons in tee ball: The reinforcement of gender and status in kindergarten sport. *Sociology of Sport Journal, 13*(1), 87-93.

Lazarus, R. S. (1991). *Emotion and adaptation*. New York: Oxford University Press.

League, Little. (2013a). Intermediate (50/70) Baseball Division. Retrieved 5th September, 2013, from http://www.littleleague.org/learn/about/divisions/baseball/llint5070bb.htm

League, Little. (2013b). Minor League Baseball Division. Retrieved 7th June, 2013, from http://www.littleleague.org/learn/about/divisions/baseball/mlbb.htm

League, Little. (2013c). Tee Ball Division. Retrieved 7th June, 2013, from http://www.littleleague.org/learn/about/divisions/TeeBallDivision.htm

Leavitt, J.L. (1979). Cognitive demands of skating and stickhandling in ice hockey. *Canadian Journal of Applied Sport Sciences, 4*(1), 46-55.

Lee, A. M., Keh, N .C, & Magill, R. A. (1993). Instructional Effects of Teacher Feedback in Physical Education. *Journal of Teaching in Physical Education, 12*(3), 228-243.

Lees, A. (2002). Technique analysis in sports: A critical review. *Journal of Sports Sciences, 20*(10), 813-828.

Lees, A., & Nolan, L. (1998). The biomechanics of soccer: A review. *Journal of Sports Sciences, 16*(3), 211-234.

Liebermann, D. G., Katz, L., Hughes, M. D., Bartlett, R. M., McClements, J., & Franks, I. M. (2002). Advances in the application of information technology to sport performance. *Journal of Sports Sciences, 20*(10), 755-769.

Linter, D., Noonan, T. J, & Kibler, B. (2008). Injury patterns and biomechanics of the athlete's shoulder. *Clinical Sports Medicine, 27*(4), 527-551.

Little League, Western Australia. (2013). Baseball WA Little League / Junior League club-ball by-laws 2013 / 2014. Retrieved 14th October, 2013, from https://sitedesq.imgstg.com/index.cfm?fuseaction=Display_Page&PageID=661&OrgID=20476

Lund, R. J., & Heefner, D. (2005). Training the baseball hitter: What does research say? *Journal of Physical Education, Recreation & Dance, 76*(3), 27-33.

Lyman, S., Fleisig, G. S., Andrews, J. R., & Osinski, E. D. (2002). Effect of pitch type, pitch count, and pitching mechanics on risk of elbow and shoulder pain in youth baseball pitchers. *The American Journal of Sports Medicine, 30*(4), 463-468.

Magill, V., & Anderson, D. (1988). Critical periods as optimal readiness for learning sport skills. In F. L. Smoll & R. E. Smith (Eds.), *Children and youth in sport: A biopsychosocial perspective* (pp. 57-72). Dubuque, IA: Brown & Benchmark.

Magyar, T. M., & Chase, M. A. (1996). Psychological strategies used by competitive gymnasts to overcome the fear of injury. *Technique, 16*(10), 1-5.

Martens, R. (1996). Turning kids on to physical activity for a lifetime. *Quest, 48*(3), 303-310.

Martens, R., Burton, D., Vealey, R. S., Bump, L. A., & Smith, D. E. (1990). Development and validation of the competitive state anxiety inventory-2. *Competitive Anxiety in Sport*, 117-190.

Martens, R., Rivkin, F., & Bump, L. A. (1984). A field study of traditional and nontraditional children's baseball. *Research Quarterly for Exercise and Sport, 55*(4), 351-355.

Martens, R., & Seefeldt, V. (1979). *Guidelines for children's sports*. Washington, DC: American Alliance for Health, Physical Education, Recreation and Dance.

Masters, R. S.W. (1992). Knowledge, knerves and know‐how: The role of explicit versus implicit knowledge in the breakdown of a complex motor skill under pressure. *British Journal of Psychology, 83*(3), 343-358.

McAuley, E. (1992). The role of efficacy cognitions in the prediction of exercise behavior in middle-aged adults. *Journal of Behavioral Medicine, 15*(1), 65-88.

McAuley, E. (1993). Self-efficacy and the maintenance of exercise participation in older adults. *Journal of Behavioral Medicine, 16*(1), 103-113.

McAuley, E., Lox, ., & Duncan, T. E. (1993). Long-term maintenance of exercise, self-efficacy, and physiological change in older adults. *Journal of Gerontology, 48*(4), P218-P224.

McIntyre, D. R., & Pfautsch, E.W. (1982). A kinematic analysis of the baseball batting swings involved in opposite-field and same-field hitting. *Research Quarterly for Exercise and Sport, 53*(3), 206-213.

McIntyre, F. (2009). *A Longitudinal Examination of the Contribution of Perceived Motor Competence and Actual Motor Competence to Physical Activity in 6 to 9 Year Old Children.* (PhD Doctoral dissertation), University of Notre Dame.

McNevin, N. H., Shea, C. H., & Wulf, G. (2003). Increasing the distance of an external focus of attention enhances learning. *Psychological Research, 67*(1), 22-29.

Messier, S. P., & Owen, M. G. (1985). The mechanics of batting: Analysis of ground reaction forces and selected lower extremity kinematics. *Research Quarterly for Exercise and Sport, 56*(2), 138-143.

Messier, S. P., & Owen, M. G. (1986). Mechanics of batting: Effect of stride technique on ground reaction forces and bat velocities. *Research Quarterly for Exercise and Sport, 57*(4), 329-333.

Milburn, P.D. (1982). Summation of segmental velocities in the golf swing. *Medicine and Science in Sports and Exercise, 14*(1), 60-64.

Mills, K. D, Munroe, K. J., & Hall, C. R. (2001). The relationship between imagery and self-efficacy in competitive athletes. *Imagination Cognition and Personality, 20*(1), 33-40.

Molinero, O., del Valle, A., Salguero, Á. E, & Rosa, S. M. (2009). Reasons for dropout in youth soccer: A comparison with other team sports. *Motricidad. European Journal of Human Movement, 22*(1), 21-30.

Moritz, S. E., Feltz, D. L., Fahrbach, K. R., & Mack, D. E. (2000). The relation of self-efficacy measures to sport performance: A meta-analytic review. *Research Quarterly for Exercise and Sport, 71*(3), 280-294.

Neissaar, I., & Raudsepp, L. (2011). Changes in physical activity, self-efficacy and depressive symptoms in adolescent girls. *Pediatrics Exercise Science, 23*(3), 331-343.

Nelson, L. B., Wilson, T. W., & Jeffers, J. B. (1989). Eye injuries in childhood: Demography, etiology, and prevention. *Pediatrics, 84*(3), 438-441.

Nicholls, J. G. (1989). *The competitive ethos and democratic education*. Cambridge, MA: Harvard University Press.

NSW Department of Education and Communities. (2011). Fundamental Movement Skills. Retrieved 24th June, 2014, from http://www.curriculumsupport.education.nsw.gov.au/primary/pdhpe/gamessport/fms001.htm

O'Donoghue, P. (2002). Performance models of ladies and mens singles tennis at the Australian Open. *International Journal of Performance Analysis in Sport, 2*(1), 73-84.

O'Donoghue, P. (2007). Reliability issues in performance analysis. *International Journal of Performance Analysis in Sport, 7*(1), 35-48.

O'Donoghue, P., & Ingram, B. (2001). A notational analysis of elite tennis strategy. *Journal of Sports Sciences, 19*(2), 107-115.

Okely, Anthony, Booth, Michael, & Patterson, John. (2001). Relationship of physical activity to fundamental movement skills among adolescents. *Medicine and Science in Sports and Exercise, 33*(11), 1899-1904.

Page, Angela, Fox, Kenneth, Biddle, Stuart, & Ashford, Basil. (1993). Evidence of cross-cultural validity for the Physical Self-Perception Profile. *Personality and Individual Differences, 14*(4), 585-590.

Pasternack, J.S., Veenema, K. R., & Callahan, C. M. (1996). Baseball injuries: A Little League survey. *Pediatrics, 98*(3), 445-448.

Perkins-Ceccato, N., Passmore, S. R, & Lee, T. D. (2003). Effects of focus of attention depend on golfers' skill. *Journal of Sports Sciences, 21*(8), 593-600.

Petlichkoff, L. M. (1996). The drop-out dilemma in youth sports. In O. Bar-Or (Ed.), *The child and adolescent athlete* (pp. 418-430). Oxford, UK: Blackwell Science.

Polit, Denise, & Beck, Cheryl. (2006). The content validity index: Are you sure you know what's being reported? Critique and recommendations. *Research in nursing & health, 29*(5), 489-497.

Race, D. E. (1961). A cinematographic and mechanical analysis of the external movements involved in hitting a baseball effectively. *Research Quarterly, 32*(3), 394-404.

Raedeke, T. D., Lunney, K., & Venables, K. (2002). Understanding athlete burnout: Coach perspectives. *Journal of Sport Behavior, 25*(1), 181-206.

Raustorp, A., Ståhle, A., Gudasic, H., Kinnunen, A., & Mattsson, E. (2005). Physical activity and self‐perception in school children assessed with the Children and Youth‐Physical Self‐Perception Profile. *Scandinavian Journal of Medicine & Science in Sports, 15*(2), 126-134.

Risser, W. L., Anderson, S. J., Bolduc, S. P., Harris, S. S., Landry, G. L., Orenstein, D. M., & Smith, A. D. (1994). Risk of injury from baseball and softball in children 5 to 14 years of age. *Pediatrics, 93*(4), 690-692.

Rose, D. J, & Christina, R. W. (1990). Attention demands of precision pistol-shooting as a function of skill level. *Research Quarterly for Exercise and Sport, 61*(1), 111-113.

Rose, G. (1969). Physical activity and coronary heart disease. *Proceedings of the Royal Society of Medicine, 62*(11 Pt 2), 1183.

Rowland, T. (1997). Counseling the young athlete: Where do we draw the line? *Pediatric Exercise Science, 9*(1), 197-201.

Rowland, T .W, Shore, S., Shephard, R. J, Wolach, B., Falk, B., Kodesh, E., Eliakim, A. (1998). Predicting athletic brilliancy, or the futility of training 'til the salchow's come home. *Pediatric Exercise Science, 10*(3), 197-201.

Scott, D. A, Bond, E. Q., Sisto, S. A., & Nadler, S. F. (2004). The intra-and interrater reliability of hip muscle strength assessments using a handheld versus a portable dynamometer anchoring station. *Archives of Physical Medicine and Rehabilitation, 85*(4), 598-603.

Shaffer, B., Jobe, F.W., Pink, M., & Perry, J. (1993). Phases of a baseball swing. In B. b. A. e. study (Ed.).

Short, S. E., Reuter, J., Brandt, J., Short, M. W., & Kontos, A. P. (2004). The relationships among three components of perceived risk of injury, previous injuries and gender in contact sport athletes. *Athletic Insight, 6*(3), 78-85.

Shultz, S. J., Nguyen, A.D., Windley, T. C., Kulas, A. S., Botic, T. L., & Beynnon, B. D. (2006). Intratester and intertester reliability of clinical measures of lower extremity anatomic characteristics: Implications for multicenter studies. *Clinical Journal of Sport Medicine, 16*(2), 155-161.

Slater, A., & Tiggemann, M. (2010). "Uncool to do sport": A focus group study of adolescent girls' reasons for withdrawing from physical activity. *Psychology of Sport and Exercise, 11*(6), 619-626.

Smith, M. D., & Chamberlin, C. J. (1992). Effect of adding cognitively demanding tasks on soccer skill performance. *Perceptual and Motor Skills, 75*(3), 955-961.

Smith, R. M., & Loschner, C. (2002). Biomechanics feedback for rowing. *Journal of Sports Sciences, 20*(10), 783-791.

Smith, R. E. (2007). Toward a cognitive-affective model of athletic burnout. *Journal of Sport Psychology, 8*(1), 36-50.

Smith, R. E., & Smoll, F. L. (1997). Coaching the coaches: Youth sports as a scientific and applied behavioral setting. *Current Directions in Psychological Science, 6*(1), 16-21.

Smith, R. E., Smoll, F.L., Cumming, S. P., & Grossbard, J. R. (2006). Measurement of multidimensional sport performance anxiety in children and adults: The Sport Anxiety Scale-2. *Journal of Sport and Exercise Psychology, 28*(4), 479.

Smith, R. E., Smoll, F. L., & Schutz, R. W. (1990). Measurement and correlates of sport-specific cognitive and somatic trait anxiety: The Sport Anxiety Scale. *Anxiety Research, 2*(4), 263-280.

Smoll, F.L. (2001). Coach-parent relationships in youth sports: Increasing harmony and minimizing hassle. In J. M. Williams (Ed.), *Applied sport psychology: Personal growth to peak performance* (Vol. 4, pp. 150-161). Mountain View, CA: Mayfield.

Snyder, E. E. (1990). Emotion and sport: A case study of collegiate women gymnasts. *Sociology of Sport Journal, 7*(3), 254-270.

Statistics, Australian Bureau of. (2012a). Children's Participation in Cultural and Leisure Activities, Australia, Apr 2012. Retrieved 1st October, 2013, from http://www.abs.gov.au/ausstats/abs@.nsf/Products/4901.0~Apr+2012~Main+Features~Sports+participation?OpenDocument

Statistics, Australian Bureau of. (2012b). Children's Participation in Cultural and Leisure Activities, Australia, Apr 2012. Canberra, Australia.

Stein, C., Fisher, L., Berkey, C., & Colditz, G. (2007). Adolescent physical activity and perceived competence: Does change in activity level impact self-perception? *Journal of Adolescent Health, 40*(5), 462. e461-462. e468.

Stuart, M. E, & Ebbeck, V. (1995). The influence of perceived social approval on moral development in youth sport. *Pediatric Exercise Science, 7*(3), 270-280.

Stuntz, C. P, & Weiss, M. R. (2009). Achievement goal orientations and motivational outcomes in youth sport: The role of social orientations. *Psychology of Sport and Exercise, 10*(2), 255-262.

Swain, A., & Jones, G. (1996). Explaining performance variance: The relative contribution of intensity and direction dimensions of competitive state anxiety. *Anxiety, Stress, and Coping, 9*(1), 1-18.

Sykes, D., Twist, C., Hall, S., Nicholas, C., & Lamb, K. (2009). Semi-automated time-motion analysis of senior elite rugby league. *International Journal of Performance Analysis in Sport, 9*(1), 47-59.

Temprado, J., Della-Grasta, M., Farrell, M., & Laurent, M. (1997). A novice-expert comparison of (intra-limb) coordination subserving the volleyball serve. *Human Movement Science, 16*(5), 653-676.

Tenga, A., Kanstad, D., Ronglan, L.T., & Bahr, R. (2009). Developing a new method for team match performance analysis in professional soccer and testing its reliability. *International Journal of Performance Analysis in Sport, 9*(1), 8-25.

Thomas, J. R., Nelson, J. K., & Silverman, S. J. (2011). *Research Methods in Physical Activity*. Champaign, USA: Human Kinetics.

Thomson, E., Lamb, K., & Nicholas, C. (2013). The development of a reliable amateur boxing performance analysis template. *Journal of Sports Sciences, 31*(5), 516-528.

Thrash, T. M., & Elliot, A. J. (2003). Inspiration as a psychological construct. *Journal of Personality and Social Psychology, 84*(4), 871.

Valentini, N. C., Rudisill, M. E., & Goodway, J. D. (1999). Incorporating a mastery climate into physical education: It's developmentally appropriate! *Journal of Physical Education, Recreation & Dance, 70*(7), 28-32.

van Teijlingen, E., & Hundley, V. (2001). The importance of pilot studies. *Social Research Update, 1*(35), 1-4.

Vaz, L., Mouchet, A., Carreras, D., & Morente, H.. (2011). The importance of rugby game-related statistics to discriminate winners and losers at the elite level competitions in close and balanced games. *International Journal of Performance Analysis in Sport, 11*(1), 130-141.

Vereijken, B., Emmerik, R. E.A., van, Whiting, H.T.A., & Newell, K. M. (1992). Free(z)ing degrees of freedom in skill acquisition. *Journal of Motor Behavior, 24*(1), 133-142.

Vinger, P. F., Duma, S. M., & Crandall, J. (1999). Baseball hardness as a risk factor for eye injuries. *Archives of Ophthalmology, 117*(3), 354.

Weiss, M. R. (1993). Psychological effects of intensive sport participation on children and youth: Self-esteem and motivation. In B. R. Cahill & A. J. Pearl (Eds.), *Intensive participation in children's sports* (pp. 39-69). Champaign, IL: Human Kinetics.

Weiss, M.R., & Petlichkoff, L. M. (1989). Children's motivation for participation in and withdrawal from sport: Identifying the missing links. *Pediatric Exercise Science, 1*(3), 195-211.

Weiss, M.R. (1993). Psychological effects of intensive sport participation on children and youth: Self-esteem and motivation. In B. R. Cahill & A. J. Pearl (Eds.), *Intensive participation in children's sports* (pp. 39-69). Champaign, IL: Human Kinetics.

Welch, C. M., Banks, S. A., Cook, F. F., & Draovitch, P. (1995). Hitting a baseball: A biomechanical description. *Journal of Orthopaedic and Sports Physical Therapy, 22*(5), 193-201.

Welk, G. J., Corbin, C. B., Dowell, M. Nann., & Harris, H. (1997). The validity and reliability of two different versions of the children and youth physical self-perception profile. *Measurement in Physical Education and Exercise Science, 1*(3), 163-177.

Whitehead, J. R. (1995). A study of children's physical self-perceptions using an adapted physical self-perception profile questionnaire. *Pediatric Exercise Science, 7*(2), 132-151.

Wiersma, L. (2000). Risks and benefits of youth sport specialization: Perspectives and recommendations. *Pediatric Exercise Science, 12*(1), 13-22.

Williams, A M., Davids, K., & Williams, J. G. (1999). *Visual perception and action in sport*. New York, NY: Taylor & Francis.

Williams, A.M., Davids, K., Burwitz, L., & Williams, J.G. (1992). Perception and action in sport. *Journal of Human Movement Studies, 22*(4), 147-204.

Wooten, H. (1994). Cutting losses for student‐athletes in transition: An integrative transition model. *Journal of Employment Counseling, 31*(1), 2-9.

Wulf, G., McNevin, N. H., Fuchs, T., Ritter, F., & Toole, T. (2000). Attentional focus in complex skill learning. *Research Quarterly for Exercise and Sport, 71*(3), 229-239.

Yamamoto, L. G., Inaba, A. S., Okamura, D. M., Yamamoto, J. A., & Yamamoto, J. B. (2001). Injury reduction and bounce characteristics of safety baseballs and acceptability by youth leagues. *Clinical Pediatrics, 40*(4), 197-203.

Appendix A- Ethics approval

Conditions of approval

1. Monitoring of Approved Research Projects

Monitoring is the process of verifying that the conduct of research conforms to the approved ethics application. Compliance with monitoring requirements is a condition of approval.

The *National Statement on Ethical Conduct in Human Research* indicates that institutions are responsible for ensuring that research is reliably monitored. Monitoring of approved projects is to establish that a research project is being, or has been, conducted in the manner approved by the Ethics Committee. Researchers also have a significant responsibility in monitoring, as they are in the best position to observe any adverse events or unexpected outcomes. They should report such events or outcomes promptly to the Ethics Committee and take prompt steps to deal with any unexpected risks.

All projects approved by an ECU Ethics Committee are approved subject to the following conditions of approval:

- If the research project is discontinued before the expected date of completion, researchers should inform the Ethics Committee as soon as possible, giving reasons.

- An annual report (for projects that are longer than one year) and a final report at the completion of the research will be provided to the Ethics Committee. You will also be notified when a report is due. The ethics report form can be found on the ethics website http://www.ecu.edu.au/GPPS/ethics/human_ethics_resources.html

- Researchers must also immediately report anything that might warrant review of the ethical approval of the protocol, including:
  Any serious or unexpected adverse effects on participants
  Any unforeseen events that might affect continued ethical acceptability of the project.

The Ethics Committee retains the right to require a more detailed and/or more frequent report if the research is deemed to be of high risk, and to recommend and/or adopt any additional appropriate mechanism for monitoring including random inspections of research sites, data and signed consent forms, and/or interview, with their prior consent, of research participants.

2. Changes and amendments

Compliance with the approved research protocol is a condition of approval, and any changes to the research design must be reported to the Ethics Committee. Amendments to the research design that may affect participants and/or that may have ethical implications must be reviewed and approved by the Ethics Committee before commencement.

Any changes to documents and other material used in recruiting potential research participants, including advertisements, letters of invitation, information sheets and consent forms, should be approved by the Ethics Committee.

In order to request approval for a change, please send an email to the Ethics Office outlining why the change is needed, describing the change (e.g. the new participants or new research procedures), and attach a copy of any amended documents.

3. Extension of ethics approval

All research projects are approved for a specified period of time – from the date of approval until the date of completion provided in the ethics application. If an extension of the approval period is required, a request must be submitted to the Ethics Committee. Please ensure that requests for extension of approval are submitted before the original approval expires.

In order to request an extension of ethics approval, please send an email to the Ethics Office providing a brief reason why the extension is needed and giving the new expected date of completion.

Appendix B- Information letter Study 1

Information Letter to Participants

Thank you very much for indicating your interest in participating in this study. The purpose of this document is to explain the study that you are going to participate. Please read carefully and understand the information below, and do not hesitate to ask any questions.

Project Title

The creation and validation of a baseball swing hitting scale.

Researchers

This research project is being undertaken as part of the requirements of a Masters by Research (Sports Science) at Edith Cowan University (ECU).

MSc. Student: Andrew Walsh (andrew.walsh@ecu.edu.au) 6304 2242

Supervisor: Dr. Greg Haff (g.haff@ecu.edu.au) 6304 5416

Co-Supervisor: Dr. Sophia Nimphius (s.nimphius@ecu.edu.au) 6304 5848

Co-Supervisor: Mrs Barbara Howard (b.howard@ecu.edu.au) 6304 5895

Further details on supervisors and School of Exercise, Biomedical and Health Sciences are available at http://www.sebhs.ecu.edu.au .

Purpose of the study

We are interested in determining creating and testing the reliability and validity of a new baseball swing competence scale

Eligibility

You will be eligible for this study if your age is between 8 and 13 yrs, have no history of major injury, have no significant vision problems and are injury free at the time of your participation in the study.

You will be screened with a generic medical questionnaire consisting of several questions about your health and physical conditions. Once you are found to be eligible for the study, you will be invited to participate as a subject in this study.

Requirements

You will be required to complete 3 testing sessions with a short familiarisation/warm up at the beginning of each session. All training sessions will comprise of a 5 min familiarisation session followed by a 20 to 30 min testing session, where will you be required to strike a ball off a tee and a ball that is tossed. You will be recorded during the testing. You will be required to wear enclosed sport shoes and wear normal sport clothes for all testing session. You will be requested not to perform any strenuous exercise 1 day prior to the testing session and refrain from consuming caffeine at least 4 hours prior to testing.

There will be recordings taken every training session. This will help us to create and validate a hitting scale.

Familiarisation session

During familiarisation session you will be required to complete 1 trial of 5 movement swings per training session.

Exercise

You (as the subject) will be required to perform 20 swings in total. You will be required to hit a ball 10 times off a tee. After the drill has been completed, you will be required to strike a tossed ball 10 times. Three sessions will be held on the different days with a day break between each trial day. You will be instructed to hit the ball up the middle for both tee and soft toss tests. A recovery period 30 sec will be given between each agility trial.

Measurements

During the testing we will be taking measurements of ball velocity off the bat (batted ball velocity). In addition to the batted ball velocity measurements, we will also be video recording your swing. This is to help us create a valid and reliable baseball swing checklist.

Risks

The risks associated with this study are minimal. These risks may include fatigue during the testing session or in hours following testing as you will perform a number of swings in one session. There is a very low possibility of being struck by the ball or any other device

Benefits

You will gain insight into the research process and techniques, and will also gain information about your swing after the trials. The results of this study will also be provided to you upon request.

Confidentiality of Information

All information provided by you will be treated with full confidentiality. Your contact information will only be accessible by the chief researcher during the period of the study. The information and data gathered from you during the study will be used to answer the research question of this study. People who will have access to the raw information for this study are only limited to the researcher and the supervisors. Data collected will be stored in a password-protected computer and is only available to the researchers. Hard copy data (paper etc) will only be kept in the researcher's office and locked in a specific drawer/filing cabinet. All data will be stored according to ECU policy and regulations following the completion of the study.

Results of the Research Study

The results of this study are intended for completion of a Masters by Research thesis and may be presented in conferences/seminars and published in peer-reviewed journal(s), as magazine articles, as an online article or part of a book section and reports. Published results will not contain information that can be used to identify participants unless specific consent for this has been obtained. A copy of published results may be obtained by the participants upon request.

Voluntary Participation

Your participation in this study is voluntary. No monetary reward will be provided. No explanation or justification is needed if you choose not to participate. Your decision if you do not want to participate or continue to participate will not disadvantage you or involve any penalty.

Withdrawing Consent to Participate

You are free to withdraw your consent to further involvement in this research project at any time. You also have the right to withdraw any personal information that has been collected during the research with your withdrawal.

Questions and/or Further Information

If you have any questions or require more information about the research project, please do not hesitate to contact

Andrew Walsh

Office 19.126, School of Exercise, Biomedical, and Health Sciences, Edith Cowan University

270 Joondalup Drive, Joondalup, WA 6027 Australia.

Mobile: 0406 522 298

Email: andrew.walsh@ecu.edu.au

Independent Contact Person

If you have any concerns or complaints about the research project and wish to talk to an independent person, you may contact:

Kim Gifkins (Research Ethics Officer)

Building 1, Block 'B', Level 3, Room 333, Edith Cowan University, 100 Joondalup Drive, JOONDALUP WA 6027

Phone: (+61 8) 6304 2170

Email: research.ethics@ecu.edu.au

Website: http://www.ecu.edu.au/GPPS/ethics

Approval by the Human Research Ethics Committee:

This research project has been approved by the ECU Human Research Ethics Committee. Attached is the letter of approval for your information.

Appendix C- Informed consent Study 1

Edith Cowan University
School of Exercise, Biomedical and Health Sciences

Informed Consent Form

Project: The creation and validation of a baseball swing hitting scale.

I have read the information sheet and understood the points in the informed consent form. I agree to participate in this study with the above title and give my consent freely. I understand that the study will be carried out as described in the information sheet, a copy of which I have retained. I realise that whether or not I decide to participate is my decision. I also realize that I can withdraw from the study at any time and that I do not have to give any reasons for withdrawing. I have agreed that I will be recorded and that any recordings/photos taken may be used in conferences and papers. I give permission that my face to be shown/ not to be shown. I have had all questions answered to my satisfaction.

Name: _____ Date: _____

Signature: _____

Parent/ Guardian (only if applicable)

I, _____, as parent / guardian of Mr/ Miss _____, acknowledge that I have read and understood the information sheet and hereby give permission for my child to participate in the study

Signature: _____

Date (DD/MM/YYYY): _____

Appendix D- Information letter study 2

Edith Cowan University
School of Exercise, Biomedical and Health Sciences

Information Letter to Participants

Thank you very much for indicating your interest in participating in this study. The purpose of this document is to explain the study that you are going to participate. Please read carefully and understand the information below, and do not hesitate to ask any questions.

Project Title

The effect of a 4-week tee ball to baseball transitional camp on perceived, actual motor competence

Researchers

This research project is being undertaken as part of the requirements of a Masters by Research (Sports Science) at Edith Cowan University (ECU).

MSc. Student: Andrew Walsh (andrew.walsh@ecu.edu.au) 6304 2242

Supervisor: Dr. Greg Haff (g.haff@ecu.edu.au) 6304 5416

Co-Supervisor: Dr. Sophia Nimphius (s.nimphius@ecu.edu.au) 6304 5848

Co-Supervisor: Mrs Barbara Howard (b.howard@ecu.edu.au) 6304 5895

Further details on supervisors and School of Exercise, Biomedical and Health Sciences are available at http://www.sebhs.ecu.edu.au .

Purpose of the study

We are interested in determining how the fear of a moving ball impacts the child's ability hit.

Eligibility

You will be eligible for this study if your age is between 8 and 13 yrs, have no history of major lower limb injury, have no significant vision problems and are injury free at the time of your participation in the study. You will be screened with a generic medical questionnaire consisting of several questions about your health and physical conditions. Once you are found to be eligible for the study, you will be invited to participate as a subject in this study.

Requirements

You will be required to attend all four sessions of a tee ball to baseball transitional camp. The camp will

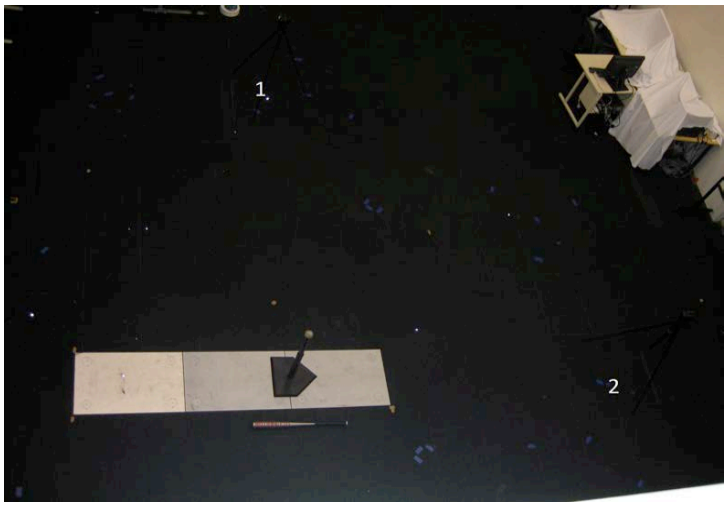
cover all the basic skills that are required to be successful in baseball (throwing, hitting, and catching). You will be required to wear your own baseball uniform and drink bottle. You will be requested not to perform any strenuous exercise 1 day prior to the testing sessions. You will be taking through a structured warm up which will contain running, stretching, catching and throwing before moving on to the drills.

Exercise

You will be required to hit a ball that will vary in difficulty as the camp progresses. The ball will start off being placed on a tee and move on towards the ball being thrown at the batter, just like in a real game. Over the course of the camp, you will be recorded while you are taking part in any hitting drills.

Measurements

During the testing session you will be required to wear your normal baseball uniform. We will be recording a variety of things. First off, when you are batting we will be taking measurements of ball velocity of the bat (batted ball velocity), and rating your swing through video recording your swing. The camera set up will be similar to the picture below



In addition, we will be asking you to fill out some questionnaires at the start of the camp and again at the very end of the camp. These questionnaires will help us to understand how the barrier of fear is playing a role

is your swing. You will be issued 4 questionnaires in total. These questionnaires are the Trait Sport-Confidence Inventory, Physical Self Perception Profile, Performance Failure Appraisal Inventory (Shortened) and a demographic questionnaire. All these questionnaires have been shown to be reliable to be completed by children. If there are any questions about the questionnaires, feel free to approach the lead researcher (Andrew Walsh).

Risks

The risks associated with this study are minimal. These risks may include fatigue, or straining a muscle during the training session or in hours following testing due to physical exertion as you will be repetitively perform swings in one session. There is a very low possibility of being struck by the ball or any other object, as the drills will not start until everyone is ready.

Benefits

You will gain insight into the research process and techniques, and will also gain information about your swing and how you can improve it after the training camp and finished. The results of this study will also be provided to you upon request.

Confidentiality of Information

All information provided by you will be treated with full confidentiality. Your contact information will only be accessible by the chief researcher during the period of the study. The information and data gathered from you during the study will be used to answer the research question of this study. People who will have access to the raw information for this study are only limited to the researcher and the supervisors. Data collected will be stored in a password-protected computer and is only available to the researchers. Hard copy data (paper etc) will only be kept in the researcher's office and locked in a specific drawer/filing cabinet. All data will be stored according to ECU policy and regulations following the completion of the study.

Results of the Research Study

The results of this study are intended for completion of a Masters by Research thesis and may be presented in conferences/seminars and published in peer-reviewed journal(s), as magazine articles, as an online article or part of a book section and reports. Published results will not contain information that can be used to identify participants unless specific consent for this has been obtained. A copy of published results may be obtained by the

participants upon request.

Voluntary Participation

Your participation in this study is voluntary. No monetary reward will be provided. No explanation or justification is needed if you choose not to participate. Your decision if you do not want to participate or continue to participate will not disadvantage you or involve any penalty.

Withdrawing Consent to Participate

You are free to withdraw your consent to further involvement in this research project at any time. You also have the right to withdraw any personal information that has been collected during the research with your withdrawal.

Questions and/or Further Information

If you have any questions or require more information about the research project, please do not hesitate to contact

Andrew Walsh

Office 19.126, School of Exercise, Biomedical, and Health Sciences, Edith Cowan University

270 Joondalup Drive, Joondalup, WA 6027 Australia.

Mobile: 0406 522 298

Email: andrew.walsh@ecu.edu.au

Independent Contact Person

If you have any concerns or complaints about the research project and wish to talk to an independent person, you may contact:

Kim Gifkins (Research Ethics Officer)

Building 1, Block 'B', Level 3, Room 333, Edith Cowan University, 100 Joondalup Drive, JOONDALUP WA 6027

Phone: (+61 8) 6304 2170

Email: research.ethics@ecu.edu.au

Website: http://www.ecu.edu.au/GPPS/ethics

Approval by the Human Research Ethics Committee:

This research project has been approved by the ECU Human Research Ethics Committee. Attached is the letter of approval for your information.

Appendix E- Informed consent Study 2

Edith Cowan University
School of Exercise, Biomedical and Health Sciences

AUSTRALIA ECU EDITH COWAN UNIVERSITY

Informed Consent Form

Project: The effect of a 4-week tee ball to baseball transitional camp on perceived, actual motor competence

I have read the information sheet and understood the points in the informed consent form. I agree to participate in this study with the above title and give my consent freely. I understand that the study will be carried out as described in the information sheet, a copy of which I have retained. I realise that whether or not I decide to participate is my decision. I also realize that I can withdraw from the study at any time and that I do not have to give any reasons for withdrawing. I have agreed that I will be recorded and that any recordings/photos taken may be used in conferences and papers. I give permission that my face to be shown/ not to be shown. I have had all questions answered to my satisfaction.

Name: _____ Date: _____

Signature: _____

Parent/ Guardian (only if applicable)

I, _____, as parent / guardian of Mr/ Miss _____, acknowledge that I have read and understood the information sheet and hereby give permission for my child to participate in the study

Signature: _____

Date (DD/MM/YYYY): _____

Appendix F- General Medical Questionnaire

Medical Questionnaire

The following questionnaire is designed to establish a background of your medical history, and identify any injury and/ or illness that may influence your testing and performance. If you are under 18 then a parent or guardian should complete the questionnaire on your behalf or check your answers and then sign in the appropriate section to verify that they are satisfied the answers to all questions are correct to the best of their knowledge.

Please answer all questions as accurately as possible, and if you are unsure about any thing please ask for clarification. All information provided is strictly confidential. If you answer "yes" to any non-exercise related question that may contraindicate you from completing a testing or training session, a clearance from a qualified medical practitioner may be required prior to participation.

Personal Details

Name:_____ Playing Position:_____

Date of Birth (DD/MM/YYYY):_____ Gender: Female/ Male

Medical History

Have you ever had, or do you currently have any of the following?

			If YES, please provide details
High or abnormal blood pressure	Y	N	_____
High cholesterol	Y	N	_____
Rheumatic fever	Y	N	_____
Heart abnormalities	Y	N	_____
Asthma	Y	N	_____
Diabetes	Y	N	_____
Epilepsy	Y	N	_____
Recurring back pain	Y	N	_____

Appendix G- Media Release Form

Edith Cowan University
School of Exercise, Biomedical and Health Sciences

Photo, Video, and Audio Consent and Release Form

During the data collection period for the project labelled "The effect of a 4-week tee ball to baseball transitional camp on perceived, actual motor competence and intention to transition", video, audio and photo data will be collected. Edith Cowan University as well as the author affiliated with the aforementioned study, requests the right to use all such photos, videos, print material and audio taken from the youth and adults involved in this project. They may be used for disclosing to any third party that has aided in the data collection (e.g. coaching staff/development officers).

By signing this I consent and give permission to allow Edith Cowan University and the author affiliated with the project labelled "The effect of a 4-week tee ball to baseball transitional camp on perceived, actual motor competence and intention to transition" the unlimited right to use the photos, video and audio clips that they have of me/my child participating in this study. I agree to give up my rights with regards to Edith Cowan University and the affiliated authors video, photo and audio clips of me/my child collected from the aforementioned study. Further, by signing the consent and release form, I acknowledge that I understand and agree to the above request and conditions. I sign this form freely and without inducement.

Name: _____ Date: _____

Signature: _____

Parent/ Guardian (only if applicable)

I, _____, as parent / guardian of Mr/ Miss _____, acknowledge that I have read and understood the information sheet and hereby give permission for my child to participate in the study

Signature: _____

Date (DD/MM/YYYY): _____

Appendix H- Physical Self-Perception Profile for Children Youth

What I Am Like

ID#: _____ Age: _____ Grade: _____ Boy or Girl (circle which)

SAMPLE SENTENCE

	Really True for me	Sort of True for me				Sort of True for me	Really True for me
(a)	☐	☐	Some kids would rather play outdoors in their spare time	**BUT**	Other kids would rather watch T.V.	☐	☐
1.	☐	☐	Some kids do very well at all kinds of sports	**BUT**	Other kids *don't* feel they are very good when it comes to sports.	☐	☐
2.	☐	☐	Some kids feel *uneasy* when it comes to doing vigorous physical exercise	**BUT**	Other kids feel *confident* when it comes to doing vigorous physical exercise.	☐	☐
3.	☐	☐	Some kids feel that they have a good-looking (fit-looking) body compared to other kids	**BUT**	Other kids feel that compared to most, their body *doesn't* look so good.	☐	☐
4.	☐	☐	Some kids feel that they *lack* strength compared to other kids their age.	**BUT**	Other kids feel that they are stronger than other kids their age.	☐	☐
5.	☐	☐	Some kids are *proud* of themselves physically	**BUT**	Other kids *don't* have much to be proud of physically.	☐	☐
6.	☐	☐	Some kids are often *unhappy* with themselves	**BUT**	Other kids are pretty *pleased* with themselves.	☐	☐
7.	☐	☐	Some kids wish they could be a lot better at sports	**BUT**	Other kids feel that they good enough at sports.	☐	☐
8.	☐	☐	Some kids have a lot of stamina for vigorous physical exercise	**BUT**	Other kids soon get out of breath and have to slow down or quit.	☐	☐
9.	☐	☐	Some kids find it *difficult* to keep their bodies looking good physically	**BUT**	Other kids find it *easy* to keep their bodies looking good physically.	☐	☐
10.	☐	☐	Some kids think that they have stronger muscles than other kids their age	**BUT**	Other kids feel that they have weaker muscles than other kids their age.	☐	☐

	Really True for me	Sort of True for me				Sort of True for me	Really True for me
11.	☐	☐	Some kids *don't* feel very confident about themselves physically	**BUT**	Other kids really feel good about themselves physically.	☐	☐
12.	☐	☐	Some kids are *happy* with themselves as a person	**BUT**	Other kids are often *not* happy with themselves.	☐	☐
13.	☐	☐	Some kids think they could do well at just about any new sports activity they haven't tried before	**BUT**	Other kids are afraid they might *not* do well at sports they haven't ever tried.	☐	☐
14.	☐	☐	Some kids *don't* have much stamina and fitness	**BUT**	Other kids have *lots* of stamina and fitness.	☐	☐
15.	☐	☐	Some kids are *pleased* with the appearance of their bodies	**BUT**	Other kids wish that their bodies looked in better shape physically.	☐	☐
16.	☐	☐	Some kids *lack* confidence when it comes to strength activities	**BUT**	Other kids are very confident when it comes to strength activities.	☐	☐
17.	☐	☐	Some kids are very *satisfied* with themselves physically	**BUT**	Other kids are often *dissatisfied* with themselvers physically.	☐	☐
18.	☐	☐	Some kids *don't* like the way they are leading their life	**BUT**	Other kids *do* like the way they are leading their life.	☐	☐
19.	☐	☐	In games and sports some kids usually *watch* instead of play	**BUT**	Other kids usually *play* rather than watch.	☐	☐
20.	☐	☐	Some kids try to take part in energetic physical exercise whenever they can	**BUT**	Other kids try to *avoid* doing energetic exercise if they can.	☐	☐
21.	☐	☐	Some kids feel that they are *often* admired for their good-looking bodies	**BUT**	Other kids feel that they are *seldom* admired for the way their bodies look.	☐	☐
22.	☐	☐	When strong muscles are needed, some kids are the *first* to step forward	**BUT**	Other kids are the *last* to step forward when strong muscles are needed.	☐	☐
23.	☐	☐	Some kids are *unhappy* with how they are and what they can do physically	**BUT**	Other kids are *happy* with how they are and what they can do physically.	☐	☐
24.	☐	☐	Some kids *like* the kind of person they are	**BUT**	Other kids often wish they were someone else.	☐	☐

	Really True for me	Sort of True for me				Sort of True for me	Really True for me
25.	☐	☐	Some kids feel that they are *better* than others their age at sports	**BUT**	Other kids *don't* feel they can play as well.	☐	☐
26.	☐	☐	Some kids soon have to quit running and exercising because they get tired	**BUT**	Other kids can run and do exercises for a long time without getting tired.	☐	☐
27.	☐	☐	Some kids are *confident* about how their bodies look physically	**BUT**	Other kids feel *uneasy* about how their bodies look physically.	☐	☐
28.	☐	☐	Some kids feel that they are *not* as good as others when physical strength is needed	**BUT**	Other kids feel that they are among the *best* when physical strength is needed.	☐	☐
29.	☐	☐	Some kids have a positive feeling about themselves physically	**BUT**	Other kids feel somewhat negative about themselves physically.	☐	☐
30.	☐	☐	Some kids are very *happy* being the way they are	**BUT**	Other kids wish they were *different*.	☐	☐
31.	☐	☐	Some kids *don't* do well at new outdoor games	**BUT**	Other kids are *good* at new games right away.	☐	☐
32.	☐	☐	When it comes to activities like running, some kids are able to keep on going	**BUT**	Other kids soon have to quit to take a rest.	☐	☐
33.	☐	☐	Some kids *don't* like how their bodies look physically	**BUT**	Other kids are *pleased* with how their bodies look physically.	☐	☐
34.	☐	☐	Some kids think that they are strong, and have good muscles compared to other kids their age	**BUT**	Other kids think that they are weaker, and *don't* have such good muscles as other kids their age.	☐	☐
35.	☐	☐	Some kids wish that they could feel better about themselves physically	**BUT**	Other kids *always* seem to feel good about themselves physically.	☐	☐
36.	☐	☐	Some kids are *not* very happy with the way they do a lot of things	**BUT**	Other kids think the way they do things is *fine*.	☐	☐

HOW **IMPORTANT** ARE THESE THINGS
TO HOW YOU FEEL ABOUT YOURSELF AS A PERSON?

	Really True for me	**Sort of True for me**				**Sort of True for me**	**Really True for me**
1.	☐	☐	Some kids think it's important to be good at sports	**BUT**	Other kids *don't* think how good you are at sports is that important.	☐	☐
2.	☐	☐	Some kids *don't* think that having a lot of stamina for energetic exercises is very important to how they feel about themselves	**BUT**	Other kids think that having a lot of stamina for vigorous exercise is *very* important.	☐	☐
3.	☐	☐	Some kids think it's *very* important to have a good-looking (fit-looking) body in order to feel good about themselves as a person	**BUT**	Other kids *don't* think that having a good-looking body is important at all.	☐	☐
4.	☐	☐	Some kids think that being physically strong is *not* all that important to how they feel about themselves as a person	**BUT**	Other kids feel that it's *very* important to be physically strong.	☐	☐
5.	☐	☐	Some kids *don't* think doing well at athletics is that important to how they feel about themselves as a person	**BUT**	Other kids feel that doing well at athletics is important.	☐	☐
6.	☐	☐	Some kids feel that having the ability to do a lot of running and exercising is *very* important to how they feel about themselves as a person	**BUT**	Other kids *don't* feel it's all that important to have the ability to do a lot of running and exercising.	☐	☐
7.	☐	☐	Some kids *don't* think that having a body that looks in good physical shape is important to how they feel about themselves	**BUT**	Other kids feel that it's *very* important to have a body that looks in good physical shape.	☐	☐
8.	☐	☐	Some kids think that having strong muscles is *very* important to how they feel about themselves	**BUT**	Other kids feel that it's *not* at all important to have strong muscles.	☐	☐

What I Am Like

ID#: _____ Age: _____ Grade: _____ Boy or Girl (circle which)

SAMPLE SENTENCE

	Really True for me	Sort of True for me			Sort of True for me	Really True for me
(a)	☐	☐	Some kids would rather play outdoors in their spare time	**BUT**	☐	☐

1.	4	3	Some kids do very well at all kinds of sports	**BUT**	2	1
2.	1	2	Some kids feel *uneasy* when it comes to doing vigorous physical exercise	**BUT**	3	4
3.	4	3	Some kids feel that they have a good-looking (fit-looking) body compared to other kids	**BUT**	2	1
4.	1	2	Some kids feel that they *lack* strength compared to other kids their age.	**BUT**	3	4
5.	4	3	Some kids are *proud* of themselves physically	**BUT**	2	1
6.	1	2	Some kids are often *unhappy* with themselves	**BUT**	3	4
7.	1	2	Some kids wish they could be a lot better at sports	**BUT**	3	4
8.	4	3	Some kids have a lot of stamina for vigorous physical exercise	**BUT**	2	1
9.	1	2	Some kids find it *difficult* to keep their bodies looking good physically	**BUT**	3	4
10.	4	3	Some kids think that they have stronger muscles than other kids their age	**BUT**	2	1

	Really True for me	Sort of True for me				Sort of True for me	Really True for me
11.	1	2	Some kids *don't* feel very confident about themselves physically	**BUT**	Other kids really feel good about themselves physically.	3	4
12.	4	3	Some kids are *happy* with themselves as a person	**BUT**	Other kids are often *not* happy with themselves.	2	1
13.	4	3	Some kids think they could do well at just about any new sports activity they haven't tried before	**BUT**	Other kids are afraid they might *not* do well at sports they haven't ever tried.	2	1
14.	1	2	Some kids *don't* have much stamina and fitness	**BUT**	Other kids have *lots* of stamina and fitness.	3	4
15.	4	3	Some kids are *pleased* with the appearance of their bodies	**BUT**	Other kids wish that their bodies looked in better shape physically.	2	1
16.	1	2	Some kids *lack* confidence when it comes to strength activities	**BUT**	Other kids are very confident when it comes to strength activities.	3	4
17.	4	3	Some kids are very *satisfied* with themselves physically	**BUT**	Other kids are often *dissatisfied* with themselvers physically.	2	1
18.	1	2	Some kids *don't* like the way they are leading their life	**BUT**	Other kids *do* like the way they are leading their life.	3	4
19.	1	2	In games and sports some kids usually *watch* instead of play	**BUT**	Other kids usually *play* rather than watch.	3	4
20.	4	3	Some kids try to take part in energetic physical exercise whenever they can	**BUT**	Other kids try to *avoid* doing energetic exercise if they can.	2	1
21.	4	3	Some kids feel that they are *often* admired for their good-looking bodies	**BUT**	Other kids feel that they are *seldom* admired for the way their bodies look.	2	1
22.	4	3	When strong muscles are needed, some kids are the *first* to step forward	**BUT**	Other kids are the *last* to step forward when strong muscles are needed.	2	1
23.	1	2	Some kids are *unhappy* with how they are and what they can do physically	**BUT**	Other kids are *happy* with how they are and what they can do physically.	3	4
24.	4	3	Some kids *like* the kind of person they are	**BUT**	Other kids often wish they were someone else.	2	1

	Really True for me	Sort of True for me			Sort of True for me	Really True for me
25.	4	3	Some kids feel that they are *better* than others their age at sports	**BUT**	Other kids *don't* feel they can play as well.	2	1
26.	1	2	Some kids soon have to quit running and exercising because they get tired	**BUT**	Other kids can run and do exercises for a long time without getting tired.	3	4
27.	4	3	Some kids are *confident* about how their bodies look physically	**BUT**	Other kids feel *uneasy* about how their bodies look physically.	2	1
28.	1	2	Some kids feel that they are *not* as good as others when physical strength is needed	**BUT**	Other kids feel that they are among the *best* when physical strength is needed.	3	4
29.	4	3	Some kids have a positive feeling about themselves physically	**BUT**	Other kids feel somewhat negative about themselves physically.	2	1
30.	4	3	Some kids are very *happy* being the way they are	**BUT**	Other kids wish they were *different*.	2	1
31.	1	2	Some kids *don't* do well at new outdoor games	**BUT**	Other kids are *good* at new games right away.	3	4
32.	4	3	When it comes to activities like running, some kids are able to keep on going	**BUT**	Other kids soon have to quit to take a rest.	2	1
33.	1	2	Some kids *don't* like how their bodies look physically	**BUT**	Other kids are *pleased* with how their bodies look physically.	3	4
34.	4	3	Some kids think that they are strong, and have good muscles compared to other kids their age	**BUT**	Other kids think that they are weaker, and *don't* have such good muscles as other kids their age.	2	1
35.	1	2	Some kids wish that they could feel better about themselves physically	**BUT**	Other kids *always* seem to feel good about themselves physically.	3	4
36.	1	2	Some kids are *not* very happy with the way they do a lot of things	**BUT**	Other kids think the way they do things is *fine*.	3	4

HOW **IMPORTANT** ARE THESE THINGS
TO HOW YOU FEEL ABOUT YOURSELF AS A PERSON?

	Really True for me	Sort of True for me			Sort of True for me	Really True for me
1.	4	3	Some kids think it's important to be good at sports	**BUT**	2	1
				Other kids *don't* think how good you are at sports is that important.		
2.	1	2	Some kids *don't* think that having a lot of stamina for energetic exercises is very important to how they feel about themselves	**BUT**	3	4
				Other kids think that having a lot of stamina for vigorous exercise is *very* important.		
3.	4	3	Some kids think it's *very* important to have a good-looking (fit-looking) body in order to feel good about themselves as a person	**BUT**	2	1
				Other kids *don't* think that having a good-looking body is important at all.		
4.	1	2	Some kids think that being physically strong is *not* all that important to how they feel about themselves as a person	**BUT**	3	4
				Other kids feel that it's *very* important to be physically strong.		
5.	1	2	Some kids *don't* think doing well at athletics is that important to how they feel about themselves as a person	**BUT**	3	4
				Other kids feel that doing well at athletics is important.		
6.	4	3	Some kids feel that having the ability to do a lot of running and exercising is *very* important to how they feel about themselves as a person	**BUT**	2	1
				Other kids *don't* feel it's all that important to have the ability to do a lot of running and exercising.		
7.	1	2	Some kids *don't* think that having a body that looks in good physical shape is important to how they feel about themselves	**BUT**	3	4
				Other kids feel that it's *very* important to have a body that looks in good physical shape.		
8.	4	3	Some kids think that having strong muscles is *very* important to how they feel about themselves	**BUT**	2	1
				Other kids feel that it's *not* at all important to have strong muscles.		

Scoring Instructions for the CY-PSPP and CY-PIP Scales

For validity, reliability, and other CY-PSPP and CY-PIP data, see the references below:

Whitehead, J.R. (1995). A study of children's physical self-perceptions using an adapted physical self-perception questionnaire. *Pediatric Exercise Science, 7*, 132-151. (Please cite this one as the original source of the CY-PSPP).

Eklund, R.C., Whitehead, J.R., & Welk, G.J. (1997). Validity of the CY-PSPP: A confirmatory factor analysis. *Research Quarterly for Exercise and Sport, 68*, 249-256.

The CY-PSPP scales are as follows:

Sport/Athletic Competence*:	#'s 1, 7, 13, 19, 25, 31.
Condition/Stamina Competence:	#'s 2, 8, 14, 20, 26, 32.
Attractive Body Adequacy:	#'s 3, 9, 15, 21, 27, 33.
Strength Competence:	#'s 4, 10, 16, 22, 28, 34.
Physical Self-Worth (Global):	#'s 5, 11, 17, 23, 29, 35.
Global Self-Worth*:	#'s 6, 12, 18, 24, 30, 36

The CY-PIP scales are as follows:

Sport/Athletic Competence Importance:	#'s 1, 5.
Condition/Stamina Competence Importance:	#'s 2, 6.
Attractive Body Adequacy Importance:	#'s 3, 7.
Strength Competence Importance:	#'s 4, 8.

- Score each item from 1 to 4, or 4 to 1 as shown on the accompanying score-master pages.
- It makes conceptual sense to calculate a mean score for each subscale. In other words, add the six item scores for each subscale and then divide it by six.
- Note that the two CY-PSPP scales denoted thus* are from Susan Harter's (1985) *Manual for the Self-Perception Profile for Children.* Please be sure to give appropriate credit in any citation.
- Note that the CY-PIP Scale items did not load on separate factors (see *Ped. Ex. Sci.* paper). Thus, be cautious with their use.

Appendix I- Fear of Failure Inventory

Instructions: For each statement, please indicate your level of agreement or disagreement. Please respond to each item as honestly as possible.

1	2	3	4	5
Strongly disagree	Disagree	Uncertain	Agree	Strongly agree

1.____When I start doing poorly on a task, I feel like giving up.

2.____If given a choice, I have a tendency to select a relatively easy task rather than risk failure.

3.____When I fail at a task, I am even more certain that I lack the ability to perform the task.

4.____I often find that I am well prepared for success on a task, but I do not perform the task well under pressure.

5.____I tend to put forth a great deal of effort into a task, but I often know that this effort is of poor quality.

6.____Sometimes I think it is better not to have tried at all, then to have tried and failed.

7.____When I am tackling a challenging task, I find that I am reminded of my previous failures.

8.____I often avoid a task because I am afraid that I will make mistakes.

9.____I find that I can learn to perform a task very well, but I "crack" under the pressure of the situation and often do not perform anywhere close to my potential.

Appendix J- Sports Anxiety Scale-2

Appendix: Sport Anxiety Scale-2

REACTIONS TO PLAYING SPORTS

Many athletes get tense or nervous before or during games, meets or matches. This happens even to pro athletes. Please read each question. Then, circle the number that says how you USUALLY feel before or while you compete in sports. There are no right or wrong answers. Please be as truthful as you can.

	Before or while I compete in sports:	Not At All	A Little Bit	Pretty Much	Very Much
1.	It is hard to concentrate on the game.	1	2	3	4
2.	My body feels tense.	1	2	3	4
3.	I worry that I will not play well.	1	2	3	4
4.	It is hard for me to focus on what I am supposed to do.	1	2	3	4
5.	I worry that I will let others down.	1	2	3	4

	Before or while I compete in sports:	Not At All	A Little Bit	Pretty Much	Very Much
6.	I feel tense in my stomach.	1	2	3	4
7.	I lose focus on the game.	1	2	3	4
8.	I worry that I will not play my best.	1	2	3	4
9.	I worry that I will play badly.	1	2	3	4
10.	My muscles feel shaky.	1	2	3	4

	Before or while I compete in sports:	Not At All	A Little Bit	Pretty Much	Very Much
11.	I worry that I will mess up during the game.	1	2	3	4
12.	My stomach feels upset.	1	2	3	4
13.	I cannot think clearly during the game.	1	2	3	4
14.	My muscles feel tight because I am nervous.	1	2	3	4
15.	I have a hard time focusing on what my coach tells me to do.	1	2	3	4

Scoring Key. Somatic: Items 2, 6, 10, 12, 14; Worry: Items 3, 5, 8, 9, 11; Concentration Disruption: Items 1, 4, 7, 13, 15.

Appendix K- Hitting Scale

	Criterion Code	Hands back, feet shoulder width apart and weight on back leg	Rotation hips followed by shoulders	Hips drive forward (shift of weight)	Line of hands directly towards pitcher	Head still and focused on contact	Follow through towards the shoulders	TOTAL
Session 1								0
								0
								0
								0
								0
								0
								0
								0
								0
								0
Session 2								0
								0
								0
								0
								0
								0
								0
								0
								0
								0
								0
Session 3								0
								0
								0
								0
								0
								0
								0
								0
								0
								0

Appendix L- Schematic design of Study 1

Recruitment

3 week reliability schedule with familiarisation

1 week

Week prior to hitting assessment	**3 week reliability study**
Subjects and parents filled out recruitment and medical forms Subjects were instructed how the study will be run	**TEE** 5X tee warm up swing (familiarisation) 10X tee swings (successful) ** 30 sec rest period between each swing* *5 min rest period* **SOFT TOSS** 5X soft toss warm up swings (familiarisation) 10X soft toss swings (successful) ** 30 sec rest period between each swing* **Week 1**- Administration of tee then soft toss protocol **Week 2**- Administration of tee then soft toss protocol **Week 3**- Administration of tee then soft toss protocol

Appendix M- Schematic of study design 2

Recruitment

4 week training schedule with familiarisation

1 week

Week prior to hitting assessment	**4 week training study**
Subjects and parents filled out recruitment and medical forms Subjects were instructed how the study will be run	Training consisted of: 5X soft toss warm up (familiarisation) 20X soft toss swings **Week 1-** Administration of physical self-perception profile/ physical importance profile (before training started). Pre-testing (recorded swings). Fear of failure/ sports anxiety scale (once training concluded) **Weeks 2 to 5-** Team warm-up, administration of training protocol **Week 6-** Administration of physical self-perception profile/ physical importance profile (before training started). Post-testing (recorded swings). Fear of failure/ sports anxiety scale (once training concluded)

Appendix N- Results for study 2 psychological measures

Pairs	Variables	Mean	Standard deviation	Significance	Cohen's d	Effect size
1	Physical Self Perception Profile Pre Physical Self Perception Profile Post	0.05	2.00	0.443	-0.11	0.05
2	Physical Importance Profile Pre Physical Importance Profile Post	0.45	0.14	0.737	0.07	0.03
3	Fear of Failure Pre Fear of Failure Post	0.02	0.34	0.849	-0.03	0.01
4	Sports Anxiety Scale Pre Sports Anxiety Scale Post	0.23	0.34	0.051	-.59	0.28
5	Hitting Competence Pre Hitting Competence Post	0.81	1.08	0.031	-1.16	0.50

Note: Significance difference $p \leq 0.05$