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Golf Skill Assessment During Early-Stage Junior Development: Practices, Pitfalls and Future Perspectives

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The development of physical literacy which includes skill development as a central component, has been shown to be very important in children and youth's adherence to physical activity and sport leading into adulthood. The motor-skill development literature has addressed the issue process-related skill assessment practices to be of great importance in the teaching-learning-assessment triad during early-stage athlete development. In relation to the development of junior golfers, the topics addressed in this paper are threefold: 1) Current assessment practices and their repercussions on youth golf instruction during the early stages of junior development (6-12 years old); 2) Recent innovations in early-stage junior golfer skill assessment through the work of Barnett et al. (2015); and 3) Further areas of exploration in relation to Barnett et al.'s (2015) work in order to improve assessment and overall teaching practices related to golf skill development at the junior level.

Introduction

Children's participation in organized sport, such as golf, can have a major impact on the development of a child's physical literacy and influence them towards continuing golf and possibly participating in other types of physical activities and sports throughout adolescence and leading into adulthood (Edwards et al., 2017). In order to develop motivation, confidence, physical competence, knowledge and understanding of children and youth, sports programs must create an environment that will nurture these attributes (Cairney et al., 2019; Eime et al., 2013).

It is pretty clear that above all, sport participation needs to be fun (Visek et al., 2015). When examining fun in youth sports from a more academic standpoint, Visek et al.'s (2015) work shows that *Positive Coaching* and *Learning and Improving* are among the top 4 fun factors that young athletes consider of primary importance. These two factors contain various elements in relation to the quality of the teaching and learning process. Hence, the results from Visek et al.'s (2015) work in this area show that children and adolescents perceive fun in various ways and that improving and becoming more competent are very high on their lists of factors that lead to more fun. Furthermore, the development of physical competency (knowledge and knowhow) has a determining effect on children's motivation to pursue an activity on a long-term basis (Barnett et al., 2008; Cairney et al., 2019; Eime et al., 2013).

In relation to junior athlete development, Bayli et al. (2013) propose a Long-Term Athlete Development Framework that has been adopted by various sports organizations across the world. Golf Canada has developed its own

Long-Term Player Development framework (Golf Canada-LTPD, 2014) based on Bayli et al's (2013) initial work. Within the Fundamentals (6 to 9 years old) and Learning to golf (8-12 years old) phases presented in this framework, the development of fundamental motor skills (FMS), fundamental sports skills (FSS), sport-specific skills (SSS) and game understanding is gradual and progressive (Golf Canada-LTPD, 2014). Content choice and teaching approaches are of major importance in order to ensure ongoing learning and development (Rink, 2009). As a result, *skill assessment approaches* during these developmental phases have significant repercussions on the quality of the teaching-learning process (Edwards et al., 2018). In the context of skill development, the formative assessment of process related components of the specific skills being taught should be considered a priority as it helps coaches choose different types of interventions directly related to the young participants requirements which are essential to the learning of motor skills during junior athlete development (Barnett et al., 2015; Hands, 2002; Knudson & Morrison, 2002; Richard & Godbout, 2000; Rink, 2009).

The continuum of golf skill development is extremely important during childhood and early adolescence. Beyond the ongoing development of FMS, the Fundamentals phase focuses on the introduction of the golf swing and on putting. During this three-year period, teaching the foundation of these skills is of the utmost importance as the following phase (Learning to Golf) is a critical period before the onset of the Peak Height Velocity (PHV – puberty) during which skill acquisition and development can and should be a major focus (Balyi et al., 2013; Golf Canada-LTPD, 2014; Titleist Performance Institute, 2021). Between the ages of 8 and 12 years old, children's cognitive development permit them to think in more abstract terms (Bouchard & Fréchette, 2011). This characteristic combined with a good base of FMS and FSS produces excellent conditions for skill development.

Based on this premise, the Fundamentals phase, as the name implies, becomes a crucial period in which a child's integration of the foundational elements of the golf swing and putting can have an influence on future development. Hence, it goes without saying that the teaching and assessment of these fundamental skills during this period are crucial as they will have a direct influence on future skill acquisition (Dudley, 2015; Giblin et al., 2014).

In relation to junior golf development, up until recently, no process-oriented assessment instrument that permitted in properly identifying skill deficits in young golfers was readily available. In order to fill this void, Barnett et al. (2015), through their work with experts in child skill development and the sport of golf, published *The Development and Validation of a Golf Swing and Putt Skill Assessment for Children*. These assessment instruments were developed in order to be simple of use and provide pertinent information needed for coaches and parents in order to identify skill deficits and in turn, help in guiding the teaching-learning process when accompanying young golfers.

In the context of early-stage junior golf skills assessment, Barnett et al.'s (2015) work is a major step in the right direction as it provides process-oriented instruments that can be used in different instructional settings around the world. Using Golf Canada's Long-Term Athlete Development (LTAD) framework, combined with the First Tee program – USA and Canada (First Tee, 2020) as a backdrop, the purpose of this paper is to examine Barnett et al.'s (2015) assessment tools more thoroughly and provide avenues for further research and development based on this initial work. A preliminary research agenda destined at expanding on Barnett et al.'s (2015) golf assessment instruments with the goal of better assisting golf coaches and instructors in the development of golf skills during crucial stages of development in children and youth participating in junior programs will be discussed.

Golf Skill Assessment – Practices and Pitfalls

Assessment of FMS at early stages of development typically focuses on object control (reception and or propulsion of an object with either hand or foot), locomotion (travelling from one point to the other) or balance skills (twisting, turning and bending) (Henderson et al., 2007). Process oriented instruments like the Test of Gross Motor Development-2 (TGMD-2) assesses the components or critical elements considered to be important in order to master the skill rather than the skill execution outcome itself (i.e., time, distance, accuracy, etc.) (Burton & Miller, 1998).

Process-oriented instruments are typically used when evaluating FMS as they are more effective in identifying skill deficits. In turn, this allows for better identification of the critical elements of a skill that needs to be focused on in order to improve its execution and essentially, its outcome (Morgan et al., 2013). Process-oriented assessment of FMS, FSS and SSS in various stages of development can and should be characterized by the use of a series of these critical elements and recorded by an assessor (teacher or coach) as either present (achieved) or not present (not achieved). Process-oriented measures are important for skill assessment of young children as the information can be used to inform the teacher or coach which specific skill components need practice and therefore, specific ideas and drills for improvement can be provided (Hands, 2002).

Even though golf might have lost a bit of its participation base over the past few years, it is still a very popular sport in many different areas of the world, particularly after its reintegration into the Olympic Games which is certainly a testimony to its global appeal (International Golf Federation, 2020). Hence, many countries around the world have put a lot of effort in attracting children and youth to golf by offering well-grounded parameters guiding junior development. Organisations like the First Tee (USA), the First Tee (Canada) formerly known as Future Links and MYGolf (Australia) have developed programs that provide guidance to schools, communities, and parents in ways to increase young children's golf exposure and education. However, in order to evaluate early-stage golfing proficiency, basic or fundamental process-oriented assessments are needed to identify skill deficits and diagnose errors (Winnick,

Table 1. Example of technical benchmarks utilized for promotion of players from the Par level (minimum age – 9 years old) to the Birdie level of development (minimum age – 11 years old) (First Tee, 2020)

Technical component	Certification requirement
Putting	Complete 9 holes with a maximum score of 27
Short Game	Complete 3 holes with a maximum score of 12
Full Swing (fairways)	Must hit 2 out of 6 fairways
Full swing (Greens)	Must hit 2 out of 6 greens from 35-55 yards away from the green.

2009). Assessment results that provide feedback aligned with specific errors that the young golfer needs to improve upon can be of great benefit to teachers, coaches and parents. Nevertheless, as coaching of young golfers may be offered by individuals with different backgrounds, process-oriented assessments need to be simple enough to accommodate people with varying levels of golf expertise (Barnett et al., 2015).

As reported by Robertson et al. (2014), a systematic review of tests examining skill outcomes in sport highlighted only three golf tests with documented reliability and/or validity measures. However, none of them was developed for early-stage junior golfers. National programs like the First Tee (USA) have developed sample product-oriented assessments in relation to golf skill development. These benchmarks are to be used in order to assess participants moving from one level of the program to the next (See [Table 1](#)).

Benchmarks of the sort are very useful in order to assess outcomes and take decisions (summative assessment) on the athlete's developmental path. However, in order for a child to get to these benchmarks, process-oriented assessments are more useful during the teaching-learning process. Whilst immediate knowledge of results can be motivating to players (Deci & Ryan, 2008) and must still be used, these product tests provide limited diagnostic and formative information for teachers, coaches and parents interested in helping young golfers improve. Process-oriented evaluations targeted primarily towards physical education programs typically evolve from the development of a list of critical elements (fundamental criteria) important to the accomplishment of the skill being developed and assessed (Graham et al., 2013; Richard, 2010; Rink, 2009).

Golf Swing and Putt Skill Assessment for Children (Barnett et al., 2015)

Based on the lack of available process-oriented assessments aimed at early-stage junior development, the research team of Barnett et al. (2015) developed two separate instruments to assess a) the full swing; and b) the putting stroke. Initial development of these descriptive rating scales (or rubrics) was based on the TGMD-2 which is, as mentioned earlier, grounded in a process format oriented towards the assessment of FMS competency in children (Ulrich, 2000). Content validity was assured through a Delphi process through the participation of both expert researchers in the field of children's movement skills assessment (N=13) and golf experts (N= 6 - Golf Australia-Research and Development specialist; High Performance Director; Technical Director;



Table 2. Golf Skill Assessment: Striking a golf ball (Barnett et al., 2015)

Materials	Directions	Skill phases	Performance Criteria	T1	T2	Score
A foam golf ball, golf club (mid iron junior size, right and left), at least 55 m of space.	Place a ball on the ground at a marked spot. Hand the golf club to the child. Tell the child to hit the ball straight ahead to finish as possible to a cone place on the ground 50 m away. Point straight ahead at cone. Repeat a second trial.	Start	Both hands on golf club (non-dominant hand towards the end of the grip, dominant hand towards the shaft).			
		Stance	Child side on to intended target (i.e. non/ preferred hip/shoulder faces shoulder towards target. Slight bend at waist and feet are shoulder width apart.			
		Focus	Head relatively still with eyes focused on ball until after release.			
		Backswing	High backswing with the club (i.e. club head above shoulder with shaft parallel to ground).			
		Hit	Contacts ball sending it generally straight ahead in general direction of target (no more than 10 am to 2 PM degrees left or right).			
		Follow through	Club follows through towards non-preferred shoulder (club head at least at chest level), and in finish position child is facing target with weight on front foot indicated by a raising of the back heel.			
			Score			

Golf Development Director; Junior Development Manager; and Tournament Preparation Consultant). The following tables presents the two instruments in question.



Table 3. Golf Skill Assessment: Putting (Barnett et al., 2015)

Materials	Directions	Skill phases	Performance Criteria	T1	T2	Score
A foam golf ball, putter, cone and at least 6m of space	Place a ball on the ground at a marked spot. Hand the putter to the child. Tell the child to hit the ball as close as possible to the cone placed at 5m away. Repeat a second trial.	Start	Child side on to intended target (i.e. non/preferred hip/ shoulder faces towards target). Both hand on putter (grip not important).			
		Stance	Back has slight bend at waist and feet are shoulder width apart.			
		Focus	Head still with eyes focused on ball until after release.			
		Backswing	Small backswing with putter (i.e. lower than kneed height).			
		Hit	Contacts ball and sends smoothly (i.e. without bounce) in general direction of target (no more than 11 am to 1 PM degrees left or right).			
		Follow through	The plane of the putter is towards the target in a smooth rhythmic pendular motion without break.			
			Score			

Based on the TGMD-2 assessment protocol, Barnett et al.'s (2015) Golf Swing and Putt Skill Assessment for Children include the participant's demonstration of the skill being assessed by completing 2 trials. Observation of the skill components correctly performed is then noted and scored (Barnett et al., 2015). Forty-three (43) children aged from 6 to 10 years old ($M=7.8$ years, $SD=1.3$) were videotaped and assessed using both instruments. This age range

was chosen as the authors considered that it was the first stage at which golf could be properly introduced and it is also within the age range in which the TGMD-2 was validated (Barnett et al., 2015).

Discriminant validity analyses show that both assessment instruments appear to discriminate well based on age, which reflects the developmental skill acquisition that would normally be observed within this age range (Barnett et al., 2015). Inter-rater and intra-rater analyses at different stages of development show good levels of reliability.

Upon examining the different criteria for each of the instruments, several aspects are apparent:

The criteria for each of the skill phases are fundamental in nature.

As a reminder, the fundamental components of the full swing (with iron) and the putt at the 6-9-year-old level (Fundamentals phase) are being assessed. Acquiring and stabilizing technique at this level will serve as a good base for more advanced skill development during the Learning to Golf phase (9-11 years old). Hence, the criteria presented in these assessment instruments are based on what would normally be emphasized for the development of full swing and putting stroke at these particular stages of development.

The criteria for each skill phase are subjective in nature.

All descriptive rating scales like the ones developed by Barnett et al. (2015) are subjective in nature. It is virtually impossible to assess the process of skill execution in a purely quantitative manner (Richard et al., 2000; Rink, 2009; Scallon, 2000). When assessing or appreciating skill execution, criteria are developed in a descriptive way that leads to a qualitative appreciation of the skill being examined. That being said, the challenge in developing this type of assessment instrument is developing criteria that is written in language that is easily understood and is as objective as possible, even if it is subjective in nature. To this effect, the instruments developed by Barnett et al. (2015) were written in a precise and succinct language that would be easily understood by assessors with varying degrees of golf expertise (i.e., PGA pros, parents, older juniors assisting in instruction, etc.). In their article, Barnett et al. (2015) mention that the training of an adult non-golfer in order to successfully observe using these assessment tools took approximately 2 hours, making it very easy to understand and accessible.

Another aspect to the subjectivity issue is the choice of criteria. Concerning these particular assessment instruments, we are certain that a lot of PGA teaching professionals from around the world and other experts in the field would have varying opinions on some of the criteria. For example, in the *Striking a golf ball assessment instrument*, some might argue that having the shaft parallel to the ground in the backswing might not have to be a mandatory requirement of technique development at this age level or any age level for that matter. However, the developers of these instruments that included golf experts, took decisions based on what they perceived to be important criteria to guide skill acquisition at this stage of development. From the decisions

that were taken, the two instruments presented measured different skill levels (mediocre skill execution versus higher skill execution) very well and showed good levels of reliability.

The criteria for each skill phase will help in identifying skill deficiencies and guide teaching

As mentioned earlier, the critical or fundamental elements in each of the skill tests developed by Barnett et al. (2015) are general as they represent the foundation to be adopted at an early stage of development. They provide reference points as to the different elements of posture, position and motor behaviours to adopt that will serve as a platform for skill development and performance leading into later stages of development (i.e., Learning to Golf phase and beyond). Instruments of this type help to guide teachers and coaches with varying degrees of expertise to be able to identify critical elements that are problematic and affect the performance outcome. As mentioned, being able to diagnose critical elements that are problematic greatly helps teachers and coaches in planning their interventions as they have a better idea of what to address with each particular child (Barnett et al., 2015; Richard & Godbout, 2000).

Discussion

The literature on the motor skill acquisition in early-stage development is clear: focusing on the process of performance is an important component in improving the teaching-learning process in order to improve skill development (Morgan et al., 2013; Rink, 2009). Frankly, it is just an integral part of good teaching/coaching, especially in early-stage development in which the basis of skill acquisition and proper technique serve as the foundation for later development.

The instruments put forward by Barnett et al. (2015) are well developed and should serve a basis for future research and development of other instruments that could be useful in the assessment process of skill acquisition during early-stage junior development. Based on the initial versions of these assessment tools, here are a few avenues that need to be addressed moving forward:

A. Continue the psychometric analyses of these instruments with assessors of varying levels of golf expertise.

Since junior programs are not always offered by PGA professionals, having assessment instruments that are easily accessible and can be understood by instructors with varying levels of expertise is important. The assessment of motor skills is a particularly complex and laborious task. The nature of motor skills associated with many constraints of the coaching environment (allotted time, number of participants to be assessed, group management, etc.) accentuates the importance of the use of simple, efficient and versatile tools. Hence, further studies should focus on inter-rater reliability analyses with parents and older juniors who often assist PGA pros or other instructors in junior programs. Also, in Barnett et al.'s (2015) study, reliability analyses were predominantly conducted using video recordings. In assessing an instrument's

practical usefulness, future research should also focus on analyzing the reliability of the Golf Swing and Putt Skill Assessment for Children in a field setting as the one of the major premises of developing these tools was to offer useful and practical tools for junior coaches with varying levels of golf knowledge (Barnett et al., 2015). Continuing in the same train of thought, discriminant validity (a subtype of construct validity) analyses should also be conducted using data from field observations. Since the original analyses were conducted from data retrieved from video recordings of children executing the full swing and the putting stroke, it can be speculated that these instruments in question will be valid in the field. However, this absolutely needs to be verified since the testing conditions were not the same as the one in which the use of these assessment tools are intended. Again, since the intention was to develop assessment tools that will predominantly be used in the field, discriminant validity analyses should take into consideration this contextual reality and be analyzed using appropriate data sources (Anastasi & Urbina, 1997).

B. Develop different versions of the Striking a golf ball and Putting instruments (Barnett et al., 2015) and add a striking a golf ball (driver), chipping and bunker assessment instruments for the 8-12-year-old age bracket (Learning to Golf).

Initial development of the Striking a golf ball and Putting assessment instruments were destined for a younger age group and was initially tested with a population varying from 6 to 10 years old. Thus, certain parts of the testing conditions were adapted for the targeted age group (i.e., using a foam ball instead of a golf ball). These instruments would be of great use in the *Learning to Golf* phase (8-12 years old) where specific sport skill development is a major focus. Hence, validity and reliability of the two instruments developed by Barnett et al. (2015) should be examined using a real golf ball. Moreover, striking a golf ball with a driver, chipping-pitching and bunker play assessment instruments focusing the process of skill execution should also be developed for this age group as these sport-specific skills will also be a major focal point during the *Learning to Golf* phase of development. In this sense, the developmental process of the golf swing and putting assessments proposed by Barnett et al. (2015), including specific methodological elements, can serve as an excellent approach in order to develop these additional assessment tools that would be destined for widespread use.

C. Accentuating self and peer assessment at the Learning to Golf stage of development

Self and peer assessment have been shown to be very beneficial to the teaching-learning process in various educational settings, including physical education and sport (Richard, 2010; Richard & Godbout, 2000). Peer and self-assessment are an integral component of authentic learning (Zessoules & Gardner, 1991) and should not only be relegated to a scholastic environment. These types of assessment practices can be very powerful in children's learning process, and it should not be underestimated that children in this developmental age bracket especially at the Learning to Golf stage (8-12 years

old), possess the cognitive capabilities of observing motor skills with a good level of precision (Richard et al., 2000). Using assessment instruments that are presented at an age-appropriate level combined with appropriate supervision by a teacher or coach, peer or self-assessment, directly or through video, can contribute to a child's learning and development of sports skills (Richard, 2010; Richard et al., 2000). Richard et al.'s (2000) work with the Team Sport Assessment Procedure (TSAP) (Gréhaigne et al., 1997) shows that when structured observation is presented an integrated progressively within a teaching scenario, children benefit through enhanced learning. In using the TSAP within a modified basketball learning scenario, children as young as 9 years old were able to observe with great level of inter-rater reliability. These results were impressive as the TSAP is based on six (6) observational variables that take into account both technical and tactical execution in a team game setting (small-sided games).

Learning through observation can help youth develop sound judgment leading to self-correction capabilities, more autonomy and essentially improved physical literacy (Edwards et al., 2018). Consequently, developing adapted versions of Barnett et al.'s (2015) golf assessment instruments for juniors at the Learning to Golf (8-12 years old) stage of development with peer or self-assessment practices in mind, and exploring children's use of these instruments through reliability analyses in real time observation (live) and video observation should be accomplished in order to verify this population's observational capabilities.

On the topic of video use as an aid to motor-skill development, various studies have demonstrated the benefits of integrating video for the assessment of motor skills in the context of physical education (Harvey & Gittins, 2014; Palao et al., 2015). Considering that video analysis is a procedure that has long been used in a sporting context to improve technical and tactical performance in a game situation (Ives et al., 2002), its use in combination with Barnett et al.'s (2015) golf assessment instruments, which are process-related, will help in guiding the observation of coaches and athletes alike (peer and self-assessment) towards the essential components of performance, generating very high-quality feedback for the regulation of learning.

Conclusion

Assessment of motor skill development during early childhood has been shown to be predominantly limited to the product of motor performance. Best practices in the context of coaching and teaching physical education put a lot of emphasis on the formative assessment of process related critical elements of the skills being taught (Morgan et al., 2013; Rink, 2009).

The Titleist Performance Institute (TPI) is one of the farthest-reaching international organizations that provides education to golf professionals around the world. Their philosophy and motto are *to assess and not guess*. It is a very sound philosophy, and it applies in different contexts, including everything that is developmental and educational in nature. In the context of junior golf development, utilizing outcomes or benchmarks is an instrumental

part of gauging children and youth's skill development. However, during the critical phases of development from 6 to 12 years old, focusing the process of skill execution is imperative. Consequently, formally assessing the skill acquisition process during this important period will enhance the teaching-learning process and improve skill acquisition in junior golfers leading to enhanced physical literacy, better performance and hopefully, more fun! As Visek et al. (2015) have indicated in their work, young athletes value learning as an integral part of what they consider as fun in their sporting experiences.

Barnett et al.'s (2015) work is the first of its kind in the world golf instruction and offers a bedrock upon which assessment tools and practices in junior golf instruction can evolve and lead to better teaching practices. Hence, Barnett et al.'s (2015) work is a significant step in the right direction. However, it is merely the beginning. As mentioned earlier, future research should expand on these assessment instruments potential in the teaching-learning-assessment triad in the development of junior golfers.

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