

Performance Enhancement and the Young Athlete:
Mapping the Landscape and Navigating Future Directions

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Abstract

The aim of this paper is to provide a comprehensive narrative review of extant scientific knowledge on the effectiveness of performance-enhancement based interventions within youth sport settings. Specifically, we explore the effects of psychological interventions on the sport performance of young athletes (18 years of age or under). Drawing upon over 80 published studies which have attempted to enhance young athletes' performances using a range of methodological and strategic approaches, four main clusters of research are presented. These clusters include: (a) Single strategy psychological skills training (PST) interventions, (b) multimodal PST interventions, (c) alternative single strategy interventions, and (d) alternative multimodal interventions. In each of these clusters, the landscape of work is overviewed and papers of particular methodological interest are highlighted before drawing out critical reflections, future research directions, and recommendations for supporting further scholarship and practice with young athletes.

Keywords: athletic performance, psychological skills training, youth sport

Within her seminal position paper over 30 years ago, Vealey (1988) defined psychological skills training (PST) as the techniques and strategies designed to teach or enhance mental skills that facilitate performance and a positive approach to sport competition. While there has been a longstanding tendency to focus research efforts on studying elite, adult, or intercollegiate athletes (Tremayne & Newbery, 2005), Vealey (1988) suggested that young athletes are:

...more ripe for PST intervention than older athletes who have already internalized dysfunctional responses to competition. Thus, PST with younger athletes can be especially effective and rewarding as a means of helping youngsters develop appropriate psychological skills for sport competition (p.323).

Along these lines, researchers have since pointed out that young athletes who are introduced to PST at an early age are more likely to use sport psychology services than mature elite athletes (Blom, Hardy, Burke, & Joyner, 2003). Scholars have also highlighted how young athletes are both capable of learning and applying psychological skills and are responsive to strategies to enhance their performance (Orlick & McCaffrey, 1991; Lauer, Zakrajsek & Lauer, 2018). Empirical research has illustrated how child athletes as young as 10 years of age demonstrate a basic understanding of goal setting and imagery, while adolescent athletes (ages 13 to 15 years) show a more advanced awareness of the most commonly used psychological strategies (i.e., self-talk, imagery, relaxation, and goal setting; McCarthy, Jones, Harwood, & Olivier, 2010). As such, it appears ideal to introduce young athletes to sport psychology and to work with them to proactively develop the skills and techniques needed to optimize sport performance.

The value placed on psychological techniques for young athletes extends implicitly to helping them to cope with the potential pressure of organized youth sport, and specifically the ongoing professionalization of talent development including sport-specific academies, performance centers, and pathway programs. To this end, young athletes have become an increasingly important client group for the sport psychology practitioner and a population

whose social, cognitive, and emotional development should be carefully considered by the practitioner when delivering their services (Visek, Harris, & Blom, 2009). There is subsequently additional salience placed on the quality and scope of scientific research with young athletes that may inform the work of the practitioner. Research on psychological interventions that influence performance in young athletes is particularly imperative given that coaches have been found to favor psychological services that offer returns around improved athlete performance or performance consistency (Wrisberg, Loberg, Simpson, Withycombe & Reed, 2010). However, despite a growing number of intervention studies evaluating performance-enhancement based interventions within youth sport, there is an absence of reviews which provide clear recommendations for supporting further scholarship and evidence-based practice within this area.

Taking these points into consideration, in our contribution to this special issue on youth sport, we review extant knowledge on the effectiveness of performance-enhancement based interventions within youth sport settings. Specifically, we explore the effects of psychological interventions on the sport performance of young athletes. In line with definitions of youth sport (Harwood & Thrower, 2019), only studies including participant samples with a mean age of 18 years or under were considered in this review. Specifically, a narrative review was conducted by drawing upon search data made available to the authors (D. J. Brown, personal communication, October 12, 2018) from a recent and extensive review of literature of psychological and psychosocial interventions on sport performance (>400 studies) across multiple age groups (see Brown & Fletcher, 2017) and further searching of key sport psychology-related journals (e.g., *The Sport Psychologist*, *Journal of Sport & Exercise Psychology*, *Journal of Applied Sport Psychology*, *Psychology of Sport and Exercise*, *Sport, Exercise and Performance Psychology*, *International Journal of Sport and Exercise Psychology*, *Journal of Sports Sciences*) and databases (e.g., *PsychINFO*, *PsychARTICLES*, *SPORTDiscus*). This process identified over 80 published intervention studies¹ reporting work

that has attempted to enhance young athletes' performances. Drawing upon this literature, we provide insights organized into four overarching clusters of research: (a) single strategy PST interventions, (b) multimodal PST interventions, (c) alternative single strategy interventions, and (d) alternative multimodal interventions (Rumbold, Fletcher, & Daniels, 2012). These clusters represent varying methodologies and strategic approaches to investigating performance enhancement in youth sport samples. In each section, we highlight papers of particular interest in terms of their methods before drawing out future research directions, challenges, and recommendations for supporting further scholarship and practice in youth sport.

Single Strategy PST Interventions

A sizeable body of research has explored the effectiveness of traditional single (i.e., individual) strategy PST interventions on performance in young athletes. Studies have explored the effectiveness of imagery (e.g., Fortes et al., 2018; Garza & Feltz, 1998; Guillot, Genevois, Desliens, Saieb, & Rogowski, 2012; Post, Wrisberg, & Mullins, 2010; Post, Muncie, & Simpson, 2012), self-talk (e.g., Hatzigeorgiadis, Zourbanos, Goltsios, & Theodorakis, 2008; Hatzigeorgiadis, Zourbanos, Mpoumpaki, & Theodorakis, 2009; Johnson, Hrycaiko, Johnson, & Halas, 2004; Ming & Martin, 1996; Theodorakis, Weinberg, Natsis, Douma, & Kazakas, 2000), relaxation (e.g., Haddad & Tremayne, 2009; Lanning & Hisanaga, 1983) and goal setting protocols (e.g., Pierce & Burton, 1998) on a variety of performance-related indices. We address each of these approaches below.

Imagery

In the case of imagery-based interventions, findings have revealed mixed results in relation to its performance-related effectiveness. A number of studies have shown that imagery can improve coach-rated performance of athletes during figure skating competitions (e.g., Garza & Feltz, 1998), team free throw scoring percentage during basketball matches (e.g., Post et al., 2010), accuracy during a tennis serve task (Guillot et al., 2012; Guillot, Desliens, Rouyer, & Rogowski, 2013), and passing decision making during a simulated volleyball match (Fortes

et al., 2018). However, other studies have shown mixed findings (e.g., Post et al., 2012; Munroe-Chandler, Hall, Fishburne, Murphy, & Hall, 2012; Simonsmeier, Frank, Gubelmann, & Schneider, 2018) or no significant improvements in relation to performance (e.g., Björkstrand & Jern, 2013; Kanthack, Bigliassi, Vieira, & Altimari, 2014; Munroe-Chandler, Hall, Fishburne, & Shannon, 2005; Rodgers, Hall, & Buckolz, 1991). However, a number of these studies were reliant upon very brief interventions that may not suffice to offer performance effects (i.e., 1-2 sessions; Björkstrand & Jern, 2013; Kanthack et al., 2014).

Given the varied nature of these findings, it is important to highlight that there is some initial evidence to suggest that imagery may be more effective for young athletes with higher levels of expertise (Simonsmeier et al., 2018), for performing closed skill tasks (i.e., tennis serving; Coelho, De Campos, Silva, Okazaki, & Keller, 2007), and when adopting an external attentional focus (Guillot et al., 2013). Interestingly, studies have also suggested that cognitive specific imagery (i.e., focused on performance of specific motor skills) may be more effective and more engaging for young children compared to adolescents (Munroe-Chandler et al., 2012). Taking these points into consideration, future research is needed to directly compare different types of imagery interventions (i.e., cognitive specific, cognitive general, motivational general mastery, and motivational general arousal) across different tasks, levels, and stages of development within the context of youth sport.

Self-talk

A number of studies have explored the impact of self-talk interventions on young athletes' performance (e.g., Hatzigeorgiadis et al., 2008; Hatzigeorgiadis et al., 2009; Hatzigeorgiadis, Galanis, Zourbanos, & Theodorakis, 2014; Johnson et al., 2004; Ming & Martin, 1996; Palmer, 1992; Theodorakis et al., 2000). This body of research has provided support for the effectiveness of both motivational (e.g., Hatzigeorgiadis et al., 2008; Hatzigeorgiadis et al., 2009) and instructional self-talk (e.g., Johnson et al., 2004) intervention strategies in different settings and conditions. Specifically, there is some evidence to suggest

that instructional self-talk, in the form of externally focused cues, may be more effective for young athletes' performance than motivational or no self-talk (Theodorakis et al., 2000), particularly during the early stages of learning (Zourbanos, Hatzigeorgiadis, Bardas, & Theodorakis, 2013). For instance, Zourbanos et al. (2013) compared the effects of self-talk on dominant and nondominant arm performance on a handball shooting task. Findings revealed that instructional and motivational self-talk both improved children's performance significantly in comparison to a control group. However, instructional self-talk had a larger effect compared to motivational self-talk for the nondominant arm.

Studies have also more recently started to explore the effects of self-talk on young athletes' performance during competition. In an innovative and extended piece of field-based intervention research, Hatzigeorgiadis and colleagues (2014) used a multiple comparison cross subject design to examine the effectiveness of motivational and instructional self-talk on percentage improvement in competitive swimming times. Forty-one adolescent competitive swimmers (mean age = 14.5 years) were randomly assigned to an experimental or control group. Participants in the experimental group were consecutively introduced to a wide variety of instructional (e.g., 'elbow', 'deep', 'ankles') and motivational cues (e.g., 'let's go strong', 'power legs', 'give it all') that were subsequently integrated and coached within swimming training sessions. After both instructional and motivational self-talk phases, the participants were allowed to autonomously design a plan to use during training and competition during the remaining weeks. Following the 10-week intervention, results showed that the intervention group had greater percentage performance improvements in competitive times than the control group. Interestingly, and of note to practitioners, when given the choice over self-talk type the swimmers preferred to use motivational self-talk cues during competition. Such preferences are consistent with the notion that highly skilled athletes should avoid attempting to consciously control movements when performing during competition, especially in high pressure situations (i.e., Conscious Processing Hypothesis; Masters, 1992). Overall, the self-talk literature offers

some important considerations for practitioners working with young athletes who are simultaneously learning skills and competing in high-pressured youth sport settings. Further research which directly compares the efficacy of different types of self-talk (i.e., instructional vs. motivational) across different conditions (i.e., skill acquisition, sport-specific tasks, competition performances) would be a valuable contribution to the literature (e.g., see Theodorakis et al., 2000).

Relaxation

In contrast to imagery and self-talk, relatively little academic attention has focused on the use of relaxation as an individual intervention to enhance performance in young athletes. As is illustrated in a forthcoming section, relaxation techniques are often combined with imagery as part of multimodal PST interventions. Despite this, there is some evidence to suggest that relatively brief (i.e., 1 x 20-minute session) and more extensive (i.e., 7 x 30-minute sessions) physical relaxation interventions such as progressive muscular relaxation and breath control can improve performance of young athletes (Haddad & Tremayne, 2009; Lanning & Hisanaga, 1983). For example, Haddad and Tremayne (2009) examined the effects of centering on free-throw basketball shooting performance. Using a single subject multiple baseline design, five 10 to 11 year old basketball players took part in a four-week intervention. The baseline period for all participants ranged from two to three weeks (i.e., two shooting sessions per week) and the intervention involved a single 20-minute session on the centering breath technique and accompanying educational-workbook activities. Shooting sessions resumed over the subsequent weeks to test the effectiveness of the intervention. Findings highlighted how implementation of the centering breath during the post intervention phase led to increases in successful free throw percentage across all participants, with moderate to high degrees of percentage improvements. Notwithstanding these encouraging findings, what is often missing in these single interventions is consideration of the type of symptoms that young athletes may experience and report (e.g., cognitive vs. somatic anxiety) as well as their perceptions of these

symptoms as facilitative or debilitating. Such data may be important to consider before implementing relaxation-based interventions, depending on the nature of the research question and the aim of the work (e.g., teaching a foundational self-regulation skill vs. targeted anxiety management).

Goal Setting

Despite its widespread use as a tool to enhance performance with athletes there is, somewhat surprisingly, relatively little research on the effectiveness of goal setting interventions on performance in youth sport. In one of the only interventions to our knowledge to be conducted with young athletes, Pierce and Burton (1998) investigated the impact of goal setting styles on a goal setting training program for gymnasts. Adopting a quasi-experimental design, 25 female gymnasts (mean age = 13.1 years) participated in a goal setting training program across an 8-week season. To investigate how goal-setting styles affected program effectiveness, gymnasts were subsequently categorized into goal-setting style groups (i.e., failure-oriented, success-oriented, performance-oriented high, and performance-oriented low). Although there are different scholarly perspectives on the nature of achievement goal orientations, performance-oriented versus success/failure-oriented goal setting styles broadly mirror the concepts of task versus ego orientation within Achievement Goal Theory (Nicholls, 1984). Findings highlighted how performance-oriented (i.e., task oriented) gymnasts significantly improved competitive performance scores over time, whereas success-oriented (i.e., ego oriented) gymnasts showed a slight decrement. Results also highlighted how performance-oriented gymnasts reported higher perceptions of the goal setting training program effectiveness and engagement with the processes. Although not conducted with young athletes per se, it is worth noting that research with adolescent high school students has shown the setting of difficult but realistic (Tenenbaum, Bar-Eli, & Yaaron, 1999; Bar-Eli, Tenenbaum, Pie, Btsh, & Almog, 1997) short and/or long term goals (Tenenbaum, Pinchas, Elbaz, Bar-Eli, & Weinberg, 1991) results in improved performances on physical tasks in comparison to

setting 'do-your-best' goals or no goals. In summary, while goal setting as a strategy is often included alongside imagery, self-talk and/or relaxation in multimodal interventions, it is curious that longitudinal studies focused on goal setting and goal debriefing (e.g., goal performance review and reflection) in young athletes are not more evident given potential impacts on self-regulated learning (Zimmerman, 2000).

Multimodal PST Interventions

Multimodal interventions typically combine two or more different types of psychological techniques and strategies (e.g., imagery, goal setting, relaxation, self-talk) within a single intervention². Such approaches have proven popular in the youth sport literature, with scholars taking two distinctive methodological avenues. First, there is a substantive cluster of studies that have tested a range of different intervention combinations with young athletes to determine which single or multimodal combination is the most effective. Many of these studies have also employed a control group condition. Such effective combinations have included: imagery and arousal regulation (Wrisberg & Anshel, 1989), relaxation/centering and self-talk (Rogerson & Hrycaiko, 2002), imagery, relaxation, and video observation (Li-Wei, Qi-Wei, Orlick, & Zitzelsberger, 1992), video observation and motor imagery (Battaglia et al., 2014), and relaxation and imagery (Koehn, Morris, & Watt, 2014).

In one of the first studies to be conducted in this area, Wrisberg and Anshel (1989) examined the effectiveness of mental imagery and arousal regulation on young basketball players' (ages 10 to 12 years) free throw shooting performance. During the intervention phase, one group learned and practiced imagery, a second group learned and practiced arousal regulation techniques, a third group practiced a combination of imagery and arousal regulation, while a control group received no strategies. Mental imagery combined with arousal adjustment emerged as the most beneficial strategy on free throw shooting performance. Findings highlighted significant group effects and subsequent pairwise contrasts illustrated differences between the combined group (imagery and arousal) and the arousal alone and control groups,

respectively. Similarly, Li-Wei et al. (1992) examined the effects of mental training on performance enhancement with 7 to 10 year old table tennis players over an extended 6-month period. Specifically, 40 children were assigned to one of three groups: (a) imagery, relaxation, and video observation of elite models, (b) video observation alone, or (c) a control group. Findings revealed that children in the first (i.e., mental training) group experienced significantly greater improvement in the accuracy and externally-rated technical quality of their shots than children in the two other comparison groups.

Collectively, the (quasi) experimental studies in this cluster do point to the efficacy of combining two or more psychological strategies within interventions to facilitate performance enhancement with young athletes. Subsequent to this ‘test the best combination’ methodology, an alternative approach has been to examine the effectiveness of holistic multimodal PST packages on performance in young athletes. Such interventions typically include multiple psychological skills (i.e., imagery, relaxation, self-talk, goal setting) delivered over an extended period in the field with the view to equipping young athletes with a foundational ‘tool box’ of psychological strategies from which they can draw upon in training and competition. Encouragingly, research has provided sound support for the efficacy of PST packages on performance enhancement across a range of sports, levels, and developmental stages (e.g., Annesi, 1998; Atienza, Balaguer, & García-Merita, 1998; Bar-Eli, Dreshman, Blumenstein, & Weinstein, 2002; Bar-Eli & Blumenstein, 2004; Bell, Hardy, & Beattie, 2013; Galloway, 2011; Fournier, Calmels, Durand-Bush, & Salmela, 2005; Mamassis & Doganis, 2004; Sharp, Woodcock, Holland, Cumming, & Duda 2013; Sheard & Golby, 2006; Wanlin, Hrycaiko, Martin, & Mahon, 1997).

In a particularly effortful field-based design, Fournier and colleagues (2005) explored the effects of a season long PST program on gymnastic performance and psychological skill development within an elite gymnastics academy. Adopting a multiple baseline single case design, ten elite (i.e., national level) female gymnasts (mean age = 12.0 years) followed a five-

step PST program consisting of relaxation (8 sessions), self-talk (5 sessions), goal setting (3 sessions), focusing (4 sessions) and visualization (5 sessions) for 30 minutes per week. These sessions were integrated into the weekly training schedule and delivered by one of the coaches educated in sport psychology. Gymnasts training at a similar level academy in a different locality formed a control group of participants. From self-reported data on psychological skills development, the intervention was most effective on improving imagery skills, relaxation, activation, focusing, and refocusing. Importantly, the gymnasts' performances progressed 5% more than a control group of gymnasts on three events (i.e., bars, beam, floor). Similarly, Sheard and Golby (2006) examined the effect of a PST program on swimming performance and psychosocial development. Thirty-six national level swimmers (mean age = 13.9 years) followed a seven-week intervention protocol that contained 45-minute weekly sessions, with five specifically addressing goal setting, visualisation, relaxation, concentration, and thought stopping, respectively. Findings revealed significant self-reported improvements on a range of psychological indices (e.g., mental toughness, self-esteem, self-efficacy) as well as performance gains in ten separate swimming events, three of which were statistically significant.

This latter body of work highlights the overarching utility of multimodal PST interventions for young athletes. The popularity of such approaches may in part be due to the perceived advantages of introducing a broad spectrum of strategies in the anticipation of positive psychological outcomes and performance gains emerging from what is an important educational initiative in its own right for young people. However, this methodological approach is limited to the extent that it struggles to pinpoint what specific strategies of an intervention battery are most effective for performance. In addition, these intervention methods are not fine grained enough to assist in deciphering under what organizational and environmental conditions and in what developmental stage (i.e., childhood, early adolescence, mid-adolescence) a particular strategy might be more or less efficacious.

Alternative Single Strategy Interventions

Researchers have recently begun to explore more novel and innovative psychological approaches (i.e., non-PST) to determine their effects on young athletes' performances. Popular single strategy interventions which have received attention in the youth sport literature include: Self-modeling (e.g., Law & Ste-Marie, 2005; Ste-Marie, Rymal, Vertes, & Martini, 2011; Ste-Marie, Vertes, Law, & Rymal, 2013; Winfrey & Weeks, 1993), music (e.g., Bishop, Karageorghis, & Kinrade 2009; Eliakim, Meckel, Nemet, & Eliakim, 2007), and mindfulness (e.g., Bernier, Thienot, Codron, & Fournier, 2009; Bernier, Thienot, Pelosse, & Fournier, 2014; Schwanhausser, 2009). Self-modeling is a form of modeling in which the content of video displayed to an athlete is edited to only show examples of her or his adaptive behavior (i.e., positive performance highlights/executions; Dowrick, 1999). Despite an increasing number of studies exploring the impact of self-modeling on performance in young athletes, studies have shown mixed results (e.g., Law & Ste-Marie, 2005; Ste-Marie et al., 2011; Ste-Marie et al., 2013; Winfrey & Weeks, 1993). For instance, Ste-Marie et al. (2011) highlighted how 22 competitive gymnasts (mean age = 12.2 years) attained significantly higher beam scores when they viewed a self-modeling video versus when they did not over the course of a competitive season. However, other studies which have explored the impact of relatively brief (i.e., 3-6 weeks) self-modeling interventions have shown no significant difference on performance in figure skating jumps (Law & Ste-Marie, 2005) and a gymnastic balance beam skill test (Winfrey & Weeks, 1993). Despite these findings, with continuing technological advances and the potential for self-modeling to enhance self-efficacy, skill acquisition, and performance, we believe this is one area worthy of further academic attention.

Music-based interventions have also shown initial promise as interventions to enhance performance in young athletes. There is some evidence to suggest that higher music intensity can increase arousal, improve choice reaction times (Bishop et al., 2009), and increase peak anaerobic power (Eliakim et al., 2007). Studies have also directly compared the effectiveness of

music against other psychological strategies. For example, Miller and Donohue (2003) examined the influence of two mental preparation interventions (i.e., music vs. personalized motivational script) on 90 high school long distance runners. Participants completed a 1.6 kilometer baseline run and then were randomly assigned to one of three conditions (i.e., listening to a personalized script of motivational and running technique statements on headphones, listening to music on headphones, listening to no sound on headphones) three minutes prior to a second time trial. Those who were assigned to the motivational and running technique statement and music conditions significantly improved their run performance, while participants in the no-sound control condition did not (Miller and Donohue, 2003). Although research in this area is relatively limited, these initial findings suggest that music is a simple, low-cost, and comparatively effective way of enhancing athletes' psychological preparation for competition.

More recently, researchers have started to explore mindfulness and acceptance-based interventions as methods of enhancing performance in young athletes. Mindfulness is a mental state of consciousness in which one attends to present experience in all its sensorial, mental, cognitive and emotional aspects with an absence of judgement (Cottraux, 2007). Such approaches (often referred to as 'third wave') are becoming increasingly popular within the field of sport psychology and offer an alternative approach to some of the traditional cognitive-behavioral therapies which focus on controlling and limiting thoughts and emotions (see sections on self-talk and relaxation above). Although only a small number of studies have explored the effectiveness of mindfulness on performance in young athletes, these studies have shown initial promise (e.g., Bernier et al., 2009; Bernier et al., 2014; Schwanhausser, 2009). For instance, building upon their earlier work Bernier and colleagues (2014) examined the effects and underlying processes of a season-long mindfulness-based intervention with seven female figure skaters (mean age = 12.6 years). Findings from two case studies were presented and highlighted how the percentage improvement in national competition scores was much

greater for those who followed the program than for a control group. In addition, the authors provided valuable insights for practitioners regarding the design and delivery of mindfulness-based interventions with young athletes to enhance their performance. Specifically, effective processes were discussed in relation to the development of mindfulness skills (i.e., degree of understanding key concepts and intention to develop skills) and the importance of committing to mindfulness training. However, given the limited empirical work here, there remains a need for more research which explores the applicability and efficacy of mindfulness-acceptance-commitment (MAC; Gardner & Moore, 2004) based approaches to performance enhancement within youth sport (Bernier et al., 2009).

While currently more isolated examples of strategies employed in the literature, there is also some preliminary evidence to suggest that interventions such as attributional retraining (Miserandino, 1998), concurrent audio feedback (Baudry, Leroy, Thouwarecq, & Chollet, 2006), low intensity yoga practices (e.g., Briegel-Jones, Knowles, Eubank, Giannoulatos, & Elliot, 2013; Donohue et al., 2006), simulation training (Granda et al., 2008), personal disclosure mutual sharing (Evans, Slater, Turner, & Barker, 2013), and perceptual training (Farrow & Abernethy, 2002; Murgia et al., 2014) can improve performance in youth sport populations. One of the approaches that we believe has particular potential for facilitating both skill acquisition and performance in young athletes is perceptual training. Murgia and colleagues (2014) tested the effectiveness of perceptual training on the anticipatory skills of soccer goalkeepers (i.e., predicting the direction of the ball on penalty kicks). Forty-two skilled academy goalkeepers (mean age = 16.0 years) were randomly assigned to an experimental, placebo, or control condition. Between pre and post testing, those in the experimental group practiced with an interactive home-training video protocol with feedback while those in the placebo condition watched televised penalty shootouts. Their results demonstrated the effectiveness of the home-training protocol, evidenced by significant accuracy improvements between pre-test and post-test seen only in the experimental group.

Alternative Multimodal Interventions

Building on the aforementioned single strategy approaches, a small number of studies have provided some support for the effectiveness of alternative (i.e., non-PST) multimodal interventions on performance. This includes investigations which have incorporated: video feedback packages (i.e., modeling, role play, instructions, video feedback, and coach feedback; Hazen, Johnstone, Martin, & Srikameswaran, 1990); verbal praise, video instructions, and feedback (Anderson & Kirkpatrick, 2002); combined self and expert modeling (Baudry, Leroy, & Chollet, 2006); coping effectiveness training (i.e., cognitive therapy, relaxation, and problem-solving; Reeves, Nicholls, & McKenna, 2011); peer assessed feedback and goal setting (Holt, Kinchin, & Clarke, 2012); and holistic decision making programs (i.e., video feedback and questioning; García-González, Moreno, Gil, Moreno, & Villar, 2014). In one particularly interesting study, Baudry, Leroy, and Chollet (2006) investigated whether video modeling could enhance gymnasts' performance of the circle on a pommel horse. Sixteen national gymnasts (mean age = 14.3 years) were assigned to a modeling group or control group. Those in the modeling group received multiple strategies, namely expert-modeling, self-modeling, and feedback. After five sessions of training, results indicated that gains in the back, entry, front, and exit phases of the circle (i.e., body segmental alignment) were greater for the modeling group than for the control group (assessed via quantitative performance analysis on gymnastics performance). More recently, García-González et al. (2014) explored the effects of decision training on decision making and performance in young tennis players. Adopting a quasi-experimental design, 11 early adolescent tennis players were assigned to a control or experimental condition. Following a 10-week decision making program based on video feedback and questioning, those in the experimental condition significantly improved their decision making and performance (i.e., skill execution) and crucially maintained performance improvements during the retention phase. As noted above, although research into more alternative and novel approaches to performance enhancement in young athletes is still in its

infancy, these studies highlight the value of exploring visual, cognitive and auditory processes (e.g., through video, feedback, questioning, decision making) to engage young athletes in ecologically strong interventions that can enhance performance through improved skill acquisition.

Critical Reflections, Future Directions and Practical Implications

Reviewing the current body of scientific work in the area of performance enhancement and young athletes affords a number of critical observations. Firstly, despite claims regularly made within the literature about the lack of intervention studies with young athletes (e.g., Foster, Maynard, Butt & Hays, 2016; Haddad & Tremayne, 2009), we have located over 80 published studies which have directly examined the effectiveness of both traditional and more novel/alternative interventions on task-based or competition performance. Importantly, many of these studies have documented positive performance effects upon the athlete and highlighted how young athletes can benefit from a range of different psychological techniques and approaches. Nevertheless, with the exception of a few areas (e.g., imagery) there remains a lack of systematic depth of research on a given strategy that may inform age and stage appropriate guidelines for practitioners working with young athletes. In the absence of such guidelines, applied practitioners are encouraged to focus on the delivery of multimodal interventions (i.e., PST packages) due to their utility and reported effectiveness across a range of sports, levels, and developmental stages.

Secondly, there is an absence of coherent sport-specific research whereby practitioners or coaches from a specific sport (e.g., tennis, soccer) may be able to follow evidence-based scientific advice in a sport across the developmental spectrum (e.g., strategies for children, early adolescents, etc.). Although there are isolated studies attempting to advance knowledge around a specific strategy or set of approaches, there are not [as yet] an extensive number of applied researchers consistently dedicated to a specific area of work. A logical starting point for such research is to identify which strategies are most effective at optimizing performance in

specific sports (or sport-specific tasks) across different stages of young athletes' development. Paying closer attention to developmental differences would also provide important insights regarding the optimal age to introduce certain strategies and how intervention delivery may differ based on the age of the child.

Thirdly, there is a sizeable body of literature reflecting practitioners' accounts and experiences of working with young athletes (e.g., Foster et al., 2016; Henriksen, Larsen, Storm & Ryom, 2014; Howells, 2017), and such accounts offer a great deal of intimate, contextual 'craft knowledge' and process-oriented guidelines (see Visek et al., 2009 for the Youth Sport Consulting Model) that may be pertinent for enhancing the quality of applied research. Henriksen and colleagues (2014) offer the viewpoint that many studies are far removed from the reality of working in the field with young athletes. As such they propose that future research with youth athletes adheres to specific practical recommendations, namely (a) delivering a holistic skills package and helping athletes with the multitude of existential challenges involved in reaching the elite level, (b) taking the sport psychology service delivery to the athletes and involving key actors in their environment as much as possible in the intervention, and (c) fostering a long term development focus and following the athletes over an extended period.

Finally, many of the interventions in these studies are delivered by the research team and carefully controlled as much as is feasible. However, it is often unclear if those delivering the interventions are qualified as practitioners. Also many of the studies do not actively involve coaches or other significant stakeholders in the process of delivering interventions. Such methodological issues mark the challenge of the trade-off between controlled science and ecological reality. Delivery of interventions by trained practitioners and engagement with coaches or others may be critical to sustaining intervention effects in a given environment beyond the initial empirical evaluation (see Hatzigeorgiadis et al., 2014, for a good example here).

The critical observations above render this area of paediatric sport psychology at somewhat of a crossroads. On the one hand, there remains a sizeable dearth of investigations in this area that demand relevant scientific rigor and longitudinal dedication on behalf of the applied researcher. Yet, sparse government or research council funding for organized youth sport research creates difficulties for executing innovative, longitudinal designs to strengthen the evidence base. On the other hand, it may be feasible to gain accessibility and financial support from sport bodies/clubs and federations but only with a focus on research designs that afford less control and greater ecological sensitivity in order to meet the needs of the sport funder. In reconciling these challenges, we believe that applied researchers should appeal to the levels of responsibility and duty of care that sport organizations should have in delivering performance enhancement interventions that are built on a clear evidence base. In this respect, the starting point is to highlight to organizations that more scientifically rigorous designs will yield more valid and robust information on developmentally appropriate strategies and techniques for young athletes, informing gold standard practice guidelines in the long term.

Over the past decade, driven by an interest in the application of ecological approaches (Bronfenbrenner, 2005) and the recognition that young athletes lie at the center of complex social systems, researchers have focused on the quality of talent development environments (Henriksen, Stambulova, & Roessler, 2010; Martindale, Collins, & Daubney, 2005) and an understanding of the psychological characteristics for developing excellence (PCDEs; MacNamara, Button, & Collins, 2010) in youth sport. Beyond a focus on performance outcomes and athletic improvement, scholarly attention has also been directed towards the study of life skills, positive youth development, and the psychosocial assets (see Holt et al., 2017) developed through organized youth sport participation. Such strengths-based approaches to developing the young person through sport are buoyed by salient societal issues around a duty of care to young athletes and topical concerns over athlete mental health (see Knight, Harwood, & Gould, 2018). However, the development of such psychosocial skills is not

conceptually divorced from impacts on performance, and there may be opportunities for researchers to investigate the degree to which psychosocial and life skill interventions improve performance as much as they influence psychological health and the quality of sport experience (see Harwood, 2008; Harwood, Barker & Anderson, 2015).

In conclusion, there exists a promising body of evidence for the impact of traditional and contemporary psychological approaches on youth athlete performance, with a blend of innovative experimental and quasi-experimental, field-based studies. However, the volume and depth of research on psychological methods and strategies per se is lacking in terms of assisting in our understanding of what approaches work best for different developmental stages and within specific sport types. Single case research designs, qualitative evaluations of programs (e.g., Sharp et al., 2013) and practitioner reflections (e.g., Henriksen et al., 2014; Howells, 2017) provide crucial insights into the complexity and challenging nature of working with young athletes. Such knowledge and knowhow on behalf of applied researchers and practitioners provide for opportunities to perhaps collaborate on executing longitudinal mixed-methods designs that facilitate developmentally sensitive examinations of specific strategies that can be delicately integrated within youth sport environments. Finally, we must remember as youth sport researchers that as much as we have a responsibility and duty of care towards the science of protecting young athletes and optimizing health and well-being, we also have a responsibility to support those committed young people who are looking to scientists to serve their intrinsic passion for sport, and introduce them to the processes and skills that will help to optimize their performance and its consistency under pressure. At present, while we may be serving young athletes with anecdotal and experiential evidence of what works, we lack the scientific evidence needed to most effectively and broadly help young athletes enhance their performance.

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Footnotes

¹ Studies included in the review are identified with an asterisk (*) in the reference list.

² Interventions which combined one PST strategy and one alternative strategy were included in this section of our review.