STUDIES IN SPORT, PHYSICAL EDUCATION AND HEALTH
241

Hannele Forsman

The Player Development Process among Young Finnish Soccer Players

Multidimensional Approach

JYVÄSKYLÄN YLIOPISTO

STUDIES IN SPORT, PHYSICAL EDUCATION AND HEALTH 241

Hannele Forsman

The Player Development Process among Young Finnish Soccer Players

Multidimensional Approach

Esitetään Jyväskylän yliopiston liikuntatieteellisen tiedekunnan suostumuksella
julkisesti tarkastettavaksi yliopiston Liikunnan salissa L303
kesäkuun 17. päivänä 2016 kello 12.

Academic dissertation to be publicly discussed, by permission of
the Faculty of Sport and Health Sciences of the University of Jyväskylä,
in building Liikunta, auditorium L303, on June 17, 2016 at 12 o'clock.

UNIVERSITY OF JYVÄSKYLÄ

JYVÄSKYLÄ 2016

The Player Development Process among Young Finnish Soccer Players

Multidimensional Approach

STUDIES IN SPORT, PHYSICAL EDUCATION AND HEALTH 241

Hannele Forsman

The Player Development Process among Young Finnish Soccer Players

Multidimensional Approach

UNIVERSITY OF JYVÄSKYLÄ

JYVÄSKYLÄ 2016

Editors
Jarmo Liukkonen
Faculty of Sport and Health Sciences, University of Jyväskylä
Pekka Olsbo, Sini Tuikka
Publishing Unit, University Library of Jyväskylä

URN:ISBN:978-951-39-6652-2
ISBN 978-951-39-6652-2 (PDF)

ISBN 978-951-39-6651-5 (nid.)
ISSN 0356-1070

Jyväskylä University Printing House, Jyväskylä 2016

ABSTRACT

Forsman, Hannele
The Player Development Process among Young Finnish Soccer Players – Multidimensional Approach
Jyväskylä: University of Jyväskylä, 2016, 99 p. (+ included articles)
(Studies in Sport, Physical Education and Health,
ISSN 0356-1070; 241)
ISBN 978-951-39-6651-5 (nid.)
ISBN 978-951-39-6652-2 (PDF)
Finnish summary
Diss.

The purpose of this thesis is to add to our knowledge and understanding of the development process of young soccer players in the development system of local soccer clubs in Finland. The first part of the thesis focuses on examining developmental activities and career progression among a group of 15-year-old soccer players (n = 159). The participants filled in questionnaires concerning their practice histories and tactical and psychological skills, and they also completed technical and physiological tests. The results showed that players with more soccer-specific play and practice during childhood also practiced more soccer during adolescence, and accordingly had better technical, tactical, psychological, and physiological skills and characteristics at that point. Furthermore, it was found that passing and centering skills, agility, and motivation recorded at the age of 15 predicted elite performance level at the age of 19 years. In the second part of the thesis a self-assessed Perceived Game-Specific Soccer Competence Scale (PGSSCS) was created and validated (n = 1321). The instrument (PGSSCS) was applied to trace the development of perceived competence in 12 to 14 years old players (n = 288) during a follow-up period of one year. The participants also filled in questionnaires related to tactical skills and motivation, and they completed tests of technical skills, speed and agility. The results showed that young players' perceived competence, motivation, technical and tactical skills, speed and agility were relatively high and remained stable over the period of one year. Positive relationships were found between the levels and slopes in perceived competence and motivation, and the levels of perceived competence and speed and agility characteristics. Taken together, the present empirical findings advance our understanding of the player development process and suggest that practitioners should encourage players to engage in large amount of soccer-specific play and practice during childhood, use a multidimensional approach in evaluating young players' long-term potential, and acknowledge the importance of perceived competence and motivation in coaching young developing players.

Keywords: soccer, practice, play, multidimensional performance characteristics, long-term potential, perceived competence, coaching

Author's address Hannele Forsman
Department of Sport Sciences
University of Jyväskylä, Finland

Supervisors Niilo Konttinen, PhD
KIHU – Research Institute for Olympic Sports
Jyväskylä, Finland

Minna Blomqvist, PhD
KIHU – Research Institute for Olympic Sports
Jyväskylä, Finland

Jarmo Liukkonen, PhD
Department of Sport Sciences
University of Jyväskylä, Finland

Reviewers Jean Côté, PhD
School of Kinesiology and Health Studies
Queen's University, Kingston, Ontario, Canada

Marije Elferink-Gemser, PhD
Center for Human Movement Sciences
University Medical Center Groningen
University of Groningen, Netherlands

Opponent Sami Yli-Piipari, PhD
Department of Kinesiology
College of Education
University of Georgia, United States of America

ACKNOWLEDGEMENTS

This study was carried out in the Research Institute for Olympic Sports (KIHU), Jyväskylä, Finland, and in Eerikkilä Sports Institute, Tammela, Finland. The data collection and reporting of the study results was done with the help of many persons to whom I would like to express my gratitude here.

First of all, special thanks to my supervisor Minna Blomqvist for your guidance, ideas, comments and patience in terms of helping me carry out of this work. Your effort in editing and commenting the original articles and the final thesis has been priceless. I am also very thankful to my other supervisors Jarmo Liukkonen and Niilo Konttinen for your valuable guidance and support during this work.

I would like to thank the co-authors of the original papers. Thank you to Keith Davids for your valuable comments and ideas that helped me to improve the quality and language of my articles. Thank you to Arto Gråstén for your help in statistical analysis on my articles. Furthermore, I am grateful for Ari Mäkiaho and Lasse Forsman for your help in statistical analysis and data handling.

I wish to express my warm thanks to my reviewers Jean Côté and Marije Elferink-Gemser for their work as the official reviewers of my thesis, and Sami Yli-Piipari for accepting the invitation to be my opponent in the public examination of my thesis.

This study was financially supported by the Finnish Ministry of Education and Culture, the Research Institute for Olympic Sports, and by personal grants from Sports Institute Foundation, and Ellen and Artturi Nyyssönen Foundation. I am very grateful for these organizations for providing financial support to this work.

Many thanks to all my colleagues for helping and supporting me during this work. I especially want to thank Kyösti Lampinen for your suggestion to start this study, and also for your valuable ideas and comments concerning this work, especially in the development of PGSSCS. I would like to acknowledge Eerikkilä Sports Institute (2011-2016) and Sports Institute of Finland (2010-2011) for providing me opportunity to do this study in addition to my basic job in these organizations. Furthermore, I would like to thank the Football Association of Finland, the Finnish Basketball Association and the Finnish Ice Hockey Association for their help in planning the sport-specific tests, and recruiting the teams to the first part of this study. Last but not the least, special thanks for all persons who took part in data collection, as well as, all the players and coaches who participated to this study – you were the ones who made this study possible.

Finally, I want to thank my family and friends for being so supportive and patient during these six years.

Jyväskylä, 2016
Hannele Forsman

FIGURES

TABLES

LIST OF ORIGINAL PUBLICATIONS

This thesis is based on the following original papers, which are referred in the text by their roman numerals (I-IV). In addition, some previously unpublished results are included in the thesis.

I Forsman, H., Blomqvist, M., Davids, K., Konttinen, N. & Liukkonen, J. 2016. The role of sport-specific play and practice during childhood in the development of adolescent Finnish team sport athletes. *International Journal of Sports Science & Coaching* 11 (1), 69-77.

II Forsman H., Blomqvist, M., Davids, K., Liukkonen, J. & Konttinen, N. 2016. Identifying technical, physiological, tactical and psychological characteristics that contribute to career progression in soccer. *International Journal of Sports Science & Coaching*. (in press)

III Forsman H., Gråstén, A., Blomqvist, M., Davids, K., Liukkonen, J. & Konttinen, N. 2015. Development and validation of the perceived game-specific soccer competence scale. *Journal of Sports Sciences.* doi: 10.1080/02640414.2015.1125518

IV Forsman H., Gråstén, A., Blomqvist, M., Davids, K., Liukkonen, J. & Konttinen, N. 2015. Development of perceived competence, tactical skills, motivation, technical skills, and speed and agility in young soccer players. *Journal of Sports Sciences.* doi: 10.1080/02640414.2015.1127401

LIST OF ABBREVIATIONS

AGT	Achievement goal theory
ANOVA	Analysis of variance
CFA	Confirmatory factor analysis
CFI	Comparative fit index
CMJ	Countermovement jump
df	Degrees of freedom
DMSP	Developmental Model of Sport Participation
EFA	Exploratory factor analysis
KMO	Kaiser-Meyer-Olkin
LTAD	Long-term Athlete Development model
M	Mean
MANOVA	Multivariate analysis of variance
p	*p* value
PAF	Principal axis factoring
PCDE	Psychological Characteristics of Developing Excellence
PGSSCS	Perceived Game-Specific Soccer Competence Scale
PSIS-R-5	Psychological Skills Inventory for Sports
RMSEA	Root mean square error of approximation
SDT	Self-determination theory
SD	Standard deviation
SE	Standard error
SEM	Structural equation modelling
SRMR	Standardized root mean square residual
TACSIS	Tactical skills Inventory for Sport
TLI	Tucker-Lewis index
Yo-Yo	Yo-Yo endurance test level 1

CONTENTS

1 INTRODUCTION

Previous research has introduced numerous factors influencing the acquisition of high levels of expertise in sport. Common factors that are suggested to be of importance in developing expertise are practice (Ericsson, Krampe & Tesch-Römer 1993, Simon & Chase 1973), teaching/coaching (Côté et al. 1995, Deakin & Cobley 2003), parental support (Bloom 1985, Côté 1999), enjoyment (Bloom 1985, Csikszentmihalyi, Rathunde & Whalen 1993), psychological characteristics (Durand-Bush & Salmela 2002, Gould, Dieffenbach & Moffett 2002), innate abilities (Bouchard & Malina 1984, Rankinen et al. 2006), and cultural factors (Baker & Horton 2004). Reaching the top level in soccer is especially challenging because soccer is one of the most popular and competitive sports in the world. There are approximately 38 million registered soccer players, of which only about 113,000 players (0.3%) actually reach professional status (FIFA 2007a).

The goal of the player development process is to find the most effective ways to help young players maximize their potential. Recently, soccer studies have tried to identify what kinds of activities professional players have engaged in during different parts of their careers. The main question is, what is the role of different activities during childhood and adolescence in the career progression of top soccer players (Haugaasen & Jordet 2012). One of the most referenced models related to understanding the role of different practice activities during development is the Developmental Model of Sport Participation (DMSP, Côté et al. 2007). Although the model has been supported by a substantial amount of research across different sports, it has been suggested that pathways of the DMSP appear not to capture the developmental activities of young soccer players (Ford et al. 2009). This is mainly because future elite soccer players have been shown to be engaged in a considerable amount of soccer-specific play and practice activities during their childhood (Ford et al. 2009, Ford & Williams 2012, Haugaasen, Toering & Jordet 2014a, Hornig, Aust & Güllich 2016). However, there is still a need for further information about the role of different kinds of play and practice actitivities in the development of young soccer players.

During development, players are likely to pass through a range of developmental stages and transitions. In order to accelerate the development of the

most talented players, many national federations and club teams invest considerable resources to identify talented players and ensure that the most talented players receive high-quality coaching and training conditions from an early age (Williams & Reilly 2000). The validity and usefulness of identification and selection of players at an early age have been questioned due to the complexity of skill acquisition, the non-linear nature of development, and differences in growth-mediated development during adolescence (Meylan et al. 2010, Phillips et al. 2010, Vaeyens et al. 2008). Because the goal of the player development process is to develop the future performance capacity of young athletes, there is a need to place a greater emphasis on the individual's capacity to learn and continue developing as an athlete rather than on their ability to simply reach a specific performance level which is assessed at one particular time during development (Abbott & Collins 2004, Phillips et al. 2010). In soccer literature, there are only a few studies which have tried to identify characteristics that predict the future performance level of young players (Gonaus & Müller 2012, Huijgen et al. 2009, Kannekens, Elferink-Gemser & Visscher 2011, Van Yperen 2009). Because all of these studies have focused on only one area of performance characteristics, examining future career progression through a multidimensional approach may advance our knowledge of how different characteristics affect the development process of future elite soccer players.

High-level motivation has been shown to be particularly important in the player development process, especially when it comes to helping athletes practice as much as needed to become an elite athlete in the future (Abbott & Collins 2004, Durand-Bush & Salmela 2002, MacNamara & Collins 2011). Due to the significant role of perceived competence in the development process of motivation among young individuals (Deci & Ryan 2000, Harter 1978), it can be argued that perceived competence also affects young players' development process. Perceived competence has been shown to be associated with intrinsic and extrinsic types of motivation (Ntoumanis 2001), as well as enjoyment and long-term sport participation (McCarthy, Jones & Clark-Carter 2008, Ullrich-French & Smith 2009, Wiersma 2001). Due to the specificity of perceived competence (Fox & Corbin 1989, Marsh et al. 1994), the perceptions of players' competence based on situational game-playing abilities may be expected to better reflect young soccer players' perceived competence than just self-perceptions of more general athletic skills or physical abilities. However, to the best of our knowledge, no valid instrument yet exists that could be used to assess game-specific perceived competence in soccer. Furthermore, no studies with longitudinal design have examined the development of perceived competence and its relationship to other performance characteristics among young soccer players.

In the Finnish sport system, like also some other countries, player development is based around sport clubs rather than elite development academies or schools. In the sport club environment, all players usually compete and practice in the club throughout their childhood and adolescence. This being the case, the most talented players are part of a heterogenous group, and there may be fewer resources for specific development of them as individuals. In addition, most of

the coaches are volunteers. In the current research literature, there are a number of studies which have examined the young soccer players' development process in academic environments, but only a very limited amount of research has been done on the development system in local sport clubs.

The purpose of this thesis is to add to our knowledge and understanding of the development process of young soccer players in the development system of local soccer clubs in Finland. The present thesis comprises four studies, which could be divided into two parts focusing on two different aspects of the player development process. The aim of the first part of this thesis is to examine the role of soccer-specific play and practice during childhood in the development of performance characteristics, and to identify performance characteristics that predict the future performance levels of 15-year-old players. The aim of the second part is to create and validate a perceived game-specific soccer competence scale, and to examine the development of perceived competence and performance characteristics during a period of one year among a group of soccer players aged 12 to 14.

The strength of this thesis lies in its multidimensional approach, as well as its use of cross-sectional and longitudinal designs to investigate the player development process in youth soccer. In addition, this thesis presents a practical and valid tool for assessing perceived competence among young soccer players. The findings have the potential to extend the previous literature on player development in soccer and to provide researchers, sport clubs and coaches with additional insights into the player development process from childhood to late adolescence.

2 REVIEW OF THE LITERATURE

2.1 Athlete developmental pathways and activities

Athlete development pathways are non-linear and dynamic due to biological, psychological, and social changes, which occur during childhood and adolescence (Abbott & Collins 2004, Phillips et al. 2010, Vaeyens et al. 2008). In order to better understand key elements of athletic development and sport participation in different stages, researchers have proposed several formal models, such as the Long-term Athlete Development Model (LTAD, Balyi & Hamilton 2004), the Psychological Characteristics of Developing Excellence (PCDE, Abbott & Collins 2004), the Developmental Model of Sport Participation (DMSP, Côté et al. 2007), the Early Engagement Hypothesis (Ford et al. 2009), and the Foundations, Talent, Elite, Mastery framework (FTEM, Gulbin et al. 2013). These models describe development as a progression from childhood through different stages into elite adult performance or recreational participation.

One of the most referenced models, the DMSP (Côté et al. 2007) contains two different pathways from the age at which athletes first enter into sport until adulthood. The difference between these two pathways, called the early specialization and early diversification pathways, is related to the relative levels of practice and play activities that athletes engage in during childhood and adolescence. Practice can be defined as a formal activity designed to improve performance in a specific sport, whereas play refers to an informal activity designed to provide enjoyment (Côté et al. 2007, Ford et al. 2009). The early specialization pathway is based on ideas from the theory of deliberate practice (Ericsson et al. 1993), which predicts that an earlier amount of deliberate practice is directly related to current performance levels. Athletes following the early specialization pathway participate in a large number of hours in deliberate practice in their primary sport, but only a low amount of hours in practice and play activities across different sports throughout their development. Engaging in sport-specific deliberate practice from an early age is expected to lead to more effective skill development and the attainment of expertise in a specific sport

(Côté et al. 2007). It has been suggested that the early specialization pathway is especially important and often necessary among sports in which expert performance is expected before the age of puberty (Law, Côté & Ericsson 2007) and in which identification and selection into talent development programmes occur already at an early age (Ward et al. 2007). It should be noted, however, that the early specialization pathway has been criticized due to the potentially negative consequences of engaging in such a large number of hours of intense practice during early development (Baker, Cobley & Fraser-Thomas 2009, Malina 2010). These consequences include burnout, dropout, overuse injuries and lower levels of attainment (Baker et al. 2009).

In contrast to the early specialization pathway, in the early diversification pathway athletes engage in a large number of hours in play activities across a number of sports, but only a low number of hours in the practice and competition of their primary sport during childhood (6–12 years of age). During early adolescence (13–15 years of age), athletes participate in a comparable number of hours in play and practice of one or two sports, including their primary sport. At the same time, their involvement in other sports decreases. Finally, during late adolescence (16+ years of age), they participate in a large number of hours in the practice of their primary sport, but only a low number of hours in play activities across other sports. Early diversification has been shown to be associated with positive sport experiences and prolonged engagement in sport (Côté et al. 2009a, Côté, Lidor & Hackfort 2009b). This pathway is thought to lead to enhanced sport expertise because of high levels of intrinsic motivation stemming from children experiencing fun, enjoyment, and competence during sport involvement. Engagement in informal and fun play activities during childhood may have a positive effect on an individual's general motivation to engage in practice and competition of his/her primary sport later on (Côté et al. 2007). Play activities may also be important during childhood because these activities involve interaction between motor, cognitive-perceptual and decision-making skills in different situational contexts, thereby providing extensive implicit skill learning (Davids, Button & Bennet 2008). Various sport experiences during childhood may allow children to experience various physical, cognitive, affective, and psychosocial constraints, which provide them with the foundation required to specialize in one sport during adolescence (Côté et al. 2009b). Some studies have even indicated that less sport-specific practice is necessary for expertise if athletes engage in a range of sports throughout their development (Baker, Côté & Abernethy 2003). Early diversification has been shown to be typical for sports such as netball, basketball, and field hockey (Baker et al. 2003), tennis and rowing (Côté 1999), ice hockey (Soberlak & Côté 2003), and triathlons (Baker, Côté & Deakin 2005). The common feature for those sports is that the peak performance level generally occurs between 20 and 30 years of age (Baker et al. 2003, Soberlak & Côté 2003). On the other hand, studies conducted among soccer players have shown that early diversification may not be the pathway that leads to elite levels in soccer (Ford et al. 2009, Ford & Williams 2012, Haugaasen & Jordet 2012). It has been argued that the development of

specific technical and tactical skills needed in soccer is associated with a considerable amount of soccer-specific play and practice activities already during childhood (Huijgen et al. 2010, Roca, Williams & Ford 2012, Valente-dos-Santos et al. 2012, Valente-dos-Santos et al. 2014, Williams et al. 2012).

The early engagement hypothesis was developed in the studies of Ford and colleagues (2009) mainly because the early specialization and diversification pathways did not appear to capture the developmental activities of young soccer players. In the early engagement pathway, athletes engage in a relatively high number of hours in play and practice activities of their primary sport during childhood, but the number of hours spent in other sports is relatively low (Ford et al. 2009). The large amount of unstructured soccer-specific play during childhood has been shown to be associated with superior perceptual-cognitive skills (Roca et al. 2012, Williams et al. 2012) and better creative thinking (Memmert, Baker & Bertsch 2010). Despite the benefits of engaging in soccer-specific play activities, it has been suggested that soccer-specific play without the required amount of soccer-specific practice may not lead to success in soccer (Ford et al. 2009, Ford & Williams 2012, Ward et al. 2007). Soccer-specific practice during childhood and adolescence has been shown to be especially important in developing players' technical skills (Huijgen et al. 2009, Huijgen et al. 2010, Valente-dos-Santos et al. 2012, Valente-dos-Santos et al. 2014), and to some extent also players' tactical skills (Memmert et al. 2010, Roca et al. 2012). Instead, the current level of knowledge about how participation in other sports may contribute to soccer players' development is inadequate to draw clear conclusions (Haugaasen & Jordet 2012). In earlier soccer studies, some elite players have participated in other sports during childhood and early adolescence, but the amount of hours spent in other sports has not differentiated more successful players from the other players (Ford et al. 2009, Ford & Williams 2012, Haugaasen, Toering & Jordet 2014b). As an exception, Hornig and colleagues (2016) found that future German National team players had spent more time in other sports during adolescence compared to future amateurs. However, in line with other soccer studies (Ford et al. 2009, Ford et al. 2012, Ford & Williams 2012, Haugaasen et al. 2014b, Ward et al. 2007), Hornig et al. (2016) also found that future elite players had dedicated the majority of their practice time to soccer-specific activities.

2.2 Performance characteristics in soccer

2.2.1 Technical skills

The technical demands of contemporary soccer have increased significantly in recent years. A greater number of passes during games suggests that there has been an increase in passing tempo, resulting in greater involvement with the ball (Barnes et al. 2014). Maintaining ball possession by keeping the ball on the ground and trying to pass it continuously during games has been shown to be

associated with success in elite soccer (Liu et al. 2015). Furthermore, players from the more successful teams have been shown to complete more short passes, successful short passes, tackles, dribbles, shots and shots on target during games (Rampinini et al. 2009a). Based on these results from game analyses, technical skills such as ball control, dribbling, passing, and shooting can be seen as fundamental skills in soccer (Ali 2011, Roesch et al. 2000).

The importance of technical skills in successful soccer performance has been supported by earlier studies which have shown that technical skills differentiate soccer players of varying performance levels (Coelho e Silva et al. 2010, Figueiredo et al. 2009, Huijgen et al. 2014, Rebelo et al. 2013, Reilly et al. 2000b, Vaeyens et al. 2006). It has also been shown that technical skills may be valuable in evaluating young soccer players' future potential (Huijgen et al. 2009). Huijgen et al. (2009) found that players who ultimately reached a professional level in soccer outscored players who reached amateur status, both in terms of peak dribbling and repeated dribbling performance, during adolescence. During adolescence, future professional players were an average of 0.3s faster in 30m peak dribbling and an average of 1s faster in 3 x 30m repeated dribbling, compared to players that remained amateurs.

Technical skills have been shown to improve with age among young soccer players (Huijgen et al. 2009, Huijgen et al. 2010, Vaeyens et al. 2006, Valente-dos-Santos et al. 2012, Valente-dos-Santos et al. 2014, Vänttinen 2013). The fastest development in technical skills has been shown to occur in prepubertal years, after which technical skills develop gradually until adulthood (Huijgen et al. 2010, Huijgen et al. 2013, Valente-dos-Santos et al. 2012, Valente-dos-Santos et al. 2014, Vänttinen 2013). Some studies have shown that growth and maturity status may be slightly associated with technical skills development (Malina et al. 2005, Malina et al. 2007, Valente-dos-Santos et al. 2014), suggesting that biological maturity does have an impact on the development of technical skills among young players. However, several studies have highlighted the importance of practice in the development of technical skills by reporting the positive associations between technical skill level and time spent in soccer-specific practice (Huijgen et al. 2009, Huijgen et al. 2010, Valente-dos-Santos et al. 2014).

2.2.2 Tactical skills

Tactical skills refer to the ability of an individual player to execute the right action at the right moment during the game (Gréhaigne & Godbout 1995). These skills are important in soccer, because in game situations players must always respond to sensory stimuli around them before actual physical or technical performance can be executed. Perceptual-cognitive skills, such as anticipation and decision-making skills, are an important part of tactical expertise. Anticipation is the ability to recognize the outcome of another player's actions prior to those actions being executed, whereas decision-making skills can be defined as an ability to plan, select and execute an action based on the current situation and the knowledge possessed (Williams & Ford 2013). Tactical skills rely primarily on cognitive skills, which are typically categorized as declarative and procedur-

al knowledge (McPherson & Kernodle 2003, Thomas & Thomas 1994). Declarative knowledge refers to the knowledge of the rules and goals of the game (McPherson 1994, Williams & Davids 1995). Procedural knowledge can be defined as the selection of an appropriate action within the context of the game (McPherson 1994).

In the previous soccer literature, it is rather well documented that successful soccer players have more developed tactical skills than other players (Huijgen et al. 2014, Kannekens, Elferink-Gemser & Visscher 2009, Kannekens et al. 2011, Reilly et al. 2000b, Vaeyens et al. 2007a). It has also been suggested that tactical skills may be valuable in evaluating the long-term potential of young soccer players (Kannekens et al. 2011). Kannekens et al. (2011) found that young soccer players who reached professional status later on had better tactical skills than those who became amateurs. The correct classification of the adult performance level based on tactical skills varied between 69–80%, depending on the playing positions. The data from Kannekens et al. (2011) suggests that especially procedural knowledge, which involves the interpretation of a specific situation and the ability to be at the right place at the right moment to make the right action, seems to contribute to future performance level in soccer.

Among young soccer players, tactical skills have been shown to improve with soccer-specific play and practice rather than with age-related development (Roca et al. 2012, Vaeyens et al. 2007a, Ward & Williams 2003, Williams et al. 2012). For instance, Roca et al. (2012) found that the average hours spent in soccer-specific play and practice during childhood and adolescence were positively associated with the level of perceptual-cognitive and anticipation skills later on.

2.2.3 Physical and physiological characteristics

The physical characteristics of elite soccer players have been shown to vary according to different playing positions (Reilly, Bangsbo & Franks 2000a). Some studies conducted among young soccer players have shown that talented players have bigger body sizes (Gil et al. 2007, le Gall et al. 2010) and less body fat than the other players (Reilly et al. 2000b, Vaeyens et al. 2006). These differences may be caused by age-related biological changes that occur during adolescence (Malina, Bouchard & Bar-Or 2004a, Meylan et al. 2010, Philippaerts et al. 2006). Before the growth spurt, the average growth in males is about 5cm per year, while weight increases about 2–3kg per year. During the growth spurt, the rate increases to around 10cm per year in height and 10kg per year in weight. This growth spurt usually occurs at the age of around 14 years in boys (Tanner, Whitehouse & Takaishi 1966).

During a soccer game, the intensity of the moving changes rapidly, shifting from walking and jogging to high-intensity running, sprinting, and jumping. Therefore, soccer players must be competent across different areas of physiological conditioning (Bloomfield, Polman & O'Donoghue 2007a). Due to the number of short sprints, fast turns, and changes in running intensity during games, (Bloomfield et al. 2007a, Di Salvo et al. 2013, Mohr, Kustrup & Bangsbo 2003),

speed and agility are important characteristics of soccer players. In order to produce these kinds of fast and powerful actions, players should have the required amount of explosive strength (Meylan & Malatesta 2009). During a game, these high-intensity activities are performed repeatedly, alternating with periods of low-intensity exercise (Bloomfield et al. 2007a). It is suggested that a player with high endurance capabilities recovers faster from high-intensity exercises, allowing him to perform more sprints and technical actions, and to maintain technical and tactical skill levels during the whole game (Helgerud et al. 2001, Rampinini et al. 2009b).

The importance of physiological characteristics in soccer performance has been acknowledged by a number of cross-sectional studies in which several physiological characteristics have differentiated players of different performance levels in youth and adult soccer (Coelho e Silva et al. 2010, Figueiredo et al. 2009, Gil et al. 2007, Huijgen et al. 2014, Kaplan, Erkmen & Taskin 2009, Rebelo et al. 2013, Reilly et al. 2000b, Vaeyens et al. 2006). Furthermore, in some longitudinal studies, physiological characteristics have been shown to contribute to future career progression in soccer (Gonaus & Müller 2012, le Gall et al. 2010). Gonaus and Müller (2012) attempted to use physiological data to predict future career progression in soccer, and they found that the more successful players in the future were superior in terms of several physiological characteristics across different age groups. Medicine ball throwing and shuttle sprinting remained very stable as a means of differentiating players, but the third highest differentiating variable changed within age category. The correct classification of adult performance level based on three physiological variables varied between 62–66%, depending on the age group. Performance differences in physiological characteristics seemed to diminish in older age groups, suggesting that other aspects probably become more important for distinguishing between players when they get older (Gonaus & Müller 2012).

Physiological characteristics have been shown to improve progressively with age among young soccer players (Gil et al. 2007, Vaeyens et al. 2006, Valente-dos-Santos et al. 2012, Valente-dos-Santos et al. 2014, Vänttinen 2013). During adolescence, a number of age-related biological changes occur which affect the development of physiological characteristics of young players (Malina et al. 2004b, Meylan et al. 2010, Philippaerts et al. 2006). Studies conducted among adolescent males in the general population suggest that the fastest development in speed and agility occurs before peak height velocity, the fastest development in maximal aerobic power occurs with peak height velocity, and the fastest development in strength and power occurs after peak height velocity (Beunen & Malina 1988, Malina et al. 2004a). Findings from soccer studies have indicated that the fastest development in physiological characteristics, such as speed, agility, explosive strength, and endurance, occurs at the same time as peak height velocity (Philippaerts et al. 2006). Even if maturity level clearly has an impact on the development of physiological characteristics during adolescence, studies with specific training interventions have shown that physiological characteristics can be improved with practice regardless of age (Bloomfield

et al. 2007b, Dellal et al. 2012, Helgerud et al. 2011, Meckel et al. 2012, Meylan & Malesta 2009, Michailidis 2015, Mujika, Santisteban & Castagna 2009a).

2.2.4 Psychological characteristics

Psychological characteristics have been shown to be important for high-level performance in sports (e.g. Durand-Bush & Salmela 2002, Gould, Dieffenbach & Moffett 2002, Gould & Maynard 2009, Mahoney, Gabriel & Perkins 1987, Williams & Krane 2001). According to Mahoney et al. (1987), elite athletes appear to be highly motivated to do well in their sport, experiencing high and stable self-confidence, being able to more efficiently concentrate before and during competition, and relying more on mental preparation. Recently, researchers have been focused on the role of psychological characteristics in the development process of young athletes, and they have found that a range of psychological factors, such as motivation, commitment, goal setting, quality of practice, imagery, realistic performance evaluation, coping under pressure, and social skills can facilitate the translation of potential into expertise (MacNamara, Button & Collins 2010a, MacNamara & Collins 2011; 2013). For instance, motivation and determination allow athletes to stay on the pathway to excellence by enabling them to invest the requisite time in practice and stay committed to the development process (e.g. Durand-Bush & Salmela 2002, MacNamara & Collins 2011). It seems that the same sets of psychological characteristics appear to be important throughout development, but they may be deployed differently depending on the individual's age, focus, stage of development, or level of maturation (MacNamara, Button & Collins 2010b).

Studies conducted in a soccer context have shown that psychological characteristics also may be important for success in soccer (Holt & Dunn 2004, Morris 2000, Reilly et al. 2000b, Rumpf et al. 2014). It has also been argued that psychological characteristics may be valuable in evaluating young soccer players' future potential (Van Yperen 2009). Van Yperen (2009) found that relative to their less successful counterparts, successful players reported higher goal commitment and were more likely to use problem-focused coping strategies and to seek social support. The correct classification of the adult performance based on these three significant psychological factors was 72%.

The psychological development of athletes takes place over a long time period, and it is influenced by a variety of individuals and factors (Bloom 1985, Csikszentmihalyi et al. 1993, Gould et al. 2002). Psychological characteristics may be influenced directly (for example, by organizing psychological lessons or specific training for athletes), but these characteristics are also affected indirectly through the psychological environment of the coaching process (Gould et al. 2002).

2.3 Perceived competence

2.3.1 Theoretical approaches to motivation and perceived competence

Researchers have applied different theoretical approaches to motivation, such as competence motivation theory (Harter 1978), self-determination theory (Deci & Ryan 1985; 2000), and achievement goal theory (Nicholls 1989). All of these theories highlight the fundamental role of perceived competence in the development of motivation in various contexts, including sports.

Perceived competence refers to an individual's evaluation of and belief in his/her own capability to interact effectively in a specific performance domain (Horn 2004). According to Harter's competence motivation theory (1978), most individuals are motivated to perceive competence in various life domains, such as academia, sports, and social relationships. Harter's (1978) theory suggests that individuals who perceive high competence in some skills are more likely to enjoy involvement and thus invest more time and effort in an attempt to further improve these skills. Improvement of skills leads to positive competence beliefs and enhanced intrinsic motivation, which supports further time investments in practice. In contrast, individuals with low perceived competence are likely to lose persistence and interest in skill improvement. Harter (1978) predicts that in forming self-perceptions of competence, four psychological constructs are employed: past experiences, difficulty or challenge associated with the outcome, reinforcement and personal interactions with significant others, and intrinsic motivation. These self-perceptions of competence can be enhanced by positive reinforcement based on successful attempts and decreased by perceptions of failure and negative responses (Harter 1978).

One of the most influential theories of motivation for performance is the self-determination theory (SDT, Deci & Ryan 1985; 2000). SDT emphasizes that perceived competence is one of the three psychological needs which has an impact on an individual's intrinsic motivation and interest. The other psychological needs are autonomy, which refers to the desire to be self-initiating in the regulation of one own actions, and social relatedness, which can be defined as a desire to be connected and appreciated by others. According to SDT, the participation motives of individuals can be categorized as intrinsically motivated, extrinsically motivated, and amotivated. These three forms of motivation differ from each other in the amount of self-determination. The most self-determined form of motivation is intrinsic motivation, which refers to being involved in an activity for the pleasure and satisfaction derived from performing the activity. Extrinsic motivation exists when an activity is engaged in for some external reasons, such as rewards, constraints, or fear of punishment. Amotivation can be defined as a state when an individual does not have any autonomous reason for activity. Based on the self-determination continuum, intrinsic motivation is expected to be associated with the most positive outcomes, whereas external motivation and amotivation are expected to lead to negative consequences (Deci &

Ryan 1985; 2000). Studies conducted in sport settings have provided support for SDT by showing that the most self-determined motivation is associated with many positive consequences such as effort (Pelletier et al. 1995), enjoyment (Ntoumanis 2002, Vlachopoulos & Karageorhis 2005), persistence (Alvarez et al. 2012, Pelletier et al. 2001, Sarrazin, Boiché & Pelletier 2007, Sarrazin et al. 2002) and well-being (Alvarez et al. 2012, Reinboth & Duda 2006).

The achievement goal theory (AGT, Nicholls 1989) suggests that individuals may interpret their competence with respect to two orientations which differ from each other in the way that competence is judged. Task-oriented individuals tend to focus on improving performance relative to their own past performance rather than in comparison to others. They adopt personal improvement and the learning of new skills as criteria for competence. Task-oriented individuals tend to be more intrinsically motivated and persistent upon failure, because the indicators of competence that they use are internal and more controllable. In contrast to task-oriented individuals, ego-oriented individuals experience competence when they have a better performance than others. In order to succeed, ego-oriented individuals usually select easier tasks. They are also less persistent when it comes to failure. An important assumption of AGT is that goal orientations are not orthogonal, meaning that an individual may hold both orientations at once (Nicholls 1989). Based on AGT, a task-oriented climate tends to promote well-being, satisfaction, and motivation, whereas an ego-oriented climate is likely to lead to dissatisfaction, lack of motivation and reduced effort (Ntoumanis & Biddle 1999). In line with that, previous sport studies have found positive associations between task-oriented motivational climate and the fulfillment of three basic psychological needs (Alvarez et al. 2012, Jõesaar, Hein & Hagger 2011, Ntoumanis & Biddle 1999, Sarrazin et al. 2002).

2.3.2 Development of perceived competence

Self-perceptions of competence among young individuals are shaped by the development of cognitive functioning and age-related changes in the social environment. With more developed cognitive functioning, individuals can better differentiate effort and ability as causes of performance success, as well as understand various information sources used to judge competence (Harter 2012, Horn 2004). Children under twelve appear to be in the concrete operational reasoning stage (Piaget 1952), in which they tend to describe themselves based on concrete and observable features. Already by that age, children possess the cognitive abilities necessary to observe and acknowledge a lot of information from different sources, but they are not capable of synthesizing all of this information to accurately evaluate their competence. The self-perceptions of competence at this age are influenced especially by parents' opinions, spectators' feedback, and the outcome of competitions (Weiss & William 2004). Children at age 12 and older appear to be in the formal operational stage (Piaget 1952), in which they are able to use all past and new information to evaluate their own competence. At this stage, other social factors, such as expectations from coaches and feedback given by coaches or peers, become more important

sources of perceived competence (Weiss & William 2004). In addition, age-related biological changes that occur during adolescence may affect the self-perceptions of competence among young individuals (Harter 2012, Horn, 2004). For instance, pubertal status is shown to be related to athletic competence, with early maturing boys having higher competence than their later maturing peers (O'Dea & Abraham 1999). Finally, in late adolescence, athletes have a more developed level of self-awareness, and they tend to use more internal and self-referenced sources, such as skill improvement, goal achievement and effort exerted, to evaluate their competence (Weiss & William 2004).

Studies conducted in a sport context indicate that athletes use a variety of sources to determine their competence, such as performance outcomes, personal statistics, learning, goal achievement, and coach behavior (Horn & Amorose 1998). Positive associations between performance outcomes and perceived competence found in previous studies (Bortoli et al. 2011, Feltz & Brown 1984, Gillet, Berjot & Gobancé 2009, Hopper, Guthrie & Kelly 1991) highlight the importance of developing athletes' sport-specific characteristics so that they correspond to the demands of the sport. Positive associations have been found between perceived soccer competence and soccer skills (Feltz & Brown 1984, Hopper et al. 1991), perceived physical competence and coaches' evaluation of athletes' performance levels (Bortoli et al. 2011), and perceived competence and performance outcomes in competitions (Gillet et al. 2009). It has been suggested that the motivational climate created by coaches has an important role in supporting the perceived competence of athletes. Moreover, it has been shown that greater emphasis by coaches on a task-oriented climate, and less emphasis on an ego-oriented climate, is positively associated with the level of perceived competence in young athletes (Alvarez et al. 2012, Weiss, Amorose & Wilko 2009).

Supporting the development of young athletes' perceived competence is important due to its significant role as a predictor of motivation and behavior in sport. Perceived competence has been shown to be associated with intrinsic and extrinsic types of motivation (Ntoumanis 2001). In addition, it has been suggested that perceived competence may be a key factor for enjoying and sustaining sport participation (McCarthy et al. 2008, Papaioannou et al. 2006, Ullrich-French & Smith 2009, Wiersma 2001) and a strong predictor of functional psycho-biosocial states in young athletes (Bortoli et al. 2011). Finally, it has been argued that high levels of perceived competence facilitate positive expectations of success and achievement-oriented behaviors, such as effort, persistence and choice of challenging tasks (Roberts, Treasure & Conroy 2007).

The perceived competence of young individuals has been traditionally evaluated by using physical competence or athletic competence scales (e.g. Fox & Corbin 1989, Harter 1982, Harter 1985, Lintunen 1987, Ryckman et al. 1982, Wichstrøm 1995). These scales have been used in different sport domains, but they are rather general, not adequately representing perceived competence in a specific sport. In order to better evaluate individuals' competence in a specific domain, some sport-specific scales have been developed (Allen & Howe 1998,

Feltz & Brown 1984). With these scales it is possible to examine individuals' perceptions of competence in a specific sport, but they do not allow for differentiation of the variety of sport-specific skills which underlie the perception of sport-specific competence. Based on many self-concept models (e.g. Fox & Corbin 1989, Marsch et al. 1994), it can be argued that individuals' perceptions of sport-specific competence are likely related to a self-assessment of the specific skills and characteristics needed in sport. For instance, in a soccer context, this means an evaluation of specific technical and tactical skills and the physiological characteristics needed in game situations.

2.4 Talent identification, selection and development

A talented player can be defined as an individual who performs better than others during practice and competitions in a specific sport and who has the potential to become an elite player in the future (Helsen et al. 2000, Howe, Davidson & Sloboda 1998). Even if talent may not be evident at an early age, there are some early indicators which provide a basis for predicting those individuals who are likely to succeed in the future (Howe et al. 1998). The goal of talent development programs is to help players to maximize their potential as players. The key stages of this process are talent identification, talent selection, and talent development. Talent identification refers to recognizing players who may have the potential to become an elite athlete, while talent selection refers to choosing these players to be part of specific training groups, teams, or academies, for example. Talent development implies offering players a suitable learning environment to realize their potential (Williams & Reilly 2000). Identifying and selecting talented players at an early age is rather popular in soccer (Güllich 2013, Huijgen et al. 2014, Vaeyens et al. 2006, Williams & Reilly 2000), mainly because it is expected to be necessary in order to offer a high-quality coaching and training environment for the most talented players (Williams & Reilly 2000).

It should be noted, however, that cross-sectional designs in which the identification and selection of the youth athletes are based on current performance are associated with low predictive value (Vaeyens et al. 2008). Early selection as a determinant of later career progression has been brought into question by study findings that national youth team membership is not necessarily a prerequisite for future progression to the senior national team and long-term development (Barreiros & Fonseca 2012, Güllich 2013, Vaeyens et al. 2009). For instance, Güllich (2013) examined the career progression of the German national youth team in soccer for over a decade and found that the mean annual turnover of players was 41%. In addition, the probability of not being on the national youth team after three years was over 50%. It was also observed that, roughly speaking, every second youth national team player played in either first or the second national league later on. Similar results have been found when examining the career progression of players accepted into elite academies at an early

age (Güllich & Emrich 2012, Güllich 2013). Güllich (2013) found that the mean turnover rate of all players in the German youth elite academies was 24.5% annually. It was also observed that only a minority of later Bundesleague players were selected in youth elite academies during early age, but 88.7% of all Bundesleague players had been involved in youth elite academies for at least one season before the age of 19.

One problem related to the predictive value of early selection procedures is large differences in growth and maturation among young players. The timing and speed of maturation varies greatly between individuals during adolescence, due to which differences in maturity can be extensive, even among players of the same chronological age (Meylan et al. 2010). Players of advanced maturity or age benefit from development of aerobic power (Malina et al. 2004b), muscular strength and endurance (Beunen et al. 1992), and motor skill execution (Malina et al. 2005, Malina et al. 2007). Fast development of these characteristics occurs at different chronological ages, depending on the timing and speed of maturation. During adolescence, even differences of less than 12 months in age may be very significant in terms of current performance level (Meylan et al. 2010). Accordingly, players who are born early in the selection year often have physical and physiological advantages over players born later in the selection year (Hirose 2009, Musch & Grondin 2001). This has been proven by a number of studies which have found that children born in the first 3–4 months from cut-off dates are over-represented in team selections (Cobley et al. 2009, Musch & Grondin 2001). This phenomenon of bias in the birth date distributions of selected players is called the relative age effect (RAE) (Barnsley, Thompson & Barnsley 1985). In soccer, the RAE is mostly observed between 13 to 16 years of age (Figueiredo et al. 2009, Hirose 2009, Malina et al. 2000), but it also seems to persist at a senior level (Helsen et al. 2012, Mujika et al. 2009b). Due to the advantages that early-maturing players have over late-maturing players, early selection may prematurely exclude late-developing players who could have the potential to attain excellence in the future (Meylan et al. 2010, Vaeyens et al. 2008, Williams & Reilly 2000).

Another problem related to early selection is the complexity of skill acquisition and the non-linear and dynamic nature of talent development (Phillips et al. 2010). Inter-individual differences in growth and development during adolescence can cause unstable, non-linear development of different performance characteristics. For instance, it has been shown that a plateau appears to exist in the velocity curves of explosive strength and running speed after peak height velocity (Philippaerts et al. 2006). Due to nonlinear development of talent, a player who possesses the required characteristics at an early age may not necessarily retain these throughout development (Ackland & Bloomfield 1996), and these characteristics do not automatically translate into exceptional performance in adulthood.

Finally, despite the multidimensional nature of soccer (Williams & Reilly 2000), most of the talent identification and selection studies have focused only on one or two domains of the multidimensional performance with a limited

number of variables (e.g. Figueiredo et al. 2009, Gil et al. 2007, Vaeyens et al. 2006). These studies have shown that various different performance characteristics – technical (Coelho e Silva et al. 2010, Figueiredo et al. 2009, Reilly et al. 2000b, Vaeyens et al. 2006), tactical (Kannekens et al. 2011, Reilly et al. 2000b, Vaeyens et al. 2007a, Ward & Williams 2003), physiological (Coelho e Silva et al. 2010, Figueiredo et al. 2009, Gil et al. 2007, Reilly et al. 2000b, Vaeyens et al. 2006), and psychological (Coelho e Silva et al. 2010, Morris 2000, Reilly et al. 2000b, Rumpf et al. 2014) – differentiate talented young players from the other players. Although these one- or two-dimensional studies have shown that different performance characteristics are important in soccer, their predictive value has proven problematic. This is because in one-dimensional approaches to talent identification, the talent of the player is estimated on the basis of a low or high level of skills in one specific variable, while excellence in sports like soccer can be achieved through different combinations of the skills and characteristics (Vaeyens et al. 2008).

Based on the aforementioned problems it has been suggested that efforts should be shifted from talent identification and selection to talent development programs (Vaeyens et al. 2008). Because the goal of talent development programs is to develop the future performance capacity of young athletes, there is a need to acquire a greater understanding of the individual's capacity to learn and continue developing as an athlete rather than of their ability to simply reach and maintain a specific performance level which is assessed at one particular time during what may be a non-linear development trajectory (Abbott & Collins 2004, Phillips et al. 2010).

3 PURPOSE OF THE STUDY

The purpose of this thesis is to add to our understanding of the development process of young Finnish soccer players during childhood and adolescence in the development system of soccer clubs. The present thesis comprises four studies, which can be divided into two parts focusing on the players' development process from two different perspectives. The first part of this thesis focuses on the developmental activities and career progression among a group of 15-year-old soccer players. The second part focuses on perceived competence development and its relation to the development of performance characteristics among a group of soccer players aged 12 to 14 years. The specific aims of the two parts are as follows:

Developmental activities and career progression:

1) To examine the role of soccer-specific play and practice during childhood in the development of young soccer players (Study I)
2) To identify performance characteristics at the age of 15 that contribute to a successful performance level at the age of 19 (Study II)

Development of perceived competence and performance characteristics:

3) To create and validate a self-reported, game-specific soccer competence scale (Study III)
4) To examine the development of young soccer players' perceived competence and performance characteristics during a period of one year (Study IV)

4 METHODS

4.1 Participants

Studies I and II The participants consisted of 159 male soccer players representing 12 soccer teams. All players were born in 1995 and were fifteen years old at the time of the study. Participating teams were selected with the help of the Football Association of Finland and were among the most successful teams in their age category in the whole of Finland. The most talented players of these teams had been selected for the Finnish national youth team at the age of fifteen years (n = 32).

For study I, the participants were divided into tertiles based on the average amount of soccer-specific play and practice reported by them during childhood (6-12 years of age). The data of 46 players were removed due to incomplete data of all variables resulting in a final data set of 113 players. A Low-Practice group comprised players (n = 37) whose amount of soccer-specific play and practice was low (range 0-4.25 hours per week) during childhood. A Medium-Practice group comprised players (n = 40) whose amount of soccer-specific play and practice was average (range 4.25-6.25 hours per week) during childhood. A High-Practice group (n = 36) comprised players whose amount of soccer-specific play and practice was high (range 6.25-24.0 hours per week) during childhood. Participants' mean ages, anthropometric data and starting ages for soccer-specific practice are presented in Table 1.

TABLE 1 General characteristics (means, SDs) of players of High-, Medium- and Low-Practice groups.

Groups	High (*n*=36)	Medium (*n*=40)	Low (*n*=37)	High vs. Low	High vs. Med	Med vs. Low
Age (years)	15.47 (0.22)	15.40 (0.26)	15.37 (0.30)	- .41	- .31	- .11
Height (m)	1.73 (0.08)	1.76 (0.08)	1.75 (0.07)	- -.22	- -.32	- .11
Weight (kg)	63.69 (9.06)	62.60 (8.19)	64.05 (10.37)	- -.05	- .12	- -.16
Starting age for soccer practice (years)	5.46 (1.13)	5.35 (1.17)	5.84 (1.26)	- -.32	- .09	- -.40

Cohen's *d* (see below the asterisk)

For study II, the participants were divided into two groups based on their performance level at the age of 19 years. The data of 45 players were removed due to missing data of some variables (n = 17) or drop-out before the age of 19 years (n = 28), resulting in a final data set of 114 players. The Elite group (n = 23) consisted of players who were regularly playing in men's first division or higher in Finland during competitive season 2014. The Sub-Elite group (n = 91) consisted of players who were playing men's second division or lower in Finland during competitive season 2014. Participants' mean ages, anthropometric data, starting ages for soccer-specific practice and practice hours are presented in Table 2.

TABLE 2 General characteristics (means, SDs) of Elite and Sub-Elite players.

Groups	Elite (*n*=23)	Sub-Elite (*n*=91)	Elite vs. Sub-Elite
Age (years)	15.48 (0.23)	15.39 (0.27)	- .38
Height	1.77 (0.08)	1.74 (0.07)	- .39
Weight	66.14 (9.04)	61.92 (8.91)	* .47
Starting age for soccer practice (years)	5.24 (1.00)	5.52 (1.27)	- .25
Soccer practice / week (hours)	12.47 (4.17)	12.78 (4.68)	- .07
Additional practice / week (hours)	3.67 (2.59)	3.31 (2.05)	- .16

*p <0.05, Cohen's *d* (see below the asterisk)

Studies III and IV The participants consisted of 1,965 young competitive soccer players (358 females; 1,607 males) ranging from 10 to 15 years (12.3 ± 1.6 years) from 21 soccer clubs. These clubs had earlier been selected to be a part of the

player monitoring program organized by Sami Hyypiä Academy, and were among the best junior soccer clubs in Finland. Participating players played in the clubs' highest level teams for their age group. Clubs were instructed to organize eight to ten hours of formal soccer practice per week including games for their first teams aged 10 to 15 years.

For study III, 1,956 players participated to exploratory factor analysis. Those participants who had data of all variables, were selected to participate to confirmatory factor analysis, resulting a final dataset of 1,321 players (261 females, 1060 males) ranging from 12 to 15 years (13.4 ± 1.0 years).

For study IV, those participants who had data of all variables measured one year after the first measurement phase, were selected to participate in one-year longitudinal study, resulting a final dataset of 288 male players ranging from 12 to 14 years (average: age 12.7 ± 0.6; height 156.3 ± 8.5cm; weight 44.9 ± 8.1kg). Some players missed testing because of injuries, illnesses, exams, or drop-outs. The number of players participating at the different measurement phases was 288, 200, and 288 respectively. The total of 200 players completed all three phases of testing. Age, growth, and performance level of the players were used as covariates. Average growth during one year was 7.1 ± 2.6 centimeters. Performance level of the players was determined by coaches who were asked to name five most talented players in their teams. Based on that experiential knowledge, players were divided into two groups; most talented (n = 94) and less talented (n = 194) at that point in time.

4.2 Procedures

In all four studies, the participants and their parents/guardians were informed beforehand of the procedures to be used in study, following which they provided their informed written consent of participation (see Appendices 6 and 7 in Finnish). The objectives and contents of the study were carefully explained to them in the consent form. The participants were told that participation to the study was voluntary and they had a right to withdraw from the study whenever they wanted without any negative repercussions.

Studies I and II Data collection occurred in the participating teams' own practice environments in autumn 2010, when players were 15-year-olds. First, the participants completed questionnaires concerning their practice history, tactical skills and psychological skills according to standardized instructions provided by researchers. Second, height and weight of the players were recorded. After that technical and physiological tests were executed in indoor soccer hall on an artificial grass. For study II, the players were tracked four years later, in order to find out in which level they played at that time when they were 19 years old.

Studies III and IV Data collection occurred during the teams' participation in the Sami Hyypiä Academy's player monitoring events at the Eerikkilä Sports Institute. All participants filled in the preliminary perceived competence

scale, as well as, questionnaires related to tactical skills and motivation in a group setting, according to standardized instructions provided by the researchers. They also completed tests of technical skills, speed and agility. Technical tests were executed in indoor soccer hall on an artificial grass, whereas speed and agility tests were executed on a running track. Height and weight of the players were also recorded. For study IV, data were collected in three measurement phases during a period of one year (T0, T1, T2). Measurement phases were at the beginning of the competitive season (February-April) and near the end of the competitive season (October-December).

4.3 Measures, scales and variables

Table 3 shows the measures, scales and variables used in the present thesis, as well as the studies in which these have been applied.

TABLE 3 Measures, scales and variables applied in studies I-IV.

	Measure/ Scale	Variables	Study			
			I	II	III	IV
Practice history	Soccer-specific practice history questionnaire	Soccer-specific play	x			
		Soccer-specific practice	x			
		Play and practice of other sports	x			
Technical skills	Technical skills tests	Dribbling and passing	x	x		
		Passing and centering	x	x		
		Dribbling			x	x
		Passing			x	x
Tactical skills	A Tactical Skills Inventory for Sports (TACSIS, Elferink-Gemser et al. 2004)	Positioning and deciding	x	x	x	x
		Knowing about the ball actions	x	x	x	x
		Knowing about the others	x	x	x	x
		Acting in changing situations	x	x	x	x
Physiological characteristics	Physiological tests	Speed	x	x	x	x
		Agility	x	x	x	x
		Countermovement jump	x	x		
		Yo-Yo Endurance Test Level 1	x	x		
Psychological skills	A Psychological Skills Inventory for Sports (PSIS-R-5, Mahoney et al. 1987)	Motivation	x	x	x	x
		Confidence	x	x		
		Concentration	x	x		
		Mental preparation	x	x		
Perceived soccer competence	A Perceived Game-Specific Soccer Competence Scale (PGSSCS, developed in study III)	Offensive skills			x	x
		1 vs 1 dyadic skills			x	x
		Defensive skills			x	x

4.3.1 Practice history

A soccer-specific practice history questionnaire was used to examine the amount of soccer-specific play, soccer-specific practice, and play and practice of other sports that players engaged at age between 6 and 15 (see Appendices 1 in Finnish and 5 in English). Questionnaire included the specific definitions of different type of play and practice activities collected in this study. Soccer-specific play was defined as soccer-specific play and practice undertaken alone or with friends which resulted in informal practice of skills and tactical behaviours. Soccer-specific practice was defined as soccer-specific practice with the team. Play and practice of other sports were defined as all practice and playing activities in a range of other sports. In order to collect the practice data of the players, they were asked to recall estimates of their average practice amount per week from the most recent 3 years initially (U15, U14, U13), and from then on, in 3- and 4-year intervals (10-12-years of age, 6-9 years of age).

The average hours per week during ten months of active play and practice per year spent in each of the activities were recorded. This method for collecting practice data was based on the study of Ward et al. (2007). To ensure validity and realibility of the questionnaire, it was pilot tested with a sample of non-participating soccer players of the same ages, with no issues of clarity reported.

4.3.2 Technical skills

For studies I and II, two soccer-specific technical skill tests were used to examine the players' technical skills. Dribbling and passing test (Figure 1) started when a player took a first touch, and ended when he crossed the finishing line. The task in this test was to complete the track as quickly as possible. Passing and centering test (Figure 2) started with the player's first touch, and ended with the final pass/cross or if maximum time (90 seconds) had passed. The task in this test was to score as many points as possible (max. 16 points) at the time provided. In both tests, best out of two competitive trials was selected to present players' levels in these technical skills. A one week interval test-retest correlation coefficient for the dribbling and passing test was r =.76 (p < .001), and for the passing and centering test r =.70 (p < .001), among a group of 37 soccer players aged 14 to 15 years old.

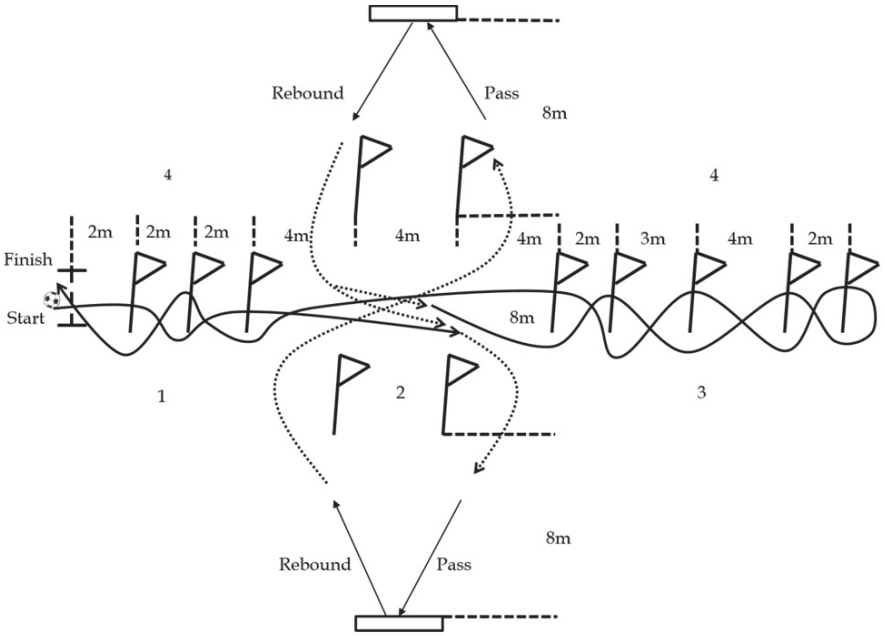
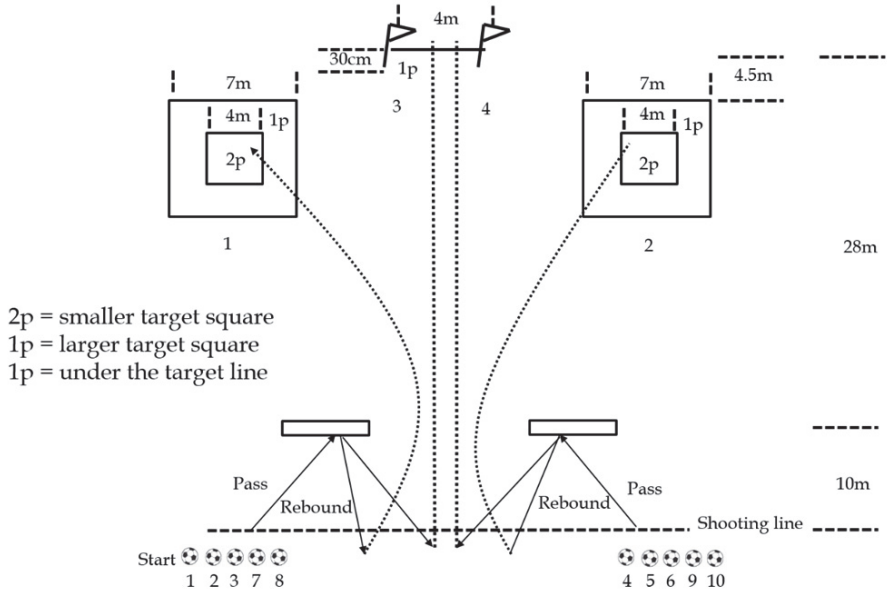


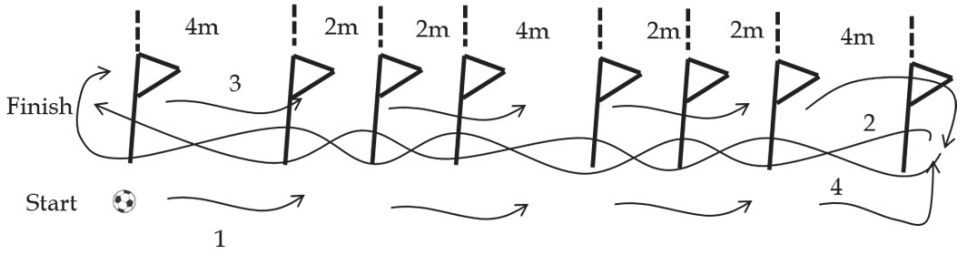
FIGURE 1 Course for the dribbling and passing test.



1. Balls 1-3 Player passes the ball against the left wall, takes a rebound with his right foot and centers the ball with his right foot towards left target squares
2. Balls 4-6 Same from the other side
3. Balls 7-8 Player passes balls against the left wall, takes a rebound with his right foot and shoots the ball with his right foot under the target line (shooting distance 38m)
4. Balls 9-10 Same from the other side

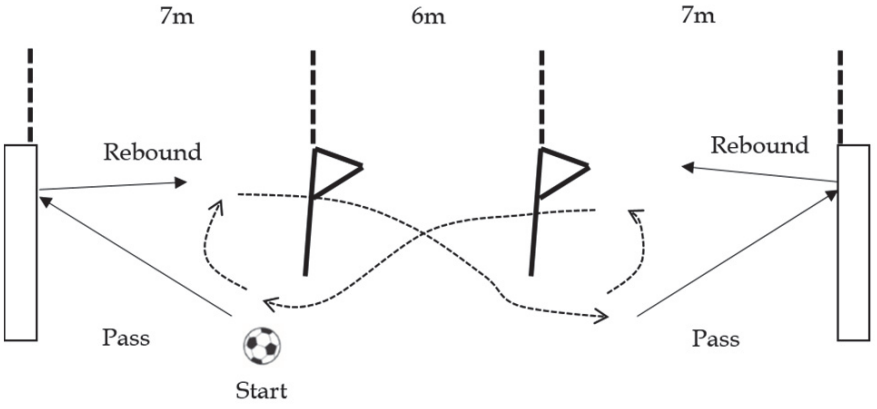
FIGURE 2 Course for the passing and centering test.

For studies III and IV, technical skills were measured with the dribbling (Figure 3) and passing (Figure 4) tests. The dribbling test started when a player took his first touch, while passing test started when a player kicked his first pass against the wall. Task, in both of these tests, was to complete the track as quickly as possible. In both tests, best out of two competitive trials was selected to present players' levels in these tests. The mean score of these two tests was calculated representing players' technical skills. The reliability of these tests for young soccer players has been confirmed in earlier studies (Vänttinen 2013) with one month interval test-retest correlation coefficient for dribbling r = 0.82 ($p < .001$) and passing r = 0.81 ($p < .001$).



1 = straight run with ball (at least 3 touches before turn)
2 = dribbling back
3= straight run with ball (at least 3 touches before turn)
4 = dribbling back

FIGURE 3 Course for the dribbling test.



Test begins when a player makes the first pass and finished when 10t pass hits the wall (5 on each side)

FIGURE 4 Course for the passing test.

4.3.3 Tactical skills

The Tactical Skills Inventory for Sports (TACSIS, Elferink-Gemser et al. 2004), with subscales of declarative and procedural knowldege, was used to examine players' self-consideration of their tactical skills in four dimensions. Positioning and deciding (9 items) and Acting in changing situations (4 items) represented procedural knowledge, while Knowing about ball actions (4 items) and Knowing about others (5 items) represented declarative knowledge. The questionnaire was translated into Finnish using the back-translation procedure. It was first translated into Finnish by a panel of experts in team sports, and later back

into English by a native bilingual British translator whose first language was English and whose other language was Finnish. The back-translated English version was compared with the original English version for consistency. Items that were shown to have a number of possible meanings in Finnish were discussed by the panel of experts in order to redraft them to be as accurate as possible in meaning. Players were asked to respond to the 22 items of the TACSIS with a 6-point Likert scale regarding sport performance, from 1 (very poor or almost never) to 6 (excellent or always). When responded, they were asked to compare themselves with the top Finnish players in the same age category. The Finnish version of the TACSIS is presented in appendix 2.

In previous research, the TACSIS was shown to have good psychometric characteristics, with Cronbach's alpha coefficients ranging from .72 to .89 depending of the subscale (Elferink-Gemser et al. 2004). In our studies (I, II), the internal consistencies of the four TACSIS sub-scales indicated satisfactory levels, with Cronbach's alpha coefficients ranging from .75 to .93.

For studies III and IV, the mean value of all 22 items of the TACSIS was calculated to represent each player's self-reported level of tactical skills. The internal consistency of the TACSIS indicated satisfactory levels, with Cronbach's alpha coefficient .95.

4.3.4 Physiological characteristics

Speed, agility, explosive leg strength, and endurance were measured to examine players' physiological characteristics. Speed was measured with a 30m all-out run from stationary start, while agility was measured with 8-figure test track (Figure 5). In both tests, players started 0.70m behind the photocells which triggered the timer, and try to complete the track as quickly as possible. Explosive strength was measured using countermovement jump. During the jump, it was reguired to keep hands on the hips while trying to jump as high as possible. Based on the flight time, jump mat automatically displayd the results in centimeters. Endurance performance was measured using the Yo-Yo Endurance Test Level 1 (Bangsbo 1996). The test involved continuos running between two lines 20m apart in the speed based on signal played from CD. The task was to run as long as possible. The test finished when player was failed to reach the line for two concecutive ends at the required time. Test results were presented in meters by calculating how many times player was able to complete the two lines 20m apart. The best of two competitive trials was selected for further analysis in speed, agility and jump tests, while endurance test was conducted only once. For studies III and IV, the mean score of the speed and agility tests was calculated representing players' speed and agility characteristics.

The coefficient of variation in sprinting time tests is shown to be approximately 2%, while the coefficient of variation in countermovement jump test is shown to be 2.4% (Moir et al. 2004). Mirkov and colleagues (2008) have reported 0.84 intraclass correlation coeffiecient and 2.5% error of measurement for similar type of agility test (Mirkov et al. 2008). An intraclass coefficient of 0.93 has

been reported in the test-retest reliability measure for 20-meter shuttle test among 12 to 15 year-old adolescents (Liu, Plowman & Looney 1992).

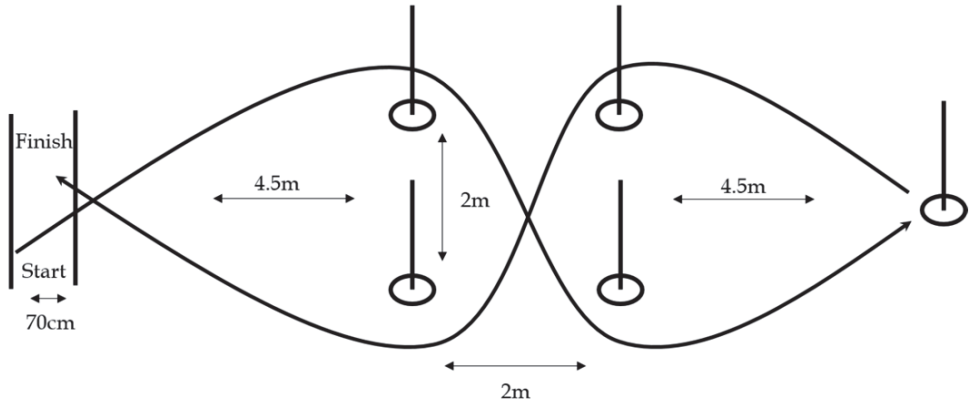


FIGURE 5 Course for the agility test.

4.3.5 Psychological skills

A Psychological Skills Inventory for Sports (PSIS-R-5, Mahoney et al. 1987) was used to examine players' self-consideration of their psychological skills in four dimensions, such as Motivation (8 items), Confidence (8 items), Concentration (7 items) and Mental preparation (6 items). Because no Finnish version of the PSIS-R-5 was available, the same standardized back-translation procedure as for TACSIS was applied. Players were asked to respond to the 29 items on a 5-point Likert scale, from 1 (almost never) to 5 (almost always). Items worded negatively were transformed by reversing the aforementioned 1-5 format. In this way, a high score on each subscale corresponds to a proposed high value for a psychological skill. The Finnish version of the PSIS-R-5 is presented in appendix 3.

In previous research, the PSIS-R-5 has been shown to be a psychometrically reliable instrument with Cronbach's alpha coefficients ranging from .67 to .84 (Elferink-Gemser 2005, White 1993). In our study, the internal consistencies of the four PSIS-R-5 subscales indicated satisfactory levels, with Cronbach's alpha coefficients ranging from .69 to .89.

4.3.6 Perceived competence

To construct the self-reporting inventory of perceived competence in soccer, the theoretical elements of game play abilities needed in game situations were determined with the help of five highly qualified soccer coaches of Finnish national teams and five experienced coach educators from the Football Association of Finland. All experts had ten to twenty years of coaching experience. It has been shown earlier, that experiential knowledge of skilled coaches with many years of experience in their profession, can be used to design and under-

take empirical studies in sport science (e.g. Greenwood, Davids & Renshaw 2014). In order to construct the self-reporting inventory of perceived competence in soccer, individual semi-structured interviews were first undertaken. In these interviews, the skilled coaches and coach educators were asked to propose the main elements they considered to be important in offensive (with-the-ball, off-the-ball) and defensive situations of the soccer game (Blomqvist, Vänttinen & Luhtanen 2005). After this stage, items were formulated and reformulated based on these elements until consensus was reached within the team of experts. The preliminary perceived competence scale consisted of twenty-three items, with a 5-point Likert response scale regarding sport performance, anchored with 1 (almost never) and 5 (almost always). The original language of the scale was Finnish. After validation of the scale it was translated into English using the standardized back-translation procedure represented before.

In order to develop and validate a new perceived soccer competence scale players were asked to respond to the 23 items of the preliminary perceived soccer competence scale, with a 5-point Likert response scale regarding sport performance, anchored with 1 (almost never) and 5 (almost always). Players were asked to compare themselves to the top Finnish players representing the same age category.

4.4 Statistical methods

Study I One-way ANOVA was applied to: 1) examine group differences in terms of age, height weight, and starting age for soccer practice, 2) compare practice histories between groups during childhood and adolescence, and 3) investigate group differences in terms of technical, tactical, physiological, and psychological skills and characteristics. A post-hoc Tukey HSD test was applied to examine the differences between three groups. Effect size values were calculated to determine the meaningfulness of the differences between groups, classified according to Cohen's (1988) suggestion of effect sizes around .20 being small, around .50 as moderate, and around .80 evidencing a large effect.

Study II Independent samples T-tests were conducted to investigate group differences in technical, tactical, physiological, and psychological skills and characteristics. Furthermore, effect sizes were computed for independent samples T-tests, as in study I. Binary logistic regression analysis was applied to identify technical, tactical, physiological, and psychological skills and characteristics that predict the performance level in soccer at the age of 19. Before the regression analysis, all variables were divided into tertiles (low, moderate, high) based on results of the players in this study. Thereafter, binary logistic regression analysis was performed using the enter procedure, with the lowest group as a reference point. Model accuracy was assessed using the Hosmer and Lemenshow test (Hosmer & Lemenshow 1989). Finally, Chi-square goodness-of-fit test was performed to compare national youth team player distributions between the Elite and Sub-Elite groups.

Study III Exploratory factor analysis was undertaken using principal axis factoring (PAF) method with promax rotation to examine the structure of relations among the items in the preliminary soccer competence scale in order to bring them together into a smaller set of variables or constructs (Nunnally & Bernstein 1994). The criteria for extraction included: a) eigenvalues greater than 1.0, b) a minimum of 5% explained variance per factor, c) communalities greater than .30, d) unique loadings of .45 and no more than .30 loading to another factor, and e) acceptable KMO (Kaiser-Meyer-Olkin) measure for sampling and Barlett's test for sampling adequacy and sphericity. Based on the recommendations of Fabrigar et al. (1999), the number of items retained per factor should be at least from three to five.

After the exploratory factor analysis confirmatory factor analysis was undertaken. First, normal distribution, outliers, and missing values of the data were examined. No modifications due to normality or outliers were required based on the Mahalanobis distance test ($p < .001$) of standardized values (± 3.00) (Tabachnick & Fidell 2007). The data included 12.5% of missing values. Little's MCAR -test ($\chi^2 = 1345.168$, df = 730, $p < .001$) and frequencies (gender, age) indicated that the missing values did not represent any particular group. Hence, the missing values were assumed to be missing at random (MAR) (Little & Rubin 2002). Next, the descriptive statistics, intraclass correlations, and composite reliability, for each variable were determined. In order to examine the associations of offensive, 1 vs 1 dyadic, and defensive skills competence, the latent factor model was implemented (Figure 6). Additionally, the relations between perceived competence and tactical skills, motivation, technical skills, and speed and agility characteristics were analyzed through the particular model. The proportions of variance predicted by perceived competence for tactical skills, motivation, technical skills, and speed and agility characteristics were investigated using squared multiple correlations (R2).

Chi-square test (χ2) was used as a test of the model's overall goodness-of-fit to the data. A statistically non-significant difference between the observed frequency distribution and the theoretical distribution represents an acceptable fit to the data. To determine the appropriateness of the model the standardized root mean square residual (SRMR), the root mean square error of approximation (RMSEA), the comparative fit index (CFI), and the Tucker-Lewis index (TLI) were also examined (Arbuckle 2007). A value of .05 or less for the SRMR indicated the reasonable magnitude of a good fit, a value of .05 or less for the RMSEA indicated an acceptable fit of the model in the relations to the degrees of freedom (Browne & Cudeck 1993). The CFI and TLI indices range from 0 to greater than 1. Fit indices greater than 0.90 are indicative for an acceptable model fit (Browne & Cudeck 1993).

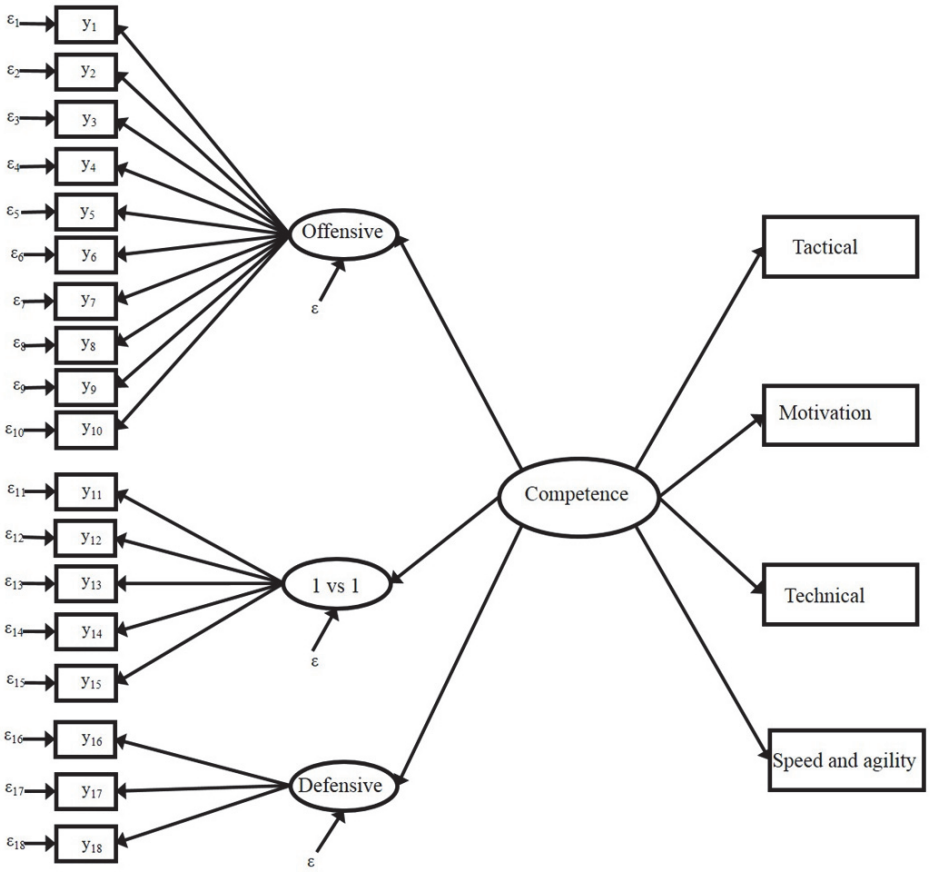


FIGURE 6 Theorized model of perceived competence, tactical skills, motivation, technical skills, and speed and agility.

Study IV First, normal distribution, outliers, and missing values of the data were examined. No modifications due to normality were required. Nor were statistically significant outliers detected through the covariance matrix based on the on the Mahalanobis distance test ($p < .001$) of standardized values (± 3.00) (Tabachnick & Fidell 2007). The data included 24% of missing values. In the case of the longitudinal data, some players did not participate in the second measurement phase (T0, $n = 288$; T1, $n = 200$; T2, $n = 288$). However, Little's MCAR -test ($\chi^2 = 380.538$, df = 269, $p < .001$) and frequencies (level, age) indicated that the missing values did not represent any particular group. Hence, the missing values were assumed to be missing at random (MAR) (Little & Rubin 2002). Next, the descriptive statistics for each variable were determined. In order to examine the development of perceived competence, tactical skills, motivation, technical skills, and speed and agility characteristics, latent growth curve models were implemented. The models were constructed by fixing the loadings of variables across T0 to T2 to 1 on the initial level and to 0, 1, 2 on growth. The intercepts, variances, and residuals of the latent variables (Level,

Slope) were estimated. Performance level, growth, and age were added into the models as covariates. Finally, the associations between latent variables of perceived competence, tactical skills, motivation, technical skills, and speed and agility characteristics were tested. Like in study III, the indices used for estimating goodness-of-fit of the model were a Chi-square test ($\chi 2$), standardized root mean square residual (SRMR), the root mean square error of approximation (RMSEA), comparative fit index (CFI), and the Tucker-Lewis index (TLI).

For all the above mentioned analysis, a p value < .05 was considered to be statistically significant. The confimatory factor analysis (CFA) and structural equation modelling were performed using Mplus Version 7.11 (Muthén & Muthén 1998-2013). All the other analyses were performed using SPSS Statistics Version 22.0 (IBM Corporation 2012).

5 RESULTS

5.1 Developmental activities and career progression

5.1.1 The role of soccer-specific play and practice activities in the development of young soccer players

During childhood (6-12 years of age), the overall group effect was significant for the amount of soccer-specific play $F(2,112) = 48.737$, $p = .000$, for the amount of soccer-specific practice $F(2,112) = 20.805$, $p = .000$, for the amount of play and practice of other sports $F(2,112) = 4.744$, $p = .011$, and for the total amount of play and practice $F(2,112) = 32.407$, $p = .000$, undertaken. The amount of soccer-specific play, the amount of soccer-specific practice, and total amount of play and practice were significantly higher in High-Practice group compared to Low- and Medium-Practice groups (Table 4). The amount of soccer-specific practice, and total amount of play and practice were also higher in Medium-Practice group compared to Low-Practice group. The amount of play and practice of other sports was significantly higher in High- and Medium-Practice groups compared to Low-Practice Group.

During adolescence (13-15 years of age), the overall group effect was significant for the amount of soccer-specific play $F(2,112) = 16.387$, $p = .000$, for the amount of soccer-specific practice $F(2,112) = 17.539$, $p = .000$, and for the total amount of play and practice $F(2,112) = 16.619$, $p = .000$, undertaken. The amount of soccer-specific play, the amount of soccer-specific practice, and total amount of play and practice were significantly higher in High-Practice group compared to Low- and Medium-Practice groups, and in Medium-Practice group compared to Low-Practice group (Table 5). The overall group effect failed to achieve conventional levels of statistical significance for the amount of play and practice of other sports.

TABLE 4 The amount of play and practice activities (hours/ week) during childhood and adolescence (means, SDs) of High-, Medium- and Low-Practice groups.

	Groups	High (n=36)	Medium (n=40)	Low (n=37)	High vs. Low	High vs. Med	Med vs. Low
Chidhood (6-12 years of age)	Soccer-specific play	5.46 (3.81)	1.68 (0.98)	0.50 (0.50)	*** 1.83	*** 1.36	- 1.51
	Soccer-specific practice	4.12 (1.14)	3.50 (0.67)	2.86 (0.59)	*** 1.38	** .66	** 1.00
	Play and practice of other sports	5.32 (4.78)	5.16 (3.48)	2.92 (2.82)	* .61	- .04	* .71
	Total amount of play and practice	14.90 (6.51)	10.34 (3.56)	6.27 (3.01)	*** 1.70	*** .87	*** 1.23
Adoles-cence (13-15 years of age)	Soccer-specific play	7.46 (3.12)	5.87 (2.67)	3.72 (2.61)	*** 1.30	* .55	** .82
	Soccer-specific practice	8.54 (1.82)	7.35 (1.47)	6.36 (1.38)	*** 1.35	** .72	* .69
	Play and practice of other sports	2.32 (2.43)	2.32 (2.43)	2.02 (2.04)	- .14	- .08	- .07
	Total amount of play and practice	18.09 (4.96)	15.38 (4.63)	12.10 (3.66)	*** 1.38	* .57	** .79

*p < .05, **p <0.01, ***p < 0.001, Cohen's d (see below the asterisk)

The overall group effect was significant for passing and centering $F(2,112) = 6.239$, $p = .003$, Positioning and deciding $F(2,112) = 4.481$, $p = .013$, Knowing about ball actions $F(2,112) = 6.456$, $p = .002$, Knowing about others $F(2,112) = 4.854$, $p = .010$, endurance $F(2,112) = 4.254$, $p = .017$, Motivation $F(2,112) = 3.344$, $p = .039$, Confidence $F(2,112) = 3.991$, $p = .021$, and Concentration $F(2,112) = 5.987$, $p = .003$. The High-Practice group outscored Low-Practice group in passing and centering, Positioning and deciding, Knowing about ball actions, Knowing about others, and Concentration (Table 5). The High-Practice group outscored Medium-Practice group in Knowing about ball actions, Confidence, and Concentration. Finally, the Medium-Practice group outscored Low-Practice group in passing and centering, and endurance.

TABLE 5 Performance characteristics (means, SDs) of High-, Medium- and Low-Practice groups.

Groups	High (n=36)	Medium (n=40)	Low (n=37)	High vs. Low	High vs. Med	Med vs. Low
Technical skills						
Dribbling and passing (s)	42.53 (4.72)	43.43 (3.44)	44.61 (3.75)	- -.49	- -.22	- -.33
Passing and centering (p)	6.44 (3.28)	6.49 (2.83)	4.47 (2.27)	** .70	- -.01	** .79
Tactical skills						
Positioning and deciding	4.49 (0.71)	4.23 (0.66)	4.00 (0.71)	** .68	- .38	- .33
Knowing about ball actions	4.53 (0.68)	4.06 (0.59)	4.01 (0.79)	** .72	** .74	- .08
Knowing about others	4.17 (0.65)	3.84 (0.62)	3.69 (0.76)	** .68	- .52	- .22
Acting in changing situations	4.45 (0.75)	4.26 (0.71)	4.12 (0.83)	- .42	- .26	- .18
Physiological characteristics						
Speed 30m (s)	4.50 (0.21)	4.52 (0.22)	4.56 (0.23)	- -.25	- -.07	- -.18
Agility (s)	6.70 (0.24)	6.78 (0.27)	6.81 (0.26)	- -.43	- -.30	- -.12
CMJ (cm)	36.06 (4.05)	35.15 (3.97)	35.35 (4.58)	- .16	- .23	- -.05
Endurance (m)	2323 (450)	2404 (319)	2162 (296)	- .42	- -.20	* .78
Psychological skills						
Motivation	4.05 (0.78)	4.01 (0.61)	3.67 (0.70)	- .51	- .05	- .52
Confidence	3.70 (0.61)	3.34 (0.61)	3.39 (0.54)	- .53	* .58	- -.08
Concentration	4.11 (0.47)	3.80 (0.49)	3.70 (0.60)	** .75	* .64	- .18
Mental preparation	2.86 (0.78)	2.85 (0.77)	2.74 (0.83)	- .14	- .01	- .15

*p < .05, **p <0.01, Cohen's d (see below the asterisk)

5.1.2 Performance characteristics that predicted the future performance level of young soccer players

Independent samples t-tests revealed that Elite players outscored Sub-Elite players, at the age of 15 years, in dribbling and passing t(112) =2.497, p = .014, passing and centering t(112) = -3.621, p = .000, Acting in changing situations, t(112) =-2.073, p = .040, speed 30m t(49.39) =3.673, p = .001, agility t(112) =4.108,

p = .000, endurance t(112) =-2.527, p = .013, and Motivation t(52.995) =-4.405, p = .000 (Table 6).

TABLE 6 Performance characteristics (means, SDs) measured at the age of 15 of Elite and Sub-Elite soccer players.

Groups	Elite (n=23)	Sub-Elite (n=91)	Elite vs. Sub-Elite
Technical characteristics			
Dribbling and passing (s)	41.41 (3.44)	43.72 (4.08)	* .61
Passing and centering (p)	8.07 (3.09)	5.52 (2.99)	*** .84
Tactical characteristics			
Positioning and deciding	4.49 (0.69)	4.28 (0.68)	- .31
Knowing about ball actions	4.46 (0.70)	4.23 (0.71)	- .33
Knowing about others	4.11 (0.80)	3.98 (0.63)	- .18
Acting in changing situations	4.62 (0.69)	4.26 (0.76)	* .50
Physiological characteristics			
Speed 30m (s)	4.41 (0.15)	4.55 (0.23)	** .76
Agility (s)	6.58 (0.20)	6.82 (0.27)	*** 1.02
CMJ (cm)	36.52 (4.42)	35.20 (4.50)	- .30
Endurance (m)	2501 (325)	2301 (359)	* .61
Psychological characteristics			
Motivation	4.35 (0.43)	3.85 (0.67)	*** .89
Confidence	3.59 (0.70)	3.41 (0.66)	- .27
Concentration	4.05 (0.51)	3.78 (0.58)	- .48
Mental preparation	2.98 (0.84)	2.87 (0.80)	- .13

*p < .05, **p <0.01, ***p < 0.001, Cohen's d (see below the asterisk)

Table 7 displays the binary logistic regression analysis results. The model showed that elite performance level at the age of 19 years was associated with passing and centering, agility, and motivation measured at the age of 15 years.

These variables together explained 43% (Nagelkerke) of the variance in performance level at the age of 19 years. The correct classification of the performance level at the age of 19 years based on passing and centering, agility and motivation together was 86%. Result of the Hosmer and Lemeshow test was not statistically significant (p = 0.256), indicating that the model fitted the data well. The odds ratio indicated that players scoring high or moderate in passing and centering, or motivation or high in agility had significantly greater chance of becoming an elite player at the age of 19 years, when compared to low-scoring players (Table 7).

TABLE 7 Binary logistic regression analysis of performance characteristics with the lowest group as a reference point.

		Range of scores	B	S.E.	Wald	df	P-value	OR
Passing and centering	Low	0-4						
	Moderate	5-7	2.144	.91	5.447	1	.020	8.530
	High	8-15	2.281	.90	6.348	1	.012	9.787
Agility	Low	7.53-6.85						
	Moderate	6.84-6.62	.209	.94	.049	1	.825	1.233
	High	6.61-6.21	2.305	.84	7.364	1	.007	10.02
Motivation	Low	2.13-3.75						
	Moderate	3.76-4.38	2.009	.87	5.251	1	.022	7.454
	High	4.39-5.00	2.265	.93	5.822	1	.016	9.628

Chi-square goodness-of-fit test was applied to examine the distribution of national youth team players at the age of 15 specified by the performance level at the age of 19. The proportion of Elite players at the age of 19 was significantly higher (X^2=33.557; df=1; p=.000) among national youth team players (59 %) than among other players (Figure 7).

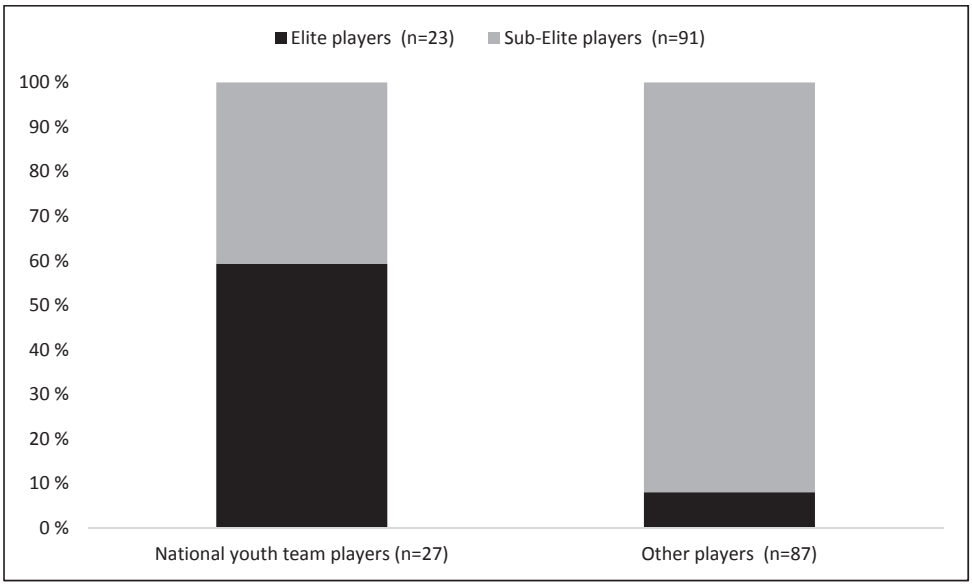


FIGURE 7 The distribution of national youth team players at the age of 15 specified by the performance level at the age of 19.

5.2 Development of perceived competence and performance characteristics

5.2.1 Development of perceived competence scale

5.2.1.1 Exploratory factor analysis

In the initial principal axis factoring (PAF), a three-factor structure was emerged, explaining a total variance of 45.9%. However, it was found that five items did not meet the retention criteria, and a decision was to eliminate them. Three items showed communalities below .35 (”I can see the whole field during the game”, ”I don’t lose my balance easily even if my opponent is disturbing me”, ”If I need help in defensive situations, I know that my teammates help/ support me”), and two items showed factor loadings smaller than .45 (”I have the courage to play at maximum from the beginning to the end of the game, because I know I have enough endurance until the end of the game”, “If I lose the ball, I get it back). The KMO and Barlett’s tests were significant. The remaining 18 items were subject to another PAF. The new PAF yielded the same three factor model with an increased total variance explained 49.0%. First factor included ten items related to offensive skills, second factor included five items related to 1 vs 1 dyadic skills, and third factor included three items related to defensive skills. Table 8 shows the factors on which items loaded, the item’s loading communalities ($h^{2)}$, the percentage variance explained by each factor,

the eigenvalues, and the alpha coefficients. The Finnish version of the scale is presented in appendix 4.

TABLE 8 Principal axis factoring (PAF) of the Perceived Game-Specific Soccer Competence Scale (PGSSCS).

Item contents	Factor loadings			h^2
	1	2	3	
Offensive skills				
1. I have a soft "touch" on the ball	.702			.446
2. I dare to keep the ball to myself even in tight spaces	.519			.439
3. I have clear solution models about how I score in the different situations in the games	.580			.395
4. I can move to the empty spaces on the field, so that my teammates can pass me the ball	.588			.450
5. I can find my teammates with my sharp and accurate passes	.683			.492
6. I can accomplish the typical play for my position in offensive play	.658			.458
7. I know how my teammates are moving in attack situations and it is easy for me to pass them the ball	.566			.382
8. I can solve / create game situations with 1-2 teammates	.726			.498
9. I can move according to our attacking plays during the game, so that my teammates can pass me the ball	.662			.498
10. I can schedule my own movement correctly in offensive and defensive play	.500			.487
1 vs 1 dyadic skills				
11. I have clear solution models about how to win 1-on-1 situations		.472		.467
12. I am usually the first player to reach the ball		.652		.475
13. I can easily lose my opponent in different game situations		.539		.527
14. I feel strong in match ups		.601		.462
15. In 1-on-1 situations, I am stronger/faster than my opponent		.871		.628
Defensive skills				
16. I am able to cover my player in defensive situations in games			.685	.553
17. I can accomplish the typical play for my position in defensive play			.870	.669
18. I can, if necessary, help / support my teammates in defensive situations			.558	.488
Percentage of Variance	43.3	7.2	6.6	
Eigenvalues	7.8	1.3	1.2	
Alpha coefficients	.89	.83	.79	

5.2.1.2 Confirmatory factor analysis

Means, standard errors and correlation coefficients of perceived competence, tactical skills, motivation, technical skills, and speed and agility characteristics were examined for males (Table 9) and females (Table 10). Descriptive statistics showed that means of all perceived competence dimensions were above the mean, and the highest means were found for defensive skills for males and females. All subscales of perceived competence were positively associated with each other in both genders. The strongest associations between perceived competence and performance measures were found between tactical skills and all subscales of perceived competence in both genders. In addition, perceived competence in offensive skills was positively associated with motivation and technical skills for males. Perceived competence in 1 vs 1 dyadic skills was positively associated with motivation, and speed and agility for both genders. All observed variables showed satisfactory levels of reliability, since composite reliability was relatively high and intraclass correlations were moderate. Composite reliability for offensive skills was .88, for 1 vs 1 dyadic skills .84, and for defensive skills .81. Intraclass correlation for offensive skills was .42 ($p < .001$), for 1 vs 1 dyadic skills .50 ($p < .001$), and for defensive skills .54 ($p < .001$).

TABLE 9 Means, standard errors and correlation coefficients of perceived competence, tactical skills, motivation, technical skills and speed and agility for males.

	Mean	SE	1.	2.	3.	4.	5.	6.
1.Offensive	3.75	.02						
2.1v1	3.67	.02	.65***					
3.Defensive	3.87	.02	.51**	.49***				
4.Tactical	4.35	.02	.71***	.60***	.60***			
5.Motivation	4.24	.02	.44***	.37***	.27	.50***		
6.Technical	33.43	.15	-.20*	-.19	-.07	-.17	-.10***	
7.Speed and agility	5.92	.01	-.08	-.25***	-.02	-.01	.08***	.52***

* $p < .05$, ** $p < .01$, *** $p < .001$

TABLE 10 Means, standard errors and correlation coefficients of perceived competence, tactical skills, motivation, technical skills and speed and agility for females.

	Mean	SE	1.	2.	3.	4.	5.	6.
1.Offensive	3.70	.03						
2.1v1	3.52	.04	.70***					
3.Defensive	3.79	.04	.63**	.55**				
4.Tactical	4.32	.04	.82***	.65***	.62***			
5.Motivation	4.35	.03	.34	.40**	.29	.39***		
6.Technical	35.90	.25	.01	.05	.06	.07	.12	
7.Speed and agility	6.19	.01	.09	-.11***	.16	.16*	.04	.35***

* $p < .05$, ** $p < .01$, *** $p < .001$

The factor model was implemented in order to analyze the associations of perceived competence, tactical skills, motivation, technical skills, and speed and agility characteristics. The theorized model revealed poor fit for the data ($\chi 2$

(234) = 917.778, $p < .001$, CFI = .91, TLI = .90, RMSEA = .047, 90% CI [.04, .05], SRMR = .042). However, the model was still improved based on the modification indices. The residuals of the items y1, y2, y5, y11, y12, y16, and y18 were allowed to correlate, because some of the shared variance of the items occurred due to latent factor. The modified model (Figure 8) was preferable to the original model fit ($\chi 2$ (230) = 787.153, $p < .001$, CFI = .93, TLI = .92, RMSEA = .043, 90% CI [.04, .05], SRMR = .039). The statistical significance of the Chi-Square test is typical in case of large sample sizes (Browne & Cudeck 1993).

The standardized results showed that perceived competence was positively associated with tactical skills, motivation, and technical skills. There was no statistically significant association between perceived competence, and speed and agility characteristics. It has to be recognized that technical skills were valued from greater to smaller, although the estimate was negative. In addition, positive associations between tactical skills and motivation, technical skills, and speed and agility characteristics, as well as motivation, and speed and agility characteristics, were observed. The covariance effect of gender on perceived competence ($p < .05$), motivation ($p < .001$), technical skills ($p < .001$), and speed and agility characteristics ($p < .001$) were found, with males scoring higher in perceived competence, technical skills, and speed and agility characteristics, and lower in motivation than females ($p < .01$). In addition, age was negatively associated to players' motivation ($p < .01$). The model showed that the squared multiple correlations for tactical skills, motivation, technical skills, and speed and agility characteristics ranged greatly explaining 74% of variance in tactical skills and 25% in motivation. Only 14% and 11% of variances in technical skills, and speed and agility characteristics, were explained.

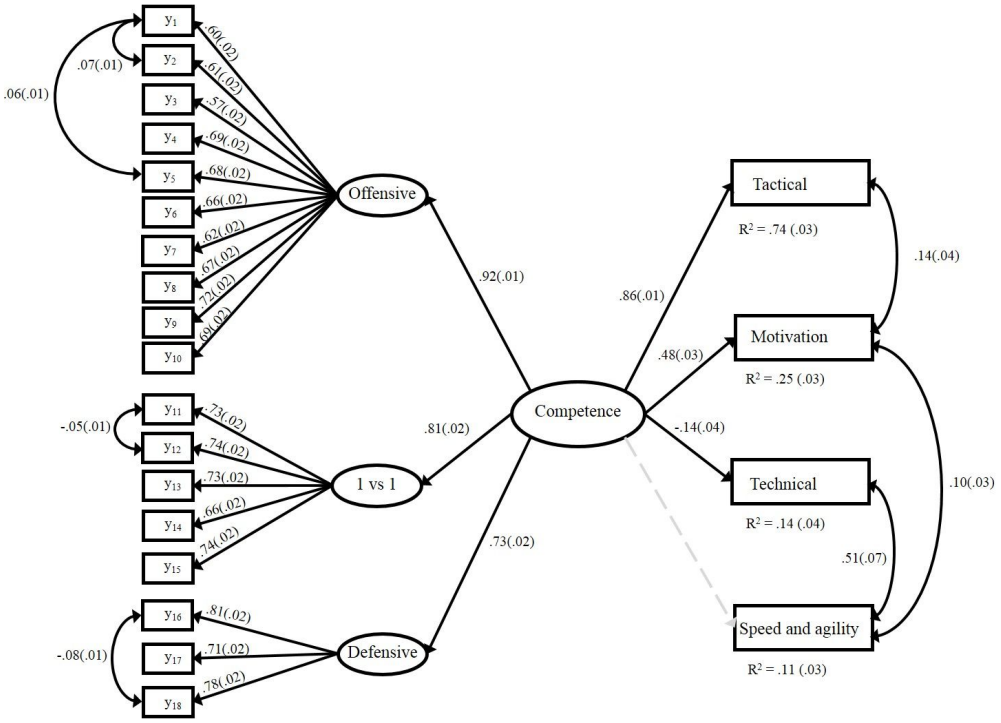


FIGURE 8 Modified model of perceived competence, tactical skills, motivation, technical skills, and speed and agility.

5.2.2 Development of perceived competence and performance characteristics during a period of one year

Correlation coefficients, means and standard deviations of perceived competence, tactical skills, motivation, technical skills, and speed and agility are shown in Table 11. Descriptive statistics highlighted that the associations between players' perceived competence, tactical skills and motivation ranged from moderate to high across the monitoring period of one year. In addition, there were moderate positive associations between technical skills, and speed and agility characteristics. Low associations were found between perceived competence, and speed and agility characteristics, tactical skills, and speed and agility characteristics, and technical skills and motivation. The mean scores indicated that the level of perceived competence, tactical skills and motivation were above mathematical means already at T0, and remained stable during the monitoring period of one year. Some development was detected in mean scores of technical skills, and speed and agility characteristics from T0 to T1 and from T1 to T2.

TABLE 11 Means and standard deviations, and correlation coefficients of the study variables.

	M	SD	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1.Competence T0	3.83	.44														
2.Competence T1	3.77	.45	.60**													
3.Competence T2	3.88	.38	.45**	.55**												
4.Tactical T0	4.45	.56	.80**	.63**	.45**											
5.Tactical T1	4.42	.59	.57**	.76**	.49**	.67**										
6.Tactical T2	4.54	.53	.45**	.56**	.76**	.58**	.53**									
7.Motivation T0	4.18	.39	.42**	.37**	.30**	.42**	.29**	.29**								
8.Motivation T1	4.13	.44	.36**	.54**	.51**	.47**	.54**	.51**	.58**							
9.Motivation T2	4.19	.42	.20**	.31**	.62**	.26**	.25**	.56**	.47**	.64**						
10.Technical T0	33.86	3.76	-.06	.09	.01	-.07	.03	-.04	-.12*	-.02	-.00					
11.Technical T1	33.01	3.36	-.02	-.17	.02	-.03	-.08	.02	-.15*	-.18	-.13	.47**				
12.Technical T2	32.69	3.23	-.05	.01	-.09	-.05	.02	-.16	-.09	.02	.00	.34**	.40**			
13.Speed and agility T0	6.08	.23	-.15*	-.11	-.12	-.13*	-.09	-.07	-.08	.02	.02	.40**	.32**	.25**		
14. Speed and agilityT1	6.01	.22	-.16*	-.13	-.12	-.11	-.08	-.03	-.13	-.01	.06	.38**	.30**	.32**	.77**	
15. Speed and agility T2	5.87	.23	-.10	-.12	-.14*	-.09	-.13	-.09	-.11	-.05	-.03	.45**	.33**	.30**	.74**	.75**

*$p < .05$, **$p < 0.01$

In order to analyze the development of perceived competence, tactical skills, motivation, technical skills, and speed and agility characteristics across the one-year period, latent growth curve models were implemented. All models revealed an excellent model fit for the data. The standardized results highlighted that players' perceived competence, tactical skills, motivation, technical skills, and speed and agility characteristics were relatively high and sustained stable across the period of one year (Table 12). The covariance effect of growth was found in the slopes of perceived competence and tactical skills, and the level of speed and agility characteristics, whereas performance level of the players displayed a significant covariance for the levels of tactical skills, motivation, technical skills, and speed and agility characteristics. In addition, the age variable related to the levels of technical skills, and speed and agility characteristics.

TABLE 12 Overall model fit and standardized results for the growth curve models of study variables.

	χ^2(df)	p-value	CFI	TLI	RMSEA	SRMR	90% C.I.	Level	Slope	Cov_1	Cov_2	Cov_3
Competence	151.755(12)	.000	.97	.90	.064	.021	.00 .12	11.29***	-.74	.11	-.08	-.10
										.02	.17*	.02
Tactical	169.039(12)	.000	1.00	1.00	.012	.016	.00 .09	8.88***	1.41	.14*	-0.08	-.03
										.06	.26*	-.09
Motivation	144.648(12)	.000	1.00	1.03	.000	.027	.00 .07	11.95***	-.76	.21***	-.06	-.04
										-.03	.08	.03
Technical	141.388(12)	.000	1.00	1.06	.000	.018	.00 .05	22.711***	-5.66	-.33***	-.11	-.45***
										.07	.17	.18
Speed and agility	490.007(12)	.000	.99	.97	.067	.053	.00 .13	36.884***	.85	-.34***	.14*	-35***
										.17	-.74	-.09

*p < .05, ***p < .001

Cov_1 = performance level, Cov_2 = growth, Cov_3 = age (Value on level above, Slope below)

The associations of latent variables of perceived competence and tactical skills, motivation, technical skills, and speed and agility characteristics were analyzed. Significantly positive associations were found between the levels of perceived competence and motivation (standardized estimate = .52, $p < .001$), levels of perceived competence, and speed and agility characteristics (standardized estimate = -.18, $p < .01$), and slopes of perceived competence and motivation (standardized estimate = .67, $p < .001$) (Figure 9).

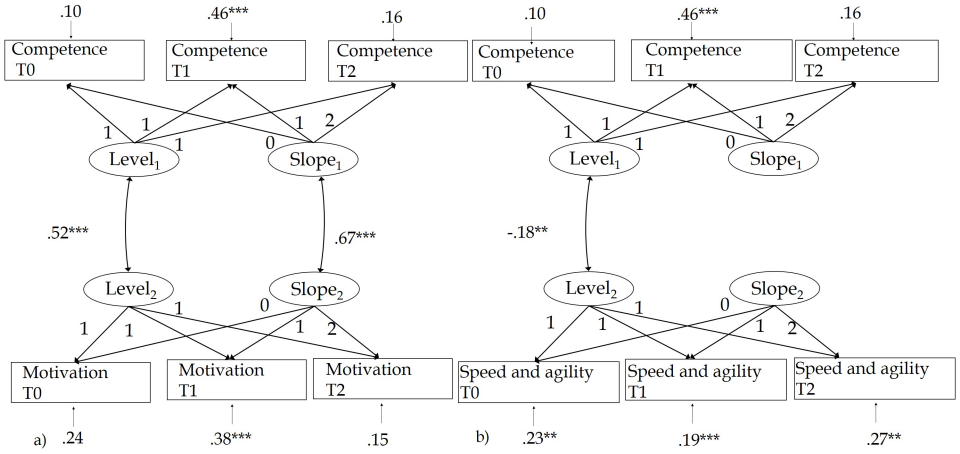


FIGURE 9 Associations between a) levels and slopes of perceived competence and motivation, and b) levels and slopes of perceived competence, and speed and agility characteristics (**$p < 0.01$; ***$p < .001$).

6 DISCUSSION

The present thesis was designed to deepen our understanding of the development process of young Finnish soccer players during childhood and adolescence in the development system of local soccer clubs. The first part of this thesis focuses on the developmental activities and career progression of a group of 15-year-old soccer players, whereas the second part focuses on perceived competence development and its relationship to the development of performance characteristics among a group of soccer players aged 12 to 14.

6.1 Developmental activities and career progression in soccer

6.1.1 Soccer-specific play and practice in the development of young soccer players

The amount of soccer-specific play and practice undertaken during childhood was related to the time spent in soccer-specific play and practice during early adolescence, and the level of technical skills, tactical skills, physiological characteristics, and psychological skills exhibited by the players at 15 years of age. The practice activities of the players followed a mixture of early engagement and early diversification pathways.

Concerning the practice history of the players, it was found that players who reported higher amounts of soccer-specific play and practice during childhood also practiced and played more soccer during adolescence. The prominence of soccer-specific play was noted in the reports of players with a higher amount of soccer-specific practice during childhood and adolescence. This finding is in agreement with Côté et al. (2007), suggesting that engagement in a large amount of play activities in one's early years has a positive effect on players' motivation to engage in soccer-specific practice activities later on. Through engagement in soccer-specific play and practice activities, the soccer skills of the players can be expected to improve, resulting in higher self-perceptions of competence, more enjoyable soccer experiences, and enhanced motivation to

practice soccer. Due to the considerable amount of practice required to attain expertise in soccer (Ford et al. 2009, Ford & Williams 2012, Haugaasen et al. 2014a, Hornig et al. 2016), it can be proposed that engaging in a large amount of soccer-specific play and practice already during childhood is important for the development of young soccer players.

In line with earlier studies (Huijgen et al. 2009, Huijgen et al. 2010, Valente-dos-Santos et al. 2012, Valente-dos-Santos et al. 2014), it was found that players reporting higher amounts of soccer-specific play and practice during childhood and adolescence displayed better technical skills during adolescence. Differences emerged especially in passing and centering test, in which players in High- and Medium-Practice groups outperformed players in a Low-Practice group. It can be argued that both soccer-specific play and practice are important for skill development among young players. Coach-led soccer practices may be especially important for learning correct techniques, whereas soccer-specific play supports the accumulation of the required amount of repetitions. Differences were not observed in other test which measured dribbling and short passing skills, indicating that dribbling and passing test may not be sensitive enough to detect differences between players of different practice histories at the age of 15 years. Furthermore, a lower amount of play and practice activities can be sufficient to develop these kind of easier skills compared to centering skills, for instance.

With respect to tactical skills development, the present findings are consistent with earlier studies (Memmert et al. 2010, Roca et al. 2012, Ward & Williams 2003, Williams et al. 2012) which have suggested that soccer-specific play and practice are important for the development of tactical skills. The players of the High-Practice group outscored the players of the Low-Practice group on three out of four subscales of tactical skills, as well as the players of the Medium-Practice group on one subscale. It has been shown in particular that large amounts of unstructured soccer-specific play activities during childhood can result in superior tactical skills (Roca et al. 2012, Williams et al. 2012). The present data confirm the earlier findings, showing that the players with better tactical skills had spent considerably more time especially in soccer-specific play than other players. One possible explanation could be that during soccer-specific play activities, players encounter many kinds of decision-making situations in varying situational and environmental contexts. In these situations, players have the possibility to make their own decisions and try different kinds of solutions without the advice and feedback of coaches. Through trial and error during these play activities, players' tactical skills may develop.

In regard to physiological characteristics, it was found that only endurance separated the practice groups. More precisely, it was found that the players of the Medium-Practice group outperformed the players of the Low-Practice group in terms of endurance. Because other differences in physiological characteristics were not found, it can be speculated that other things than practice activities, such as individual differences in age-related biological changes that occur during adolescence, may have affected the development of these character-

istics. However, despite the fact that the development of physiological characteristics is related to the growth and maturation of young players (Malina et al. 2004b, Philippaerts et al. 2006), physiological characteristics can be developed through soccer practice (Hill-Haas et al. 2011, Koklu et al. 2011, Reilly 2005) and specific physiological practice programs, regardless of players' ages (e.g. Bloomfield et al. 2007b, Dellal et al. 2012, Meylan & Malesta 2009, Michailidis 2015, Mujika et al. 2009a). Our data did not include specific information about the nature and content of practice activities, and therefore it is difficult to say if these activities were designed to effectively develop the physiological characteristics of the players. This means, for instance, that practice activities should have included enough maximal sprints, jumps, and turns for speed, agility and explosive strength development, or enough tempo for endurance development.

In the current study, the players reporting higher amounts of soccer-specific play and practice during childhood also reported higher levels of motivation, confidence, and concentration during adolescence. More precisely, it was found that the players of the High-Practice group outperformed the players of the Medium-Practice group in terms of confidence and concentration, and also the players of the Low-Practice group in concentration. All of these three psychological skills have been shown to be important for high levels of performance in sports (Mahoney et al. 1987), while motivation is also suggested to be related to the development of young athletes by enabling them to invest the requisite time in practice needed to attain expertise in sport (Abbott & Collins 2004, Durand-Bush & Salmela 2002, MacNamara & Collins 2011). In our study, the higher levels of motivation of players with more soccer-specific play and practice during childhood may be explained by better technical and tactical skills. It can be suggested that players with better technical and tactical skills have experienced more successful performances and feelings of enjoyment during play and practice activities, through which their perceived competence in soccer has increased. Due to the important role of perceived competence in the development process of motivation (Deci & Ryan 2000, Harter 1978), it can be argued that higher perceived competence positively affects players' motivation towards soccer.

With respect to athlete developmental models, the players in this study followed a mix of early engagement and early diversification pathways. The developmental pathway of the High-Practice group mainly contained elements from the early engagement pathway, while the developmental pathways of the Medium- and Low-Practice groups followed a mix of the early engagement and early diversification pathways. Earlier studies conducted among soccer players have shown that the developmental pathways of elite soccer players have contained the elements of the early engagement (Ford et al. 2009, Ford et al. 2012, Ford & Williams 2012) and early specialization pathways (Ford et al. 2012, Ward et al. 2007). These findings raise some interesting questions related to constraints in sport development systems in different nations. Countries with elite development sport academies which recruit individuals at a young age are likely to have players who have engaged in a lot of practice and competition in

soccer during childhood. On the other hand, in countries with less formal recruitment systems, players may start formal practice activities later and engage in a lot of play activities across various sports during childhood (Ford et al. 2012). Furthermore, in some northern countries, like Finland, weather conditions during winter can make it unsuitable for outdoor soccer play and practice, due to which players may engage more in other sports throughout their development. The players in this study spent a considerable amount of time in other sports during childhood. This may have been important for the development of these players, because without engagement in other sports, the total amount of play and practice actitivies during childhood would have been rather low. Based on earlier studies, it can be supposed that engagement in various sports during childhood provides enjoyable sport experiences for players (Côté et al. 2009a), as well as the foundation required to specialize in one sport during adolescence (Côté et al. 2009b).

Taking these findings together, it can be recommended that young soccer players engage in a considerable amount of soccer-specific play and practice activities during their development. Engaging in soccer-specific play and practice activities already during childhood is important for the development of young players, because players who play and practice more soccer during childhood are likely to play and practice more soccer also during adolescence. Both soccer-specific play and practice during childhood seem to be important for the development of various performance characteristics among young soccer players, although they play different roles in this development process. Taking into account the considerable amount of time the players in this study spent in other sports during childhood, it can be suggested that those various sport experiences were also important in their development process.

6.1.2 Performance characteristics that predict the future performance level of young soccer players

The present study showed that passing and centering skills, agility, and motivation recorded at the age of 15 predicted the elite performance level of soccer players at the age of 19. The correct classification of Elite and Sub-Elite level players based on these three variables was 86%.

The current findings are consistent with previous reports (Coelho e Silva et al. 2010, Figueiredo et al. 2009, Huijgen et al. 2014, Reilly et al. 2000b, Vaeyens et al. 2006), suggesting that technical skills differentiate young soccer players of different performance levels. In our study, Elite players outscored Sub-Elite players in both dribbling and passing, as well as passing and centering tests, at the age of 15. Instead of the dribbling test suggested by Huijgen et al. (2009), it was found that the passing and centering test was able to predict the future performance level of the players in this study. The young soccer players who scored in the moderate or highest category in the passing and centering test were about eight to ten times more likely to reach the elite level at the age of 19 than low-scoring players. It can be proposed that high-level passing and centering skills are especially important for the future career progression of young

soccer players because of the increased technical demands in elite soccer during recent years (Barnes et al. 2014). The predictive power of the passing and centering test over the dribbling and passing test may be due to its more challenging nature. In order to be successful in the test, a player should be able to center the ball accurately towards target areas five times with both legs. This means that a player should have a well-developed kicking technique also with the weaker leg.

In line with earlier studies (Coelho e Silva et al. 2010, Figueiredo et al. 2009, Gil et al. 2007, Huijgen et al. 2014, Reilly et al. 2000b, Vaeyens et al. 2006), it was found that young soccer players who reached the elite performance level at the age of 19 outscored other players in speed (30 m), agility, and endurance at the age of 15. Furthermore, in agreement with Gonaus and Müller (2012), agility was shown to be one of three variables which predicted the future performance level of young players in this study. The players scoring high in agility were about ten times more likely to reach the elite performance level at the age of 19 years than low-scoring players. It can be suggested that the better agility characteristics of Elite players compared to Sub-Elite players helps them to succeed in soccer because of the number of short spints, fast turns and changes in running direction that players have to execute during the game (Bloomfield et al. 2007a, Di Salvo et al. 2013, Mohr et al. 2003). Even if growth and maturity are related to physiological development during adolescence (Malina et al. 2004a, Malina et al. 2004b, Philippaerts et al. 2006), it can be argued that growth and maturity have less of an effect on agility performance, compared to performance in other areas of physiological conditioning (Vandendriessche et al. 2012).

In regard to psychological skills, it was found that motivation was the only psychological skill assessed at the age of 15 which differentiated Elite and Sub-Elite players and also predicted the future performance level of the players at the age of 19 years. This finding confirms the earlier findings of Van Yperen (2009), showing that psychological skills are associated with successful career progression in soccer. It also supports earlier studies which have shown that motivation is important for the development of an elite athlete (Abbott & Collins 2004, Durand-Bush & Salmela 2002, Gould et al. 2002, MacNamara & Collins 2011, Williams & Krane 2001). In our study, young soccer players who scored in the moderate or highest category in motivation at 15 years of age were about seven to ten times more likely to reach the elite performance level at the age of 19 than low-scoring players. It can be suggested that a high level of motivation is especially important during adolescence when young players encounter life situations related to education and interpersonal relationships, which require their attention in addition to soccer. At the same time, competition becomes harder and players need to decide if they are ready to invest as much time as it requires to attain expertise in adulthood. In order to find enough time for soccer, players may have to make sacrifices, such as spending less time with their friends or giving up other hobbies. At least in the Finnish development system, it may also be challenging to combine school and soccer practices opti-

mally during adolescence. This means, for instance, that players should be ready to go to soccer practices early in the morning before school or late in the evening. Due to the challenges that players often face during adolescence, it can be proposed that only the most motivated players are ready to do what it takes to reach the top level in soccer in the future.

In contrast to earlier findings from Kannekens et al. (2011), tactical skills did not predict the future performance level of the players in this study. However, in agreement with other previous studies (Huijgen et al. 2014, Kannekens et al. 2009), it was found that Elite players outscored Sub-Elite players in tactical skills. In our study, the discriminating tactical skill was found to be Acting in changing situations, whereas in earlier studies Positioning and deciding was shown to be a key tactical skill that differentiates players at different performance levels (Huijgen et al. 2014, Kannekens et al. 2009). A common feature of these two variables is that both Positioning and deciding and Acting in changing situations represent procedural knowledge, which refers to the selection of appropriate action within the context of the game (McPherson 1994). As opposed to Positioning and deciding, Acting in changing situations is related to the defensive actions of the game. Based on these findings, it can be argued that procedural knowledge related to either offensive or defensive situations of the game appears to be important in the development of young soccer players.

Concerning the career progression of young Finnish soccer players, the first official talent selection occurs when players are selected for the national youth team during the year when they turn 15 years old. Our findings are in line with those of Güllich (2013), suggesting that early selection in the national youth team is neither a guarantee nor a necessity for future success in the Finnish soccer development system. Of the players selected into the national youth team at the age of 15, 59% were defined as elite players and played in the men's first division or higher at the age of 19. It can be argued that the selection criteria of the national youth teams are often strongly related to the current performance levels of the players, due to which differences in the biological maturity level of the players affect selections. In the present study, the correct classification of Elite and Sub-Elite players based on passing and centering skills, agility and motivation measured at the age of 15 was 86%, suggesting that these performance characteristics could be more valuable in predicting players' potential to develop. The variables together explained 43% of the variance in the performance levels at this age, indicating that other things also affected the career progression of these young players. For instance, the amount of play and practice activities engaged in throughout the development process has been shown to be related to future performance levels in soccer (Ford & Williams 2012, Haugaasen et al. 2014a, Hornig et al. 2016). Furthermore, MacNamara and colleagues have suggested (MacNamara et al. 2010a, MacNamara & Collins 2011; 2013) that there are a range of psychological factors, such as motivation, commitment, goal setting, quality of practice, imagery, realistic performance evaluation, coping under pressure, and social skills, which can facilitate the translation of potential into expertise. The role of sociological issues, such as parental sup-

port, coach-athlete relationship, cultural background, facilities for practice, and ability to avoid injuries, can not be underestimated in the career progression of young soccer players (Williams & Reilly 2000).

To summarize, the results of this longitudinal study suggest that a multidimensional approach should be used in evaluating young soccer players' future potential. The present findings show that especially players with high-level passing and centering skills, agility and motivation at the age of 15 years have better possibilities of reaching the elite level at the age of 19, although they do not deny that a small proportion of players can develop into elite players despite not displaying high scores in these variables at the age of 15. Based on our findings, it can be argued that variables which are less sensitive to maturation effects seem to predict young soccer players' long-term potential more accurately than other performance characteristics or selection into the national youth team.

6.2 Development of perceived competence and performance characteristics among young soccer players

6.2.1 Development and validation of perceived competence scale

Through the present study, a self-assessed Perceived Game-Specific Soccer Competence Scale (PGSSCS) was created and validated. In order to construct this scale, the theoretical elements of game-play abilities needed in game situations were determined by using the expertise of five highly qualified Finnish coaches and coach educators. After formulating the items of the preliminary scale, an exploratory factor analysis was applied. Through exploratory factor analysis, the original items of the preliminary scale were divided into three factors: offensive skills, 1 vs 1 dyadic skills, and defensive skills. The confimatory factor analysis generally showed acceptable values of goodness-of-fit indices indicating satisfactory construct validity of the three-factor model of the Perceived Game-Specific Soccer Competence Scale. Relatively high composite reliability, internal consistency and intraclass correlation of all three subscales demonstrated that the PGSSCS was a reliable tool to assess young soccer players' perceived competence.

The criterion validity of the instrument was verified by comparing the subscales of PGSSCS to other performance measures. Tactical skills were explained by perceived competence more strongly than other variables, which may be due to the self-assessment used to measure tactical skills in this study (TACSIS, Elferink-Gemser et al. 2004). The positive association found between perceived competence and motivation in this study is in line with Gillet et al. (2009), and it supports the role of perceived competence in the development process of motivation (Deci & Ryan 2000, Harter 1978). Technical skills were only slightly explained by perceived competence, which may be due to the

skillful and homogeneous group of players participating in this study. It could be that players perceived themselves to be rather skillful in comparison to other players of their age group in Finland, even if they were not the best players in terms of technical skills among the players participating in this study.

All in all, the present study has led to the development of a psychometrically valid and reliable practical coaching tool which can be used to collect information on level of perceived competence as well as the long-term development of perceived competence among young players. With the PGSSCS, information can be gathered on players' perceptions of their offensive, 1 vs 1 dyadic, and defensive skills, which can be expected to broadly represent their perceived abilities in actual game situations.

6.2.2 Development of perceived competence and performance characteristics during a period of one year

The present findings show that young soccer players' perceived competence, tactical skills, motivation, technical skills, and speed and agility characteristics remained relatively high and stable during the period of one year. Positive associations were found between the levels of perceived competence and motivation, the levels of perceived competence and speed and agility characteristics, and the slopes of perceived competence and motivation.

The stability of perceived competence and motivation during one year may have been due to the fact that the participants in this study were highly competitive and skillful players, representing the best Finnish teams in their age group. In contrast to findings of earlier studies in a school environment (e.g. Jacobs et al. 2002, Rodriquez, Wigfield & Eccles 2003), the perceived competence of the players in this study did not decline during the period of one year, suggesting that in a competitive sport environment, the perceived competence of young players is more stable than in an educational setting. It can also be speculated that the practice sessions of the participating teams included exercises at an appropriate level, allowing players possibilities to succeed and experience feelings of competence. Through these successful performances, players may have had a lot of positive encouragement from their coaches, parents, and peers. It would be important to maintain the high perceived competence levels in the future as well, since it has been shown to be positively associated with intrinsic and extrinsic types of motivation (Ntoumanis 2001), enjoyment and persistence (McCarthy et al. 2008, Ullrich-French & Smith 2009, Wiersma 2001), positive psycho-biosocial states (Bortoli et al. 2011), positive expectations for success and achievement-oriented behaviors (Roberts et al. 2007).

With respect to the development of the performance characteristics measured in the present study, it was observed that the tactical and technical skills, as well as the speed and agility characteristics, of the players were relatively high and stable over the period of one year. Some development over 12 months was detected in these skills and characteristics, but these changes were not revealed to be statistically significant. Previous studies have shown that the fastest development in technical skills occurs in the prepubertal years (Valente-dos-

Santos et al. 2012, Valente-dos-Santos et al. 2014, Vänttinen 2013), whereas the fastest development in physiological characteristics usually occurs with peak height velocity at the age of around 14 years (Philippaerts et al. 2006). In this study, the average growth of the players during one year was 7.1 cm, whereas growth has been shown to be around 10 cm per year during the peak height velocity (Tanner et al. 1966). This finding indicates that some players in this study may have reached peak height and others not, and therefore quite significant individual variation may have existed vis-à-vis physiological characteristics and, also to some extent, technical skills.

In the current study, a covariance effect of growth was found in the slope of perceived competence and tactical skills, suggesting that perceived competence and tactical skills developed more among players who grew more. Perceived competence and tactical skills were both measured with self-assessment, reflecting the players' own perceptions of their competence in soccer. This finding is consistent with the data of O'Dea & Abraham (1999), which showed that pubertal status can be positively related to athletic competence in males. The finding also suggests that perceived competence is higher among early developing players, compared to their later developing peers. In contrast to the findings of Philippaerts et al. (2006), growth was negatively associated with the level of speed and agility characteristics, indicating that players who grew more displayed lower levels of speed and agility characteristics. This finding may reflect the temporary disruption of motor coordination during adolescence (Butterfield et al. 2004), which might affect agility performance in particular.

The present data showed that the performance levels of the players displayed significant covariance effects for tactical skills, motivation, technical skills, and speed and agility characteristics, whereas age was related to the levels of technical skills and speed and agility characteristics. These findings confirm previously observed results and earlier findings which have shown that players identified as talented are better than other players in various performance characteristics (Huijgen et al. 2014, Reilly et al. 2000b), and that technical and physiological characteristics improve progressively with age (Huijgen et al. 2010, Vaeyens et al. 2006, Valente-dos-Santos et al. 2012, Valente-dos-Santos et al. 2014, Vänttinen 2013).

In line with several motivational theories (Deci & Ryan 2000, Harter 1978), the findings of the present study highlight the role of perceived competence in the development process of motivation. In our study, positive associations between the levels and slopes of perceived competence and motivation were found. This means that players with higher perceived competence also had higher motivation, and that a greater increase in perceived competence was linked to a greater increase in motivation. These findings suggest that supporting the development of perceived competence in young players results also in increased motivation levels. Contrary to earlier findings among young soccer players (Feltz & Brown 1984, Hopper et al. 1991), the present study did not find a significant association between the levels of perceived competence and soccer-specific technical skills. However, as opposed to technical skills, the levels of

speed and agility characteristics were positively associated with the level of perceived competence in this study. This means that players with better speed and agility characteristics felt themselves to be more competent in soccer. One explanation could be that players with high speed and agility characteristics are able to, for instance, win 1 vs 1 situations, be the first player to reach a loose ball, and pass to an opponent in order to score goals during games. Through these kinds of successful game performances, the perceived competence of the players with better speed and agility characteristics may have been enhanced.

Together these results suggest that in coaching young soccer players, emphasis should be made on supporting the development of perceived competence and motivation, and that this might be especially important in players maturing later. Furthermore, a multidimensional approach should be adopted for player development processes, and the nature of players' individual needs and developmental stages should be carefully considered in childhood and adolescence.

6.3 Practical implications

Our findings support earlier findings (Ford et al. 2009, Ford & Williams 2012, Haugaasen et al. 2014a, Hornig et al. 2016) about the importance for the development of soccer players of engaging in soccer-specific play and practice activities already during childhood. Soccer activities engaged in during childhood should consist of both coach-led team practices and informal play activities because these activities have a different role in the development process of young soccer players. The amount of coach-led soccer practices is at a relatively good level in Finland, but the amount of soccer-specific play should be increased so that more and more players would be able to reach the top level in soccer. In order to inspire players to play soccer on their own time, they should be provided with fun and enjoyable soccer experiences during childhood. Fun and enjoyable soccer experiences during childhood can be expected to be manifested as a motivation to play and practice soccer also during adolescence. The coach can help create these kinds of experiences by providing players with feelings of success and an appropriate level of challenges during team practices, by setting achievable goals, by giving informative feedback rather than controlling feedback or criticism as well as by being interested in their individual practice and development. In addition to providing players with fun and enjoyable soccer experiences, it should also be ensured that players have enough time and the right conditions to play soccer on their own, especially during the winter when weather conditions constrain playing soccer outside. One possibility to increase the amount of soccer-specific play activities could be changing the one weekly team practice session to free practice. In addition to soccer practices, the possibility to practice other sports should be provided to young players. This could be carried out for instance by inserting additional practices such as gymnastics, martial arts or other ball games as a part of soccer teams' practice plans.

Additional practices can be organized in cooperation with clubs from other sports. Engaging in other sports may provide players with more diverse sport experiences and help them to accumulate enough total practice time.

The findings of the present thesis support the idea that the focus in coaching young players should be shifted from early talent identification to the player's potential to continue developing (Abbot & Collins 2004, Vaeyens et al. 2008). Furthermore, the potential of players should be evaluated with a multidimensional and individual approach focusing especially on the variables which are less sensitive to maturation effects during adolescence. Selection procedures used in coaching young players need to be developed so that they are open, dynamic and continuous. The potential of players should be evaluated regularly and deselected players should also have an opportunity to continue developing according to their own potential and be selected later on. One possibility is to consider if the late-maturing players should be provided with their own practice sessions and games in which they have possibilities to experience success and compare their skills in relation to players at the same stage of biological development. It could be possible that these late-maturing players have the potential to reach the top level in soccer even if it is not visible at an early age.

In addition to the development of the multidimensional skills and characteristics needed in soccer, the coaching of young players should emphasize supporting their perceived competence. It can be argued that players' self-perceptions of their own abilities have a significant effect on their motivation (Deci & Ryan 2000, Harter 1978, Gillet et al. 2009). The perceived competence of young soccer players can be assessed with the Perceived Game-Specific Soccer Competence Scale (PGSSCS), which was created as part of this thesis. The PGSSCS can be used to gather information on developing players' perceptions of their abilities in different game situations. By comparing the player's own self-perceptions, the player's performance in games and tests and the coaches' evaluations of the player's abilities, it can be seen how well a player's own self-perceptions are in line with his abilities in practice. This information, collected from different sources, can be used as a basis for development discussion and individual goal setting. For perceived competence development, it is important that players are developing so that their skills and characteristics meet the requirements of soccer. It is also important to show players that they are developing based on facts from tests and game analysis.

The coach obviously has a major role in the comprehensive development of young soccer players. This being the case, it is essential to develop coaching education so that coaches receive the knowledge and skills needed in order to develop players comprehensively, individually and in the long term. It can be argued that coaches' knowledge of young soccer players should be developed to encompass evaluating players' long-term potential as well as understanding the effect of biological maturation on the development of the players during adolescence. From the perspective of perceived competence, coaches' abilities to pay attention to players' individual learning and development as well as to give positive, inspiring and constructive feedback to players should be developed.

Furthermore, coaches' abilities to plan and implement practices so that players develop in accordance with the requirements of soccer and in relation to other players of the same age must also be improved.

6.4 Limitations and suggestions for future research

There are some limitations in this study that should be acknowledged and taken into consideration when interpreting the data. First, a self-reported questionnaire was used in examining the practice history of the players. In this practice history questionnaire, players were asked to retrospectively recall practice activities they engaged in during childhood and adolescence, which may have caused some bias in the reported amount of different practice types, especially in their early years. Second, even though retrospective longitudinal tracking was used to identify performance characteristics that support career progression in soccer, players were followed up only when they were 19 years old. Performance characteristics were assessed only once at 15 years, and the data did not include information of development or practice activities engaged in by these players between the ages 15 and 19 years. Third, the period of 12 months selected for the duration of the longitudinal study may be a relatively short period in the development of a young player; this could be a reason for the small differences observed in the average scores of the variables of perceived competence and performance characteristics. Furthermore, the data of this longitudinal study did not include information on practice quality and quantity, or the maturity levels of the players.

In order to further understand the developmental pathways of soccer players, developmental activities and multidimensional development year by year from childhood until adulthood should be examined in future studies. Future studies should include more detailed information on practice activities, soccer performance measurements that better reflect the actual game performance, and an assessment of the maturity levels of the players. In order to better understand why some players reach the expert level while others not, the individual profiles of players who make it to the top should be investigated. In order to further understand how to comprehensively facilitate the development of players of different ages, it is necessary to apply longitudinal designs with specific coaching interventions. For instance, factors affecting the development of motivation among young players should be examined more broadly and in the longer term. In its current form, the PGSSCS created in this study is a valid tool for assessing perceived game-specific competence among young Finnish soccer players, but with further work it could be easily adapted to track a range of languages, countries and sports.

7 PRIMARY FINDINGS AND CONCLUSIONS

The main findings and conclusions of the present thesis are as follows:

1. The amount of soccer-specific play and practice engaged in during childhood was related to the time spent in soccer-specific play and practice during adolescence, as well as the level of technical skills, tactical skills, physiological characteristics and psychological skills exhibited by players at 15 years of age. These findings suggest that both soccer-specific play and practice are important for the development of young soccer players, and that these seem to be especially important for technical and tactical skills development.

2. The elite performance level at the age of 19 years was associated with key performance aspects of passing and centering skills, agility, and motivation measured at the age of 15 years. The correct classification of Elite and Sub-Elite level players based on these three variables was 86%. The results of this longitudinal study suggest that a multidimensional approach, including the variables which are less sensitive to maturation effects, should be used when evaluating young soccer players' future potential.

3. A psychometrically valid and reliable practical coaching tool for assessment of perceived game-specific soccer competence was created. The PGSSCS can be used to gather information on developing players' perceptions of their offensive, 1 vs 1 dyadic, and defensive skills, which can be expected to broadly represent their perceived abilities in actual game situations. Coaches can use this tool in order to better understand game-specific perceived competence development among young soccer players.

4. Perceived competence, motivation, technical and tactical skills, and speed and agility characteristics remained relatively high and stable during the period of one year among 12 to 14 years old players. Positive as-

sociations were found between the levels and slopes of perceived competence and motivation, and the levels of perceived competence and speed and agility characteristics. Based on these findings, it seems crucial in coaching to support the perceived competence of young soccer players, and this may be even more important for players maturing later. Concerning the large differences in growth-mediated development that occur during adolescence, it can be recommended to monitor the development of perceived competence and the various performance characteristics of young players, individually and over the long term.

YHTEENVETO (FINNISH SUMMARY)

Jalkapallo on yksi harrastetuimmista ja kilpailluimmista urheilulajeista lasten ja nuorten keskuudessa sekä Suomessa että koko maailmassa. Osa nuorista pelaajista harrastaa jalkapalloa pääasiassa pitääkseen hauskaa harrastuksensa parissa, osa taas tavoittelee tosissaan huippujalkapalloilijan uraa. Huippujalkapalloilijan uraa tavoittelevien pelaajien kehitysprosessista vastaavien jalkapallotoimijoiden tehtävänä on auttaa nuoria pelaajia kehittymään ja saavuttamaan potentiaalinsa sekä tavoitteensa jalkapalloilijoina. Haastavan tehtävästä tekee se, että huippujalkapalloilijaksi kehittyminen on monimutkainen ja pitkä prosessi, johon vaikuttavat lukuisat eri tekijät. Tällaisia tekijöitä ovat mm. harjoittelun laatu ja määrä, kehittyminen kokonaisvaltaisen valmennuksen eri osa-alueilla, sitoutuminen ja motivaatio jalkapallossa kehittymiseen sekä erilaiset ympäristötekijät (vanhempien tuki, valmentajien tuki ja osaaminen, harjoitusolosuhteet, harjoitus- ja kilpailujärjestelmä).

Suurin osa aikaisemmista nuorten pelaajien kehittymisprosessiin keskittyneistä jalkapallotutkimuksista on tehty akatemiaympäristössä. Siellä resurssit pelaajien yksilölliseen kehittämiseen ovat erilaiset kuin seuraympäristössä, jossa nuorten jalkapalloilijoiden kokonaisvaltaista kehittymistä on tutkittu melko vähän. Tämän väitöskirjatutkimuksen tarkoituksena olikin lisätä ymmärrystä nuorten suomalaisten jalkapalloilijoiden kokonaisvaltaisesta kehittymisprosessista paikallisiin urheiluseuroihin perustuvassa urheilujärjestelmässä. Tutkimus koostuu kahdesta osasta, joissa pelaajien kokonaisvaltaista kehittymisprosessia on tutkittu eri näkökulmista ja eri aineistojen kautta.

Tämän väitöskirjatutkimuksen ensimmäisessä osassa tutkittiin lapsuuden aikaisen jalkapalloharjoittelun merkitystä pelaajan kehittymisessä kokonaisvaltaisen valmennuksen eri osa-alueilla, ja toisaalta näiden valmennuksen eri osa-alueiden merkitystä pelaajan tulevan menestyksen kannalta. Tutkimukseen osallistui 159 poikajalkapalloilijaa, jotka tutkimuksen tiedonkeräysvaiheessa olivat 15-vuotiaita. Tiedonkeräys toteutettiin pelaajien omassa seuraympäristössä, jossa pelaajat arvioivat kirjallisten kyselyiden kautta omaa harjoitushistoriaansa sekä taktisia ja psykologisia taitojaan. Lisäksi pelaajat osallistuivat teknisiä lajitaitoja mittaaviin syöttö- ja pujottelu ja syöttö- ja keskitystesteihin sekä fyysisiä ominaisuuksia mittaaviin nopeus-, ketteryys-, kevennyshyppy- ja kestävyystesteihin. Neljä vuotta tiedonkeräysvaiheen jälkeen selvitettiin pelaajien senhetkinen pelitaso. Menestyneiksi pelaajiksi katsottiin ne pelaajat, jotka 19-vuotiaana pelasivat miesten 1-divisioonassa, Veikkausliigassa tai ulkomailla.

Tutkimuksen tulokset osoittivat, että lapsuusvaiheessa enemmän jalkapalloa omatoimisesti ja ohjatusti pelanneet ja harjoitelleet pelaajat harjoittelivat enemmän jalkapalloa myös nuoruusvaiheessa. Lisäksi he olivat muita pelaajia parempia teknisissä, taktisissa, fyysisissä ja psykologisissa taidoissa ja ominaisuuksissa nuoruusvaiheessa. Tutkimuksen perusteella voidaan sanoa, että jalkapalloilijana kehittymisen kannalta olennaista on pelata ja harjoitella jalkapalloa huomattavia määriä jo lapsuusvaiheessa. Lapsuusvaiheessa on tärkeää synnyttää pelaajien innostus jalkapallon pelaamiseen ja harjoitteluun, sillä lap-

suusvaiheessa syntynyt innostus näkyy nuoruusvaiheessa motivaationa pelata ja harjoitella jalkapalloa. Valmentaja voi tukea innostuksen syntymistä tarjoamalla pelaajille onnistumisen elämyksiä ja oikeantasoisia haasteita joukkueharjoituksissa, antamalla rakentavaa ja myönteistä palautetta sekä olemalla kiinnostunut pelaajien harjoittelusta ja kehittymisestä. Lapsuusvaiheen harjoittelun pitäisi koostua sekä omatoimisesta pelaamisesta ja harjoittelusta että valmentajajohtoisesta joukkueharjoittelusta, koska niiden vaikutus kehittymiseen on erilainen. Joukkueharjoittelun määrä on Suomessa yleisesti ottaen melko hyvällä tasolla, mutta omatoimisen jalkapallon pelaamisen ja harjoittelun määrää tulisi lisätä, jotta yhä useammalla pelaajalla olisi mahdollisuus halutessaan kehittyä huipputason jalkapalloilijaksi. Jalkapalloharjoittelun lisäksi nuorille pelaajille pitäisi tarjota mahdollisuus myös muiden lajien harjoitteluun omalla ajalla tai ohjatusti. Muiden lajien harjoittelun kautta pelaajat voivat saada lisää virikkeitä kokonaisvaltaiseen kehittymiseen. Lisäksi muiden lajien harjoittelu voi olla tukemassa kehittymisen kannalta riittävän kokonaisliikuntamäärän saavuttamista.

Nuorten jalkapalloilijoiden tulevaa menestystä tässä tutkimuksessa ennustivat hyvät syöttö- ja keskitystaidot, ketteryysominaisuudet ja korkea motivaatio. Parhaaseen kolmannekseen edellä mainituissa testeissä 15-vuotiaana kuuluneilla pelaajilla oli noin kymmenkertaiset mahdollisuudet menestyä 19-vuotiaana kuin huonoimpaan kolmannekseen testeissä kuuluneilla. Syöttö- ja keskitystaidot, ketteryys ja motivaatio yhdessä luokittelivat pelaajat oikein menestyneisiin ja muihin pelaajiin 19-vuotiaina 86 %:n tarkkuudella. Nuorten maajoukkueeseen 15-vuotiaana valituista pelaajista 59 % kuului menestyneiden pelaajien ryhmään 19-vuotiaana. Tutkimuksen perusteella voidaan sanoa, että nuoren jalkapalloilijan potentiaalia tulisi arvioida kokonaisvaltaisesti, yksilöllisesti ja pitkäjänteisesti. Potentiaalin arvioinnissa tulisi keskittyä etenkin sellaisiin muuttujiin, joihin biologinen kypsyminen ei merkittävästi vaikuta nuoruusvaiheessa. Nuorten pelaajien parissa toteuttavia valintaprosesseja tulisi kehittää, niin että ne ovat avoimia, dynaamisia ja jatkuvia. Tietyllä hetkellä valitsematta jääneelle pelaajalle on tarjottava mahdollisuus kehittyä oman potentiaalinsa mukaisesti jalkapalloilijana ja tulla valituksi myöhemmin. Biologisesti myöhemmin kypsyvissä pelaajissa voi olla valtavasti hyödyntämätöntä potentiaalia ajatellen myöhempää menestystä jalkapalloilijana. Tämä potentiaali ei vain tule näkyviin vielä aikaisella iällä ja voi jäädä huomioimatta ellei kehittämis- ja valintajärjestelmät anna siihen mahdollisuuksia.

Tämän väitöskirjatutkimuksen toisessa osassa keskityttiin pelikeskeisen koetun pätevyyden mittarin kehittämiseen jalkapalloon (n = 1,321), ja toisaalta koetun pätevyyden ja kokonaisvaltaisen valmennuksen eri osa-alueiden kehittymiseen vuoden seurantajakson aikana 12–14-vuotiailla poikajalkapalloilijoilla (n = 288). Tiedonkeräys toteutettiin pelaajien leireillessä joukkueidensa mukana Sami Hyypiä Akatemian järjestämissä kehittymisen seuranta -tapahtumissa Eerikkilän Urheiluopistolla. Pelaajat arvioivat kirjallisten kyselyiden kautta omaa koettua pätevyyttään, taktisia taitojaan ja motivaatiotaan. Lisäksi pelaajat osallistuivat teknisiä taitoja mittaaviin pujottelu- ja syöttötesteihin sekä fyysisiä ominaisuuksia mittaaviin nopeus- ja ketteryystesteihin.

Tutkimuksen tuloksena syntyi luotettava koetun pätevyyden pelikeskeinen mittari jalkapalloon. Mittaria voidaan suositella käytettävän arvioitaessa nuoren jalkapalloilijan koettua pätevyyttä. Mittarin avulla saadaan käytännönläheistä tietoa pelaajan omasta arviostaan osaamisestaan hyökkäys-, 1 v 1- ja puolustustaidoissa. Kehitetyllä mittarilla mitattuna tutkimukseen osallistuneiden pelaajien koettu pätevyys oli korkea ja pysyi samalla tasolla vuoden seurantajakson aikana. Myös motivaatio säilytti korkean tasonsa vuoden aikana. Teknisissä ja taktisissa taidoissa sekä nopeus- ja ketteryysominaisuuksissa tapahtui pientä kehitystä, mutta muutokset eivät olleet tilastollisesti merkitseviä. Koetun pätevyyden taso ja muutos olivat positiivisesti yhteydessä motivaation tasoon ja muutokseen. Koetun pätevyyden taso oli positiivisesti yhteydessä myös nopeus- ja ketteryysominaisuuksien tasoon. Tutkimuksen tulosten perusteella voidaan sanoa, että jalkapallossa vaadittavien taitojen ja ominaisuuksien kehittämisen lisäksi nuorten pelaajien valmennuksessa tulisi kiinnittää huomiota pelaajien koetun pätevyyden kehittymiseen ja tukemiseen. Jalkapallossa itsensä päteväksi kokevat pelaajat ovat todennäköisemmin motivoituneita kehittymään jalkapalloilijana, ja näin ollen myös valmiita tekemään sen työmäärän mitä kehittyminen huipputasolle jalkapallossa vaatii. Erityisen tärkeää näyttäisi olevan biologisesti hitaammin kypsyvien pelaajien koetun pätevyyden tukeminen. Valmentajat voivat tukea pelaajien koettua pätevyyttä kiinnittämällä huomiota pelaajien yksilölliseen oppimiseen ja kehittymiseen sekä antamalla myönteistä, innostavaa ja rakentavaa palautetta pelaajille. Valmentajilla tulee olla osaamista kehittää pelaajia kokonaisvaltaisesti jalkapallovaatimusten mukaisesti ja tehdä tämä kehittyminen näkyväksi pelaajille sekä päivittäisessä arjessa että testien ja pelianalyysien kautta. Johtuen suurista eroista yksilöllisessä kasvu- ja kypsymisaikataulussa lapsuus- ja nuoruusvaiheessa, koetun pätevyyden ja kokonaisvaltaisen valmennuksen eri osa-alueiden kehittymistä voidaan suositella seurattavan säännöllisesti, yksilöllisesti ja pitkällä aikajänteellä.

Yhteenvetona tämän väitöskirjatutkimuksen perusteella voidaan sanoa, että nuorten jalkapalloilijoiden kehittymisprosessista vastaavien jalkapallotoimijoiden tulisi 1) innostaa pelaajia pelaamaan ja harjoittelemaan jalkapalloa sekä omalla ajalla että ohjatusti jo lapsuusvaiheessa, 2) arvioida pelaajien pitkän tähtäimen potentiaalia yksilöllisesti, kokonaisvaltaisesti ja säännöllisesti kiinnittäen huomiota etenkin sellaisiin muuttujiin, joihin biologinen kypsyminen ei merkittävästi vaikuta nuoruusvaiheessa sekä 3) tukea ja seurata pelaajien koetun pätevyyden ja motivaation kehittymistä.

REFERENCES

Abbott, A. & Collins D. 2004. Eliminating the dichotomy between theory and practice in talent identification and development: Considering the role of psychology. Journal of Sports Sciences 22 (5), 395-408.

Ackland, T. R. & Bloomfield, J. 1996. Stability of human proportions through adolescent growth. Australian Journal of Science and Medicine in Sports, 28 (2), 57-60.

Ali, A. 2011. Measuring soccer skill performance: A review. Scandinavian Journal of Medicine and Science in Sports 21 (2), 170-183.

Allen, J. B. & Howe, B. L. 1998. Player ability, coach feedback, and female adolescent athletes' perceived competence and satisfaction. Journal of Sport and Exercise Psychology 20, 280-299.

Alvarez, M. S., Balaguer, I., Castillo, I. & Duda, J. L. 2012. The coach-created motivational climate, young athletes' well-being, and intentions to continue participation. Journal of Clinical Sport Psychology 6 (2), 166-179.

Arbuckle, J. 2007. Amos 18.0 User's Guide. Chicago, IL: Amos Development Corporation 1995-2009.

Baker, J., Cobley, S. & Fraser-Thomas, J. 2009. What do we know about early sport specialization? Not much! High Ability Studies 20 (1), 77-89.

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

Baker, J., Côté, J. & Deakin, J. 2005. Expertise in ultra-endurance triathletes: Early sport involvement and theory of deliberate practice. Journal of Applied Sport Psychology 17 (1), 64-78.

Baker, J. & Horton, S. 2004. A review of primary and secondary influences on sport expertise. High Ability Studies 15 (2), 211-228.

Balyi, I. & Hamilton, A. 2004. Long-term athlete development: Trainability in children and adolescent. Windows of opportunity. Optimal trainability. Victoria, BC: National Coaching Institute British Columbia & Advanced Training and Performance Ltd.

Bangsbo, J. 1996. YO-YO endurance test. In J. Bangbo (Ed) YO-YO Tests. Copenhangen, Denmark: August Krogh Institute, 6-14.

Barnes, C., Archer, D. T., Hogg, B., Bush, M. & Bradley, P. S. 2014. The evolution of physical and technical performance parameters in the English Premier League. International Journal of Sports Medicine 35, 1-6.

Barnsley, R., Thompson, A. & Barnsley, P. 1985. Hockey success and birthdate: The RAE. Canadian Association for Health, Physical Education, and Recreation Journal 5, 23-28.

Barreiros, A. N. & Fonseca, A. M. 2012. A retrospective analysis of Portuguese elite athletes' involvement in international competitions. International Journal of Sports Science & Coaching 7 (3), 593-600.

Beunen, G. P. & Malina, R. M.1988. Growth and physical performance relative to the timing of the adolescent spurt. Exercise and Sport Sciences Reviews 16, 503-540.

Beunen, G. P., Malina, R. M., Renson, R., Simons, J., Ostyn, M. & Lefevre, J. 1992. Physical activity and growth, maturation and performance: a longitudinal study. Medicine and Science in Sports and Exercise 24 (5), 576-585.

Blomqvist, M., Vänttinen, T. & Luhtanen P. 2005. Assessment of secondary school students' decision-making and game-play ability in soccer. Physical Education and Sport Pedagogy 10 (2), 107-119.

Bloom, B. S. 1985. Developing talent in young people. New York: Ballantine.

Bloomfield, J., Polman, R. & O'Donoghue P. 2007a. Physical demands of different positions in FA Premier League Soccer. Journal of Sport Science and Medicine 6, 63-70.

Bloomfield, J., Polman, R., O'Donoghue, P. & McNaughton, L. 2007b. Effective speed and agility conditioning methodology for random intermittent dynamic type of sports. Journal of Strength and Conditioning Research 21 (4), 1093-1100.

Bortoli, L., Bertollo, M., Comani, S. & Robazza, C. 2011. Competence, achievement goals, motivational climate, and pleasant psychobiosocial states in youth sport. Journal of Sports Sciences 29 (2), 171-180.

Bouchard, C. & Malina, R. M. 1984. Genetics and Olympic athletes: A discussion of methods and issued. In J. E. L. Carter (Ed.) Kinanthropology of Olympic athletes. Basel, Switzerland: Karger, 28-38.

Browne, M. & Cudeck, R. 1993. Alternative ways of assessing model fit. In K. Bollen & J. Long (Eds.) Testing structural equation models. Newbury Park, CA: Sage, 136-162.

Butterfield, S. A., Lehnhard, R., Lee, J. & Coladarci, T. 2004. Growth rates in running speed and vertical jumping by boys and girls ages 11-13. Perceptual and Motor Skills 99 (1), 225-234.

Cobley, S., Baker, J., Wattie, N. & McKenna, J. 2009. Annual age-grouping and athlete development: A meta-analytical review of relative age effects in sport. Sports Medicine, 39 (3), 235-256.

Coelho e Silva, M. J., Figueiredo, A. J., Simoões, F., Seabra, A., Natal, A., Vaeyens, R., Philippaerts, R., Cumming, S. P. & Malina, R. M. 2010. Discrimination of U-14 soccer players by level and position. International Journal of Sports Medicine, 31, 790-796.

Cohen, J. 1988. Statistical power analysis for the behavioural sciences. (2nd ed) New York: Lawrence Erlbaum Publishers.

Côté, J. 1999. The influence of the family in the development of talent in sport. The Sport Psychologist 13 (4), 395-417.

Côté, J., Baker, J. & Abernethy, B. 2007. Practice and play in the development of sport expertise. In: Tenenbaum, G. & Eklund, R. C. (Eds) Handbook of sport psychology. New Yersey: John Wiley & Sons, 184-202.

Côté, J., Horton, S., MacDonald, D. & Wilkes, S. 2009a. The benefits of sampling sports during childhood. Physical and Health Education Journal 74, 6-11.

Côté, J., Lidor, R. & Hackfort, D. 2009b. 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 & Exercise Psychology 7 (1), 7-17.

Côté, J., Salmela, J. H., Trudel, P., Baria, A. & Russell, S. J. 1995. The coaching model: A grounded assessment of expertise gymnastics coaches' knowledge. Journal of Sport and Exercise Psychology 17, 1-7.

Csikszentmihalyi, M., Rathunde, K. & Whalen, S. 1993. Talented teenagers: The roots of success and failure. New York: Cambridge University Press.

Davids, K. W, Button, C. & Bennett, S. J. 2008. Dynamics of skill acquisition: A constrain-led approach. Champaign, IL: Human Kinetics.

Deakin, J. M. & Cobley, S. 2003. An examination of the practice environments in figure skating and volleyball: a search for deliberate practice. In J. Starkes & K. A. Ericsson (Eds.) Expert performance in sports: advances in research on sport expertise. Champaign, IL: Human Kinetics, 90-113.

Deci, E. L. & Ryan, R. M. 1985. Intrisic motivation and self-determination in human behavior. New York: Plenum Press.

Deci, E. L. & Ryan, R. M. 2000. The "what" and "why" of goal pursuits: human needs and the self-determination of behavior. Psychological Inquiry 11 (4), 227-268.

Dellal, A., Varliette, C., Owen, A., Chiriro, E. N. & Pialoux, V. 2012. Small-sided games versus interval training in amateur soccer players: effects on the aerobic capacity and the ability to perform intermittent exercises with changes of direction. Journal of Strength and Conditioning Research 26 (10), 2712-2720.

Di Salvo, V., Pigozzi, F., Gonzalez-Haro, C., Laughlin, M. S. & De Witt, J. K. 2013. Match performance comparison in top English soccer leagues. International Journal of Sports Medicine 34 (6), 526-532.

Durand-Bush, N. & Salmela J. H. 2001. The development of talent in sport. In R. N. Singer, H. A. Hausenblas & C. M. Janelle (Eds) Handbook of sport psychology. (2nd ed.) New York: Wiley, 269-289.

Durand-Bush, N. & Salmela J. H. 2002. The development and maintenance of expert athletic performance: perceptions of world and Olympic champions. Journal of Applied Sport Psychology 14, 154-171.

Elferink-Gemser, M. T. 2005. Today's talented youth field hockey players, the stars of tomorrow? A study of talent development in field hockey. Groningen Studies in Sport Sciences 1. Groningen: University of Groningen.

Elferink-Gemser, M. T., Visscher, C., Richart, H. & Lemmink, K. A. P. M. 2004. Development of the Tactical Skills Inventory for Sports. Perceptual and Motor Skills 99, 883-895.

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.

Fabrigar, L. R., Wegener, D. T., MacCallum, R. C. & Strahan, E. J. 1999. Evaluating the use of exploratory factor analysis in psychological research. Psychological Methods 4 (3), 272-299.

Feltz, D. L. & Brown, E. W. 1984. Perceived competence in soccer skills among young soccer players. Journal of Sport and Exercise Psychology 6, 385-394.

FIFA. 2007. FIFA Big count 2006. FIFA communication Divisions.

Figueiredo, A. J., Goncalves, C. E., Coelho e Silva, M. J. & Malina R. M. 2009. Characteristics of youth soccer players who drop out, persist or move up. Journal of Sports Sciences 27 (9), 883-891.

Ford, P. R., Carling, C., Garces, M., Margues, M., Miguel, C., Farrant, A., Stenling, A., Moreno, J., le Gall, F., Holmström, S., Salmela, J. H. & Williams, M. 2012. The developmental activities of elite soccer players under-16 years from Brazil, England, France, Ghana, Mexico, Portugal and Sweden. Journal of Sports Sciences 30 (15), 1653-1663.

Ford, P. R., Ward, P, Hodges N. J. & Williams, M. 2009. The role of deliberate practice and play in career progression in sport: the Early engagement hypothesis. High Ability Studies 20 (1), 65-75.

Ford, P. R. & Williams, A. M. 2012. The Developmental activities engaged in by elite youth soccer players who progressed to professional status compared to those who did not. Psychology of Sport and Exercise 13, 349-352.

Fox, K. R. & Corbin, C. B. 1989. The Physical Self-Perception Profile: Development and preliminary validation. Journal of Sport and Exercise Psychology 11, 408-430.

Gil, S., Ruiz, F., Irazusta, A., Gil, J. & Irazusta, J. 2007. Selection of young soccer players in terms of anthropometric and physiological factors. Journal of Sports Medicine and Physical Fitness 47 (1), 25-32.

Gillet, N., Berjot, S. & Rosnet, E. 2009. A motivational model of performance in the sport domain. European Journal of Sport Science 9 (3), 151-158.

Gonaus, C. & Müller, E. 2012. Using physiological data to predict future career progression in 14- to 17-year-old Austrian soccer academy players. Journal of Sports Sciences 30 (15), 1673-1682.

Gould, D., Dieffenbach, K. & Moffett, A. 2002. Psychological characteristics and their development in Olympic champions. Journal of Applied Sport Psychology 14, 172-204.

Gould, D. & Maynard, I. W. 2009. Psychological preparation for the Olympic Games. Journal of Sports Sciences, 27 (13), 1393-1408.

Greenwood, D., Davids, K. & Renshaw, I. 2014. Experiential knowledge of expert coaches can help identify informational constraints on performance of dynamic interceptive actions. Journal of Sports Sciences 32 (4), 328-35.

Gréhaigne, J. F. & Godbout, P. 1995. Tactical knowledge in team sports from a constructivist and cognitivist perspective. Quest 47, 490-505.

Gulbin, J. P., Croser, M. J., Morley E. J. & Weissensteiner, J. R. 2013. An integrated framework for the optimisation of sport and athlete development: a practitioner approach. Journal of Sports Sciences 31 (12), 1319-1331.

Güllich, A. 2013. Selection, de-selection and progression in German soccer talent promotion. European Journal of Sport Science 14 (6), 530-537.

Güllich, A. & Emrich, E. 2012. Individualistic and collectivistic approach in athlete support programmes in the German high-performance sport system. European Journal for Sport and Society 9 (4), 243-268.

Harter, S. 1978. Effectance motivation reconsidered toward a developmental model. Human Development 21 (1), 34-64.

Harter, S. 1982. The perceived competence scale for children. Child Development 53 (1), 87-97.

Harter, S. 1985. Manual for the self-perception profile for children. Denver: University of Denver.

Harter, S. 2012. Construction of the self: Developmental and sociocultural foundations. New York: Guilford.

Haugaasen, M. & Jordet, G. 2012. Developing soccer expertise: a soccer-specific research review. International Review of Sport and Exercise Psychology 5 (2), 177-201.

Haugaasen, M., Toering, T. & Jordet, G. 2014a. From childhood to senior professional soccer: A multi-level approach to elite youth soccer players' engagement in soccer-specific activities. Psychology of Sport and Exercise 15, 336-344.

Haugaasen, M., Toering, T. & Jordet, G. 2014b. From childhood to senior professional soccer: elite youth players' engagement in non-soccer activities. Journal of Sports Sciences 32 (20), 1940-1949.

Helgerud, J., Engen, L. C., Wisloff, U. & Holt, J. 2001. Aerobic endurance training improves soccer performance. Medicine and Science in Sports and Exercise 33 (11), 1925-1931.

Helgerud, J., Rocas, G., Kemi, O. J. & Hoff, J. 2011. Strength and endurance on elite soccer players. International Journal of Sports Medicine 32 (9), 677-682.

Helsen, W. F., Baker, J., Michiels, S., Schorer, J., Van Winckel, J. & Williams, A. M. 2012. The relative age effect in European professional soccer: did ten years of research make any difference? Journal of Sports Sciences 30 (15), 1665-1671.

Helsen, W. F., Hodges, N. J., Van Winckel, J. & Starkes, J. L. 2000. The roles of talent, physical precocity and practice in the development of soccer expertise. Journal of Sports Sciences 18 (9), 727-736.

Hill-Haas, S. V., Dawson, B., Impellizzeri, F. M. & Coutts, A. J. 2011. Physiology of small-sided games training in soccer: a systematic review. Sports Medicine 41 (3), 199-220.

Hirose, N. 2009. Relationship among birth-month distribution, skeletal age and anthropometric characteristics in adolescent elite soccer players. Journal of Sports Sciences 27 (11), 1159-1166.

Holt, N. L. & Dunn, J. G. H. 2004. Toward a grounded theory of the psychosocial competencies and environmental conditions associated with soccer success. Journal of Applied Sport Psychology 16, 199-219.

Hopper, C., Guthrie, G. D. & Kelly, T. 1991. Self-concept and skill development in youth soccer players. Perceptual and Motor Skills 72, 275-285.

Horn, T. S. 2004. Developmental perspectives on self-perceptions in children and adolescents. In M. R. Weiss (Ed) Developmental sport and exercise psychology: A lifespan perspective. Morgantown, WV: Fitness Information Technology, 101-143.

Horn, T. S. & Amorose, A. J. 1998. Sources of competence information. In J. L. Duda (Ed) Advances in sport and exercise psychology measurement. Morgantown, WV: Fitness Information Technology, 49-63.

Hornig, M., Aust, F. & Güllich, A. 2016. Practice and play in the development German top-level professional soccer players. European Journal of Sport Science 16 (1), 96-105.

Hosmer, D. W. & Lemenshow, S. 1989. Applied logistic regression. New York: Wiley & Sons.

Howe, M. J. A., Davidson, J. W. & Sloboda, J. A. 1998. Innate talents: Reality or myth? Behavioral and Brain Sciences 21 (3), 399-442.

Huijgen, B. C, Elferink-Gemser M. T., Ali, A. & Visscher C. 2013. Soccer skill development in talented players. International Journal of Sports Medicine 34, 720-726.

Huijgen, B. C, Elferink-Gemser, M. T., Lemmink, K. A. P. M. & Visscher, C. 2014. Multidimensional performance characteristics in selected and deselected talented soccer players. European Journal of Sport Science 14 (1), 1-9.

Huijgen, B. C, Elferink-Gemser M. T., Post, W. & Visscher C. 2009. Soccer skill development in professionals. International Journal of Sports Medicine 30, 585-591.

Huijgen, B. C, Elferink-Gemser M. T., Post, W. & Visscher C. 2010. Development of dribbling in talented youth soccer players aged 12-19 years: A longitudinal study. Journal of Sports Sciences 28 (7), 689-698.

IBM Corporation 2012. Statistics for Windows Version 21.0. Armonk, NY: IBM Corp.

Jacobs, J., Hyatt, S., Eccles, J. S., Osgood, D. W. & Wigfield, A. 2002. Changes in children's self-competence and values: gender and domain differences across grades one through twelve. Child Development 73 (2), 509-527.

Jõesaar, H., Hein, V. & Hagger, M. S. 2011. Peer influence on young athletes' need satisfaction, intrinsic motivation and persistence in sport: A 12-month prospective study. Psychology of Sport and Exercise 12 (5), 500-508.

Kannekens, R., Elferink-Gemser, M. T., & Visscher, C. 2009. Tactical skills of world-class youth soccer teams. Journal of Sports Sciences 27 (8), 807-812.

Kannekens, R., Elferink-Gemser M. T. & Visscher C. 2011. Positioning and deciding: Key factors for talent development in soccer. Scandinavian Journal of Medicine and Science in Sports 21, 846-852.

Kaplan, T., Erkmen, N. & Taskin, H. 2009. The evaluation of the running speed and agility performance in professional and amateur soccer players. Journal of Strength and Conditioning Research 23 (3), 774-778.

Koklu, Y., Asci, A., Kocak, F. U., Alemdaroglu, U. & Dundar, U. 2011. Comparison of the physiological responses to different small-sided games in elite young soccer players. Journal of Strength and Conditioning Research 25 (6), 1522-1528.

Law, M., Côté, J. & Ericsson, K.A. 2007. Characteristics of expert development in rhythmic gymnastics: A retrospective study. International Journal of Sport and exercise Psychology 5, 82-103.

le Gall, F., Carling, C., Williams, M. & Reilly, T. 2010. Anthropometric and fitness characteristics of international, professional and amateur male graduate soccer players from an elite youth academy. Journal of Science and Medicine in Sport 13 (1), 90-95.

Lintunen, T. 1987. Perceived physical competence scale for children. Scandinavian Journal of Sports Science 9 (3), 57-64.

Little, R. & Rubin, D. 2002. Statistical analysis with missing data. New York: Wiley.

Liu, H., Gomez, M. A., Lago-Peñas, C. & Sampaio, J. 2015. Match statistics related to winning in the group stage of 2014 Brazil FIFA World Cup. Journal of Sports Sciences 33 (12), 1205-1213.

Liu, N.Y., Plowman, S.A. & Looney, M.A. 1992. The reliability and validity of the 20-meter shuttle test in American students 12 to 15 years old. Research Quarterly for Exercise and Sport 63 (4), 360-365.

MacNamara, Á., Button, A. & Collins, D. 2010a. The role of psychological characteristics in facilitating the pathway to elite performance. Part 1: Identifying mental skills and behaviors. The Sport Psychologist 24, 52-73.

MacNamara, Á., Button, A. & Collins, D. 2010b. The role of psychological characteristics in falicitating the pathway to elite performance. Part 2: Examining environmental and stage related differences in skills and behaviors. The Sport Psychologist 24, 74-96.

MacNamara, A. & Collins, D. 2011. Development and initial validation of the psychological characteristics of developing excellence questionnaire. Journal of Sports Sciences 29 (12), 1273-1286.

MacNamara, A. & Collins, D. 2013. Do mental skills make champions? Examining the discriminant fuction of the psychological characteristics of developing excellence questionnaire. Journal of Sports Sciences 31 (7), 736-744.

Mahoney, M. J, Cabriel, T. J. & Perkins, T. S. 1987. Psychological skills and exceptional athletic performance. The Sport Psychologist 1, 181-199.

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

Malina, R., Bouchard, C. & Bar-Or, O. 2004a. Growth, maturation, and physical activity. (2nd ed.) Champaign, IL: Human Kinetics.

Malina, R. M., Cumming, S. P., Kontos, A. P., Eisenmann, J. C., Ribeiro, B. & Aroso, J. 2005. Maturity-associated variation in soccer-specific skills of youth soccer players aged 13-15 years. Journal of Sports Sciences 23 (5), 515-522.

Malina, R. M., Eisenmann, J. C., Cumming, S. P., Ribeiro, B. & Aroso, J. 2004b. Maturity-associated variation in the growth and functional capacities of young soccer players 13-15 years. European Journal of Applied Physiology 91 (5-6), 555-562.

Malina, R. M., Pena Reyes, M. E., Eisenmann, J. C., Horta, L., Rodriquez, J. & Miller, R. 2000. Height, mass and skeletal maturity of elite Portuguese soccer players aged 11-16 years. Journal of Sports Sciences 41 (5), 685-693.

Malina, R. M., Ribeiro, B., Aroso, J. & Cumming, S. P. 2007. Characteristics of youth soccer players aged 13-15 years classified by skill level. British Journal of Sports Medicine 41 (5), 290-295.

Marsh, H. W., Richards, G., Johnson, S., Roche, L. & Tremayne, P. 1994. Physical Self Description Questionnaire: Psychometric properties and a multitrait-multimethod analysis of relations to existing instruments. Journal of Sport and Exercise Psychology 16, 270–305.

McCarthy, P. J., Jones, M. V. & Clark-Carter, D. 2008. Understanding enjoyment on youth sport: A developmental perspective. Psychology of Sport and Exercise 9, 142-156.

McPherson, S. L. 1994. The development of sport expertise – mapping the tactical domain. Quest 46 (2), 223-240.

McPherson, S. L. & Kernodle, M. W. 2003. Tactics, the neglected attribute of expertise. Problem presentations and performance skills in tennis. In J. L. Starkes & K. A. Ericsson (Eds) Expert performance in sports: advances in research on sport expertise. Champaign, IL: Human Kinetics, 137-167.

Meckel, Y., Gefen, Y., Nemet, D. & Eliakim, A. 2012. Influence of short vs. long repetition sprint training on selected fitness components in young soccer players. Journal of Strength and Conditioning Research 26 (7), 1845-1851.

Memmert, D., Baker, J. & Bertsch, C. 2010. Play and practice in the development of sport-specific creativity in team ball sports. High Ability Studies 21 (1), 3-18.

Meylan C., Cronin J., Oliver J. & Hughes, M. 2010. Reviews: Talent identification in soccer: The role of maturity status on physical, physiological and technical characteristics. International Journal of Sports Science and Coaching 5 (4), 571-592.

Meylan, C. & Malatesta, D. 2009. Effects on in-season plyometric training within soccer practice on explosive actions of young players. Journal of Strength and Conditioning Research 23 (9), 2605-2613.

Michailidis, Y. 2015. Effect of plyometric training on athletic performance in preadolescent soccer players. Journal of Human Sport & Exercise 10 (1), 15-23.

Mirkov, D., Nedeljkovic, A., Kukolj, M., Ugarkovic, D. & Jaric, S. 2008. Evaluation of the reliability of soccer-specific field tests. Journal of Strength and Conditioning Research 22 (4), 1046-1050.

Mohr, M., Krustrup, P. & Bangsbo, J. 2003. Match performance of high-standard soccer players with special reference to development of fatigue. Journal of Sports Sciences 21 (7), 519-528.

Moir, G., Button, C., Glaister, M. & Stone, M. H. 2004. Influence of familiarization on the reliability of vertical jump and acceleration sprinting performance in physically active men. Journal of Strength and Conditioning Research 18 (2), 276-280.

Morris, T. 2000. Psychological characteristics and talent identification in soccer. Journal of Sports Sciences 18, 715-726.

Mujika, J., Santisteban, J. & Castagna, C. 2009a. In-season effect of short-term sprint and power training programs on elite junior soccer players. Journal of Strength and Conditioning Research 23 (9), 2581-2587.

Mujika, J., Vaeyens, R., Matthys, S. P., Santisteban, J., Goiriena, J. & Philippaerts, R. 2009b. The relative age effect in a professional soccer club setting. Journal of Sports Sciences 11 (27), 1153-1158.

Musch, J. & Grondin, S. 2001. Unequal competition as an impediment to personal development: A review of the relative age effect in sport. Developmental Review 21, 147-167.

Muthén, L. & Muthén, B. 1998–2013. Mplus user's guide sixth edition. Los Angeles, CA: Muthén & Muthén.

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

Ntoumanis, N. 2001. Empirical links between achievement goal theory and self-determination theory in sport. Journal of Sport Sciences 19 (6), 397-409.

Ntoumanis, N. 2002. Motivational clusters in a sample of British physical education classes. Psychology of Sport and Exercise 3 (3), 177-194.

Ntoumanis, N. & Biddle, S. J. 1999. A review of motivational climate in physical activity. Journal of Sports Sciences 17 (8), 643-665.

Nunnally, J. C. & Bernstein, I. H. 1994. Psychometric theory. New York: McGraw-Hill.

O'Dea, J. A. & Abraham, S. 1999. Association between self-concept and body weight, gender and pubertal development among female and male adolescent. Adolescence 34 (133), 69-79.

Papaioannou, A., Bebetsos, E., Theodorakis, Y., Christodoulidis, T. & Kouli, O. 2006. Causal relationships of sport and exercise involvement with goal orientations, perceived competence and intrinsic motivation in physical education: A longitudinal study. Journal of Sports Sciences 24 (4), 367–382.

Pelletier, L. G., Fortier, M. S., Vallerand, R. J. & Briere, N. M. 2001. Associations among perceived autonomy support, forms of self-regulation, and persistence: a prospective study. Motivation and Emotion 25 (4), 279-306.

Pelletier, L. G., Fortier, M. S., Vallerand, R. J., Tuson, K. M., Briere, N. M. & Blais, M. R. 1995. Toward a new measure of intrinsic motivation, extrinsic

motivation, and amotivation in sports: the sport motivation scale (SMS). Journal of Sport and Exercise Psychology 17 (1), 35-53.

Philippaerts, R. M., Vaeyens, R., Janssens, M., Van Renterghem, B., Matthys, D., Craen, R., Bourgois, J., Vrijens, J., Beunen, G. & Malina, R. M. 2006. The relationship between peak height velocity and physical performance in youth soccer players. Journal of Sports Sciences 24 (3), 221-230.

Phillips, E., Davids, K., Renshaw, I. & Portus, M. 2010. Expert performance in sport and the dynamics of talent development. Sports Medicine 40 (4), 271-283.

Piaget, J. 1952. The origins of intelligence in children. New York: International Universities Press.

Rampinini, E., Impellizzeri, F. M., Castagna, C., Coutts, A. J. & Wisloff, U. 2009a. Technical performance during soccer matches of the Italian Serie A league: effect of fatigue and competitive level. Journal of Science and Medicine in Sport 12 (1), 227-233.

Rampinini, E., Sassi, A., Morelli, A., Mazzoni, S., Fanchini, M. & Coutts, A. J. 2009b. Repeated-sprint ability in professional and amateur soccer players. Applied Physiology, Nutrition, and Metabolism = Physiologie Appliquee, Nutrition et Metabolisme 34 (6), 1048-1054.

Rankinen, T., Bray, M. S., Hagberg, J. M., Pérusse, L., Roth, S. M., Wolfarth, B. & Bouchard, C. 2006. The human gene map for performance and health-related fitness phenotypes: the 2005 update. Medicine & Science in Sports and Exercise 38 (11), 1863-1888.

Rebelo, A., Brito, J., Maia, J., Coelho e Silva, M. J., Figueiredo, A. J., Bangsbo, J., Malina, R. M. & Seabra, A. 2013. Anthropometric characteristics, physical fitness and technical performance of under-19 soccer players by competitive level and field position. International Journal of Sports Medicine 34 (4), 312-317.

Reilly, T. 2005. An ergonomics model of the soccer training process. Journal of Sports Sciences 23 (6), 561-572.

Reilly, T., Bangsbo J. & Franks A. 2000a. Anthropometric and physiological predispositions for elite soccer. Journal of Sports Sciences 18 (9), 669–683.

Reilly, T., Williams, A. M., Nevill, A. & Franks, A. 2000b. A multidisciplinary approach to talent identification in soccer. Journal of Sports Sciences 18 (9), 695-702.

Reinboth, M. & Duda, J. L. 2006. Perceived motivational climate, need satisfaction and indices of well-being in team sports: A longitudinal perspective. Psychology of Sport and Exercise 7, 269-286.

Roberts, G. C., Treasure, D. C. & Conroy, D. E. 2007. Understanding the dynamics of motivation in sport and physical activity: An achievement goal interpretation. In G. Tenenbaum & R. Eklund (Eds.) Handbook of sport psychology. (3rd ed) New York: Wiley, 3-30.

Roca, A., Williams, A. M. & Ford, P. R. 2012. Developmental activities and the acquisition of superior anticipation and decision making in soccer players. Journal of Sports Sciences 30 (15), 1643-1652.

Rodriquez, D., Wigfield, A. & Eccles, J. S. 2003. Changing competence perceptions, changing values: implications for youth sport. Journal of Applied Sport Psychology 15, 67-81.

Roesch, D., Hodgson, R., Peterson, T. L., Graf-Baumann, T., Junge, A., Chomiak, J. & Dvorak, J. 2000. Assessment and evaluation of soccer performance. The American Journal of Sports Medicine 28 (5S), S29-39.

Rumpf, M. C., Schneider, A. S. Schneider, C. & Mayer, H. M. 2014. Training profiles and motivation of male and female youth soccer players. International Journal of Sports Science and Coaching 9 (1), 207-216.

Ryckman, R. M., Robbins, M. A., Thornton, B. & Cantrell, P. 1982. Development and validation of a physical self-efficacy scale. Journal of Personality and Social Psychology 42 (5), 891-900.

Sarrazin, P., Boiché, J. C. S. & Pelletier, L. G. 2007. A self-determination theory approach to dropout in athletes. In M. Hagger & N. Chatzisarantis (Eds) Intrinsic motivation and self-determination in exercise and sport. Champaign, IL: Human Kinetics, 229-241.

Sarrazin, P., Vallerand, R., Guillet, E., Pelletier, L. & Cury, F. 2002. Motivation and dropout in female handballers: a 21-month prospective study. European Journal of Social Psychology 32 (3), 395-418.

Simon, H. A. & Chase, W. G. 1973. Skill in chess. American Scientist 61 (4), 394-403.

Soberlak, P. & Côté, J. 2003. The developmental activities of professional ice hockey players. Journal of Applied Sport Psychology 15 (1), 41–49.

Tabachnick, B. & Fidell, L. 2007. Using Multivariate Statistics. Boston: Allyn and Bacon.

Tanner, J. M., Whitehouse, R. H. & Takaishi, M. 1966. Standards from birth to maturity for height, weight, height velocity and weight velocity: British children. Archives of Disease in Childhood 41 (219), 454-471.

Thomas, K. T. & Thomas, J. R. 1994. Developing expertise in sport – the relation of knowledge and performance. International Journal of Sport Psychology 25, 295-312.

Ullrich-French, S. & Smith, A. L. 2009. Social and motivational predictors of continued youth sport participation. Psychology of Sport and Exercise 10, 87-95.

Vaeyens, R., Güllich, A., Warr, C. R. & Philippaerts, R. 2009. Talent identification and promotion programmes of Olympic athletes. Journal of Sports Sciences 27 (13), 1367-1380.

Vaeyens, R., Lenoir, M., Williams, A. M., Mazyn, L. & Philippaerts, R. M. 2007a. The effects of task constraints on visual search behavior and decision-making skill in youth soccer players. Journal of Sport & Exercise Psychology 29 (2), 147-169.

Vaeyens, R., Lenoir, M., Williams, M. & Philippaerts, R. M. 2008. Talent identification and development programmes in sport, current models and future directions. Sports Medicine 38 (9), 703-714.

Vaeyens, R., Malina, R. M., Janssens, M., Van Renrghem, B., Bourgois, J., Vrijens, J. & Philippaerts, R. M. 2006. A Multidisciplinary selection model for youth soccer: The Ghent Youth Soccer Project. British Journal of Sport Medicine 40, 928-34.

Valente-dos-Santos, J., Coelho-E-Silva, M. J., Duarte, J., Pereira, J., Rebelo-Golcalves, R., Figueiredo, A., Mazzuco, M. A., Sherar, L. B., Elferink-Gemser, M. T. & Malina R. M. 2014. Allometric multilevel modelling of agility and dribbling speed by skeletal age and playing position in youth soccer players. International Journal of Sports Medicine 35, 762-771.

Valente-dos-Santos, J., Coelho-E-Silva, M. J., Simoes, F., Figueiredo, A. J., Leite, N., Elferink-Gemser, M. T., Malina, R. M. & Sherar, L. 2012. Modeling developmental changes in functional capacities and soccer-specific skills in male players aged 11-17 years. Pediatric Exercise Science 24, 603-621.

Vandendriessche, J. B., Vaeyens, R., Vandorpe, B., Lenoir, M., Lefevre, J. & Philippaerts, R. M. 2012. Biological maturation, morphology, fitness, and motor coordination as part of a selection strategy in the search for international youth soccer players (age 15-16 years). Journal of Sports Sciences 30 (15), 1695-1703.

Van Yperen, N. W. 2009. Why some make it and others do not: Identifiying psychological factors that predict career success in professional adult soccer. The Sport Psychologist 23, 317-329.

Vlachopoulos, S. P. & Karageorghis, C. I. 2005. Interaction of external, introjected, and identified regulation with intrinsic motivation in exercise: relationship with exercise enjoyment. Journal of Applied Biobehavioral Research 10 (2), 113-132.

Vänttinen, T. 2013. Growth-associated variation in body size, hormonal status, physical performance characteristics and perceptual-motor skills in Finnish young soccer players, a two-year follow-up study in the U11, U13 and U15 age groups. Studies in Sport, Physical Education and Health 197. Jyväskylä: University of Jyväskylä.

Ward, P., Hodges, N. J., Williams, A. M. & Starkes, J. L. 2007. The road to excellence in soccer: A quasi-longitudinal approach to deliberate practice. High Ability Studies 18 (2), 119–153.

Ward, P. & Williams, A. M. 2003. Perceptual and cognitive skill development in soccer: the multidimensional nature of expert performance. Journal of Sport and Exercise Psychology 225, 93-111.

Weiss, M. R., Amorose, A. J. & Wilko, A. M. 2009. Coaching behaviors, motivational climate, and psychosocial outcomes among female adolescent athletes. Pediatric Exercise Science 21 (4), 475-492.

Weiss, M. R. & William, L. 2004. The why of youth sport involvement: A developmental perspective on motivational processes. In M. R. Weiss (Ed) Developmental sport and exercise psychology: A lifespan perspective. Morgantown, WV: Fitness Information Technology, 223-268.

White, S. A. 1993. The relationship between psychological skills, experience, and practice commitment among collegiate male and female skiers. The Sport Psychologist 7, 49-57.

Wichstrøm, L. 1995. Harter's self-perception profile for adolescents: reliability, validity, and evaluation of the question format. Journal of Personality Assessment 65 (1), 100-116.

Wiersma, L. D. 2001. Conceptualization and development of the sources of enjoyment in youth sport questionnaire. Measurement in Physical Education and Exercise Science 5 (3), 153–177.

Williams, A. M., Bell-Walker, J., Ward, P. & Ford, P. R. 2012. Perceptual-cognitive expertise, practice history profiles and recall performance in soccer. British Journal of Psychology 103 (3), 393-411.

Williams, M. & Davids, K. 1995. Declarative knowledge in sport – a by-product of experience or a characteristic of expertise. Journal of Sport and Exercise Psychology 17, 259-275.

Williams, A. M. & Ford, P. R. 2013. 'Game intelligence': Anticipation and decision making. In A. M. Williams (Ed), Science and soccer: Developing elite performers (3rd ed.). Oxon: Routledge.

Williams, J. M. & Krane, V. 2001. Psychological characteristics of peak performance. In J. M. Williams (Ed.) Applied sport psychology: Personal growth to peak performance. (4th ed.) Mountain View, CA: Mayfield, 137-147.

Williams, A. M. & Reilly, T. 2000. Talent identification and development in soccer. Journal of Sports Sciences 18 (9), 657-667.

APPENDICES

Appendix 1. Finnish version of the practice history questionnaire

Minkä ikäisenä aloitit jalkapallon pelaamisen?_____

HARJOITTELU JA PELAAMINEN KAUDELLA 2009-2010

Arvioi harjoitteluasi edellisen sarjakauden (kesä 2010) aikana:

(1) Lajiharjoitukset = joukkueen kanssa tehtävät lajiharjoitteet	n._____ kertaa viikossa n. _____ tuntia/ harjoitus
(2) Oheisharjoitukset = joukkueen kanssa tehtävät muut kuin lajiharjoitteet, kuten juoksu- tai voimaharjoitteet	n. _____ kertaa viikossa n. _____ tuntia/ harjoitus
(3) Omatoimiset lajiharjoitukset = joukkueharjoitusten ulkopuolella tapahtuva pallollinen harjoittelu ja pelaaminen	n. _____ kertaa viikossa n. _____ tuntia/ harjoitus
(4) Omatoimiset oheisharjoitukset = joukkueharjoitusten ulkopuolella tapahtuva muu kuin pallollinen harjoittelu	n. _____ kertaa viikossa n. _____ tuntia/ harjoitus
(5) Muiden lajien harjoitukset = muiden lajien liittyvä ohjattu harjoittelu harrastamiseen	n. _____ kertaa viikossa n. _____ tuntia/ harjoitus

Arvioi harjoitteluasi edellisen harjoituskauden (talvi 2009- 2010) aikana:

(1) Lajiharjoitukset = joukkueen kanssa tehtävät lajiharjoitteet	n._____ kertaa viikossa n. _____ tuntia/ harjoitus
(2) Oheisharjoitukset = joukkueen kanssa tehtävät muut kuin lajiharjoitteet, kuten juoksu- tai voimaharjoitteet	n. _____ kertaa viikossa n. _____ tuntia/ harjoitus
(3) Omatoimiset lajiharjoitukset = joukkueharjoitusten ulkopuolella tapahtuva pallollinen harjoittelu ja pelaaminen	n. _____ kertaa viikossa n. _____ tuntia/ harjoitus
(4) Omatoimiset oheisharjoitukset = joukkueharjoitusten ulkopuolella tapahtuva muu kuin pallollinen harjoittelu	n. _____ kertaa viikossa n. _____ tuntia/ harjoitus
(5) Muiden lajien harjoitukset = muiden lajien liittyvä ohjattu harjoittelu harrastamiseen	n. _____ kertaa viikossa n. _____ tuntia/ harjoitus

Kuinka monta peliä pelasit edellisellä kaudella (sarja- ja harjoituskausi 2009-2010)?

n._____ peliä/ kausi (sarjapelit, turnaukset yms.)

Kuinka pitkään pidit lomaa edellisen kauden (sarja- ja harjoituskausi 2009-2010) aikana:

Joukkueharjoittelusta n. _____ viikkoa
Omatoimisesta harjoittelusta n. _____viikkoa
Harjoittelusta loukkaantumisen takia n. _____viikkoa

HARJOITTELU JA PELAAMINEN KAUDELLA 2008-2009 (13-14-VUOTIAANA)

Arvioi harjoitteluasi kauden 2008-2009 aikana:

(1) Lajiharjoitukset = joukkueen kanssa tehtävät lajiharjoitteet	n._____ kertaa viikossa n. _____ tuntia/ harjoitus
(2) Oheisharjoitukset = joukkueen kanssa tehtävät muut kuin lajiharjoitteet, kuten juoksu- tai voimaharjoitteet	n. _____ kertaa viikossa n. _____ tuntia/ harjoitus
(3) Omatoimiset lajiharjoitukset = joukkueharjoitusten ulkopuolella tapahtuva pallollinen harjoittelu ja pelaaminen	n. _____ kertaa viikossa n. _____ tuntia/ harjoitus
(4) Omatoimiset oheisharjoitukset = joukkueharjoitusten ulkopuolella tapahtuva muu kuin pallollinen harjoittelu	n. _____ kertaa viikossa n. _____ tuntia/ harjoitus
(5) Muiden lajien harjoitukset = muiden lajien liittyvä ohjattu harjoittelu harrastamiseen	n. _____ kertaa viikossa n. _____ tuntia/ harjoitus
(6) Muiden lajien pihapelit = pihapelejä ja –leikkejä kavereiden kanssa	n. _____ kertaa viikossa n. _____ tuntia/ kerta

Kuinka monta peliä pelasit edellisen kauden 2008-2009 aikana?

n._____ peliä/ kausi

HARJOITTELU JA PELAAMINEN KAUDELLA 2007-2008 (12-13-VUOTIAANA)

Arvioi harjoitteluasi kauden 2007-2008 aikana:

(1) Lajiharjoitukset = joukkueen kanssa tehtävät lajiharjoitteet	n._____ kertaa viikossa n. _____ tuntia/ harjoitus
(2) Oheisharjoitukset = joukkueen kanssa tehtävät muut kuin lajiharjoitteet, kuten juoksu- tai voimaharjoitteet	n. _____ kertaa viikossa n. _____ tuntia/ harjoitus
(3) Omatoimiset lajiharjoitukset = joukkueharjoitusten ulkopuolella tapahtuva pallollinen harjoittelu ja pelaaminen	n. _____ kertaa viikossa n. _____ tuntia/ harjoitus
(4) Omatoimiset oheisharjoitukset = joukkueharjoitusten ulkopuolella tapahtuva muu kuin pallollinen harjoittelu	n. _____ kertaa viikossa n. _____ tuntia/ harjoitus
(5) Muiden lajien harjoitukset = muiden lajien liittyvä ohjattu harjoittelu harrastamiseen	n. _____ kertaa viikossa n. _____ tuntia/ harjoitus
(6) Muiden lajien pihapelit = pihapelejä ja –leikkejä kavereiden kanssa	n. _____ kertaa viikossa n. _____ tuntia/ kerta

Kuinka monta peliä pelasit edellisellä kauden 2007-2008 aikana?

n._____ peliä/ kausi

HARJOITTELU JA PELAAMINEN 10-12-VUOTIAANA

Arvioi harjoitteluasi 10-12-vuotiaana

(1) Lajiharjoitukset = joukkueen kanssa tehtävät lajiharjoitteet	n._____ kertaa viikossa n. _____ tuntia/ harjoitus
(2) Omatoimiset lajiharjoitukset = joukkueharjoitusten ulkopuolella tapahtuva pallollinen harjoittelu ja pelaaminen	n. _____ kertaa viikossa n. _____ tuntia/ harjoitus
(3) Muiden lajien harjoitukset = muiden lajien liittyvä ohjattu harjoittelu harrastamiseen	n. _____ kertaa viikossa n. _____ tuntia/ harjoitus
(4) Muiden lajien pihapelit = pihapelejä ja –leikkejä kavereiden kanssa	n. _____ kertaa viikossa n. _____ tuntia/ kerta

HARJOITTELU JA PELAAMINEN 6-9-VUOTIAANA

Arvioi harjoitteluasi 6-9-vuotiaana

(1) Lajiharjoitukset = joukkueen kanssa tehtävät lajiharjoitteet	n._____ kertaa viikossa n. _____ tuntia/ harjoitus
(2) Omatoimiset lajiharjoitukset = joukkueharjoitusten ulkopuolella tapahtuva pallollinen harjoittelu ja pelaaminen	n. _____ kertaa viikossa n. _____ tuntia/ harjoitus
(3) Muiden lajien harjoitukset = muiden lajien liittyvä ohjattu harjoittelu harrastamiseen	n. _____ kertaa viikossa n. _____ tuntia/ harjoitus
(4) Muiden lajien pihapelit = pihapelejä ja –leikkejä kavereiden kanssa	n. _____ kertaa viikossa n. _____ tuntia/ kerta

Appendix 2. Finnish version of Tactical Skills Inventory for Sports

Seuraavassa sinua pyydetään arvioimaan **omaa toimintaasi pelissä suhteessa oman ikäluokkasi huippupelaajiin.** Arvioi itseäsi asteikolla 1-6 (1= erittäin huono, 6 = erinomainen tai 1= en lähes koskaan, 6 = aina). Valitse jokaisesta kohdasta itseäsi parhaiten kuvaava vaihtoehto.

		1	2	3	4	5	6
1.	Päätökset, joita teen seuraavista tilanteista ovat yleensä						
2.	Tiedän, kuinka teen itseni pelattavaksi peleissä						
3.	Katkoni vastustajan keskityksistä ovat						
4.	Sijoittautumiseni peleissä on yleensä						
5.	Käsitykseni ympärillä olevista tapahtumista ja pelitilanteista pallollisena pelaajana tai kun omalla joukkueella on pallo, on						
6.	Ennakointikykyni pelissä on						
7.	Olen hyvä tekemään oikeita päätöksiä oikeilla hetkillä						
8.	Valmentajani mielestä pelikäsitykseni on						
9.	Vapaan paikan hakeminen ja sijoittautuminen on						
10.	Valmentajani mielestä sijoittautumiseni on						
11.	Arviointikykyni vastustajan pelistä on						
12.	Pallonriistoni ovat						
13.	Jos joukkueeni menettää pallon, vaihdan nopeasti puolustusrooliini						
14.	Reagoin nopeasti, kun joukkueeni saa pallon hallintaansa						
15.	Tiedän nopeasti, kuinka vastustaja pelaa						
16.	Tiedän tarkalleen, milloin minun pitää syöttää pallo joukkuekaverilleni ja milloin ei						
17.	Jos joukkueeni saa pallon, tiedän tarkalleen mitä minun tulee tehdä						
18.	Kun teen jonkin suorituksen tiedän jo tarkalleen mitä minä itse ja seuraava pelaaja voi tehdä seuraavaksi						
19.	Jos minulla on pallo, tiedän tarkalleen kenelle syötän						
20.	Olen tietoinen siitä, minne vastustajani ovat menossa, vaikka en näkisikään heitä						
21.	Olen tietoinen siitä, minne joukkuekaverini ovat menossa, vaikka en näkisikään heitä						
22.	Jos vastustaja saa pallon haltuunsa, tiedän tarkalleen mitä hän aikoo tehdä						

Appendix 3. Finnish version of Psychological Skills Inventory for Sports

Seuraavassa sinua pyydetään arvioimaan itseäsi suhteessa oman ikäluokkasi huippupelaajiin. Arvioi itseäsi asteikolla 1-5 (1= en lähes koskaan, 5 = lähes aina). Valitse jokaisesta kohdasta itseäsi parhaiten kuvaava vaihtoehto.

		1	2	3	4	5
1.	Olen todella motivoitunut pärjäämään lajissani hyvin					
2.	Joskus minulta puuttuu motivaatiota harjoitella					
3.	Voittaminen on erittäin tärkeää minulle					
4.	Tällä hetkellä tärkein asia elämässäni on pärjätä jalkapallossa					
5.	Jalkapallo on koko elämäni					
6.	Haluan harjoitella kovasti kuuluakseni jalkapallon parhaimmistoon					
7.	Jalkapallossa haluan tuoda esille parhaimmat puoleni pelaajana					
8.	Haluan menestyä jalkapallossa					
9.	Useimmissa otteluissa olen luottavainen, että suoriudun hyvin					
10.	Itseluottamukseni horjuu helposti					
11.	Pieni vamma/loukkaantuminen tai huono harjoittelu voi horjuttaa itseluottamustani					
12.	Minulla on usein epäilyksiä kyvyistäni					
13.	Kun suoritukseni alkavat mennä huonosti, itseluottamukseni tippuu nopeasti					
14.	Pystyn säilyttämään luottamukseni itseeni jopa huonojen suoritusten/ otteluiden aikana					
15.	Itseluottamukseni heittelee/vaihtelee paljon					
16.	Minulla on uskoa itseeni					
17.	Minulla on usein ongelmia keskittyä ottelun aikana					
18.	Minulla on pelin aikana jaksoja, jolloin suoritukseni ovat harvinaisen hyviä					
19.	Kun pelini ei kulje, keskittymiseni heikkenee					
20.	Ottelun aikana ympärillä olevien ihmisten kommentit häiritsevät minua					
21.	Ottelun alussa minulla on vaikeuksia unohtaa asioita, joita olin tekemässä aiemmin					
22.	Ottelun aikana muut häiritsevät minua/ vievät huomioni					
23.	Pystyn keskittymään paremmin vaikeaan otteluun kuin helppoon otteluun					
24.	Usein unelmoin otteluista					
25.	Harjoittelen ottelua päässäni usein ennen ottelua					
26.	Kun harjoittelen ottelua mielessäni, näen itseni pelaamassa ikään kuin katsoisin videota					
27.	Kun valmistaudun otteluun, yritän kuvitella miltä se tuntuu lihaksissani					
28.	Kun suljen silmäni, voin kuvitella miltä lihakseni tuntuvat					
29.	Valmistaudun otteluun muodostamalla mielikuvan suorituksestani					

Appendix 4. Finnish version of The Perceived Game-Specific Soccer Competence Scale

Seuraavassa sinua pyydetään arvioimaan itseäsi suhteessa oman ikäluokkasi huippupelaajiin. Arvioi itseäsi asteikolla 1-5 (1= en lähes koskaan, 5 = lähes aina). Valitse jokaisesta kohdasta itseäsi parhaiten kuvaava vaihtoehto.

		1	2	3	4	5
1.	Minulla on hyvä ”tatsi” palloon					
2.	Uskallan pitää palloa itselläni ahtaissakin paikoissa					
3.	Minulla on selkeät ratkaisumallit, miten voitan 1 vs. 1 tilanteet					
4.	Minulla on selkeät ratkaisumallit, miten teen maalin eri tilanteissa peleissä					
5.	Osaan liikkua kentällä tyhjään tilaan oikeaan aikaan niin, että minulle voi syöttää					
6.	Löydän pelikaverini terävillä ja tarkoilla syötöilläni					
7.	Osaan sijoittua puolustuspelissä niin, että huomioin pallon, pelikaverini ja lähimmän vastustajan					
8.	Ehdin usein pallolle ensimmäisenä					
9.	Pääsen helposti irti vastustajastani eri pelitilanteissa					
10.	Kaksinkamppailuissa tunnen olevani vahva					
11.	1 vs. 1 tilanteissa olen vastustajaani vahvempi/ nopeampi					
12.	Osaan toteuttaa pelipaikkani mukaista peliä hyökkäyspelissä					
13.	Tiedän, miten pelikaverini liikkuvat hyökkäystilanteissa ja minun on helppo syöttää heille					
14.	Osaan ratkaista/luoda pelitilanteita yhdessä 1-2 pelikaverini kanssa					
15.	Osaan liikkua pelattavaksi hyökkäyspelissämme pelitapamme mukaisesti niin, että minulle on helppo syöttää					
16.	Osaan toteuttaa pelipaikkani mukaista peliä puolustuspelissä					
17.	Pystyn tarvittaessa auttamaan/ tukemaan pelikavereitani puolustustilanteissa					
18.	Osaan ajoittaa omaa tekemistäni oikein hyökkäys- ja puolustuspelissä					

Appendix 5. English version of the practice history questionnaire

At what age did you start playing soccer? _____

PRACTICE AND PLAY ACTIVITIES DURING SEASON 2009-2010

Evaluate your practice activities during competitive season (summer 2010).

(1) Soccer practice with the team = soccer drills and exercises done with the team	_____ times per week _____ hours per practice session
(2) Other practice with the soccer team= other drills and exercises done with the team, for instance sprint and strength exercises	_____ times per week _____ hours per practice session
(3) Individual soccer practice and play = soccer drills and exercises, and soccer play done with your own time	_____ times per week _____ hours per practice session
(4) Other individual practices = other drills and exercises done with your own time	_____ times per week _____ hours per practice session
(5) Formal practices of other sports	_____ times per week _____ hours per practice session

Evaluate your practice activities during practice season (winter 2009-2010).

(1) Soccer practice with the team = soccer drills and exercises done with the team	_____ times per week _____ hours per practice session
(2) Other practice with the soccer team= other drills and exercises done with the team, for instance sprint and strength exercises	_____ times per week _____ hours per practice session
(3) Individual soccer practice and play = soccer drills and exercises, and soccer play done with your own time	_____ times per week _____ hours per practice session
(4) Other individual practices = other drills and exercises done with your own time	_____ times per week _____ hours per practice session
(5) Formal practices of other sports	_____ times per week _____ hours per practice session

How many games did you play during last season (competitive and practice season 2009-2010)?

_____ games/ season (serial matches, tournaments, etc.)

How many weeks did you have holiday from soccer practice during last season (competitive and practice season 2009-2010)?

From team practice_____weeks
From individual practice and play_____weeks
From practice due to injury_____weeks

PRACTICE AND PLAY ACTIVITIES DURING SEASON 2008-2009 (13-14 years of age)

Evaluate your practice activities during season 2008-2009

(1) Soccer practice with the team = soccer drills and exercises done with the team	_____ times per week _____ hours per practice session
(2) Other practice with the soccer team= other drills and exercises done with the team, for instance sprint and strength exercises	_____ times per week _____ hours per practice session
(3) Individual soccer practice and play = soccer drills and exercises, and soccer play done with your own time	_____ times per week _____ hours per practice session
(4) Other individual practices = other drills and exercises done with your own time	_____ times per week _____ hours per practice session
(5) Formal practices of other sports	_____ times per week _____ hours per practice session
(6) Informal play activities of other sports = play activities of other sports than soccer done with your own time	_____ times per week _____ hours per practice session

How many games did you play during season 2008-2009 (competitive and practice season)?

_____ games/ season (serial matches, tournaments, etc.)

PRACTICE AND PLAY ACTIVITIES DURING SEASON 2007-2008 (12-13 years of age)

Evaluate your practice activities during season 2007-2008

(1) Soccer practice with the team = soccer drills and exercises done with the team	_____ times per week _____ hours per practice session
(2) Other practice with the soccer team= other drills and exercises done with the team, for instance sprint and strength exercises	_____ times per week _____ hours per practice session
(3) Individual soccer practice and play = soccer drills and exercises, and soccer play done with your own time	_____ times per week _____ hours per practice session
(4) Other individual practices = other drills and exercises done with your own time	_____ times per week _____ hours per practice session
(5) Formal practices of other sports	_____ times per week _____ hours per practice session
(6) Informal play activities of other sports = play activities of other sports than soccer done with your own time	_____ times per week _____ hours per practice session

How many games did you play during season 2007-2008 (competitive and practice season)?

_____ games/ season (serial matches, tournaments, etc.)

PRACTICE AND PLAY ACTIVITIES AT AGES BETWEEN 10 AND 12

Evaluate your practice activities at the age between 10 and 12

(1) Soccer practice with the team = soccer drills and exercises done with the team	_____ times per week _____ hours per practice session
(2) Individual soccer practice and play = soccer drills and exercises, and soccer play done with your own time	____ times per week _____ hours per practice session
(3) Formal practices of other sports	_____ times per week _____ hours per practice session
(4) Informal play activities of other sports = play activities of other sports than soccer done with your own time	_____ times per week _____ hours per practice session

PRACTICE AND PLAY ACTIVITIES AT AGES BETWEEN 6 AND 9

Evaluate your practice activities at the age between 6 and 9

(1) Soccer practice with the team = soccer drills and exercises done with the team	_____ times per week _____ hours per practice session
(2) Individual soccer practice and play = soccer drills and exercises, and soccer play done with your own time	_____ times per week _____ hours per practice session
(3) Formal practices of other sports	_____ times per week _____ hours per practice session
(4) Informal play activities of other sports = play activities of other sports than soccer done with your own time	_____ times per week _____ hours per practice session

Appendix 6. Parental consent (studies I, II) in Finnish

Suostumus tutkimukseen pelaajan kehittymiseen vaikuttavista tekijöistä joukkuepalloilussa

Kansainväliset sopimukset ihmisillä tehtävistä tutkimuksista edellyttävät, että tutkimuksiin osallistuville selvitetään mittauksiin ja testeihin liittyvät riskit ja hyödyt, ja että tutkittavat antavat kirjallisen suostumuksensa tutkimukseen osallistumisesta. Myös henkilökohtaisten tietojen keräämiseen, rekisteröintiin ja julkaisemiseen tarvitaan henkilötietolain mukaan ko. henkilön kirjallinen suostumus.

Kilpa- ja huippu-urheilun tutkimuskeskuksessa (KIHU) tehdään jatkuvasti tutkimuksia, joissa ammattitaitoiset työntekijät mittaavat urheilijoiden ja muiden tutkittavien fysiologisia, biomekaanisia ja psykologisia muuttujia levon ja kuormituksen aikana. KIHU on vakuuttanut tutkittavat ja tutkijat mittaustapahtumiin liittyvien ulkoisten syiden aiheuttamien tapaturmien, vahinkojen ja vammojen varalta. Tutkittavalla on kuitenkin suotavaa olla oma henkilökohtainen tapaturma/sairaus- ja henkivakuutus, koska vakuutusyhtiöt eivät myönnä tutkimusprojekteja varten täysin kattavaa vakuutusturvaa esim. sairauskohtauksia ja äkillisen ponnistuksen aiheuttamia lihas- tai jännevammoja varten. Osallistuminen mittauksiin on täysin vapaaehtoista ja tutkittava voi kieltäytyä mistä tahansa kokeista ja mittauksista, ja hän saa keskeyttää kokeen milloin tahansa. Mittaushenkilökunnalla on koulutus, ohjeistus ja välineistö tapaturmien ja sairaskohtausten ensiapuun. Mittaajat selvittävät ennen kutakin mittausta tarkemmin suoritusohjeet ja testin turvalliseen suorittamiseen liittyvät seikat. Mittaushenkilökunta antaa tarvittaessa lisätietoa testeihin liittyvistä riskeistä ja niistä saatavasta hyödystä. Tutkijat raportoivat mittauksista suoraan tutkimuksiin osallistuville henkilöille näiden kanssa sovituilla tavoilla, sekä tieteellisissä ja valmennuksellisissa julkaisuissa siten, että yksityiseen henkilöön identifioitavissa olevia tietoja ei julkaista. Tutkimuksesta saatavaa tietoa voidaan edelleen käyttää hyväksi harjoitusmenetelmien kehittämisessä ja urheilusuoritusten parantamisessa. Vastuullinen tutkija vastaa kerätyn aineiston turvallisesta säilyttämisestä.

Väitöskirjatutkimus – pelaajan kehittymiseen vaikuttavia tekijöitä

Tämän tutkimuksen tavoitteena on selvittää pelaajan kehittymiseen vaikuttavia tekijöitä joukkuepalloilussa. Tutkimuksen tavoitteena on antaa käytännönläheistä tietoa suomalaisesta valmennuksesta ja suomalaisten junioripelaajien ominaisuuksista, harjoittelusta ja kehittymisestä. Tutkimukseen on valittu 12-14 seurajoukkuetta jalkapallosta, jääkiekosta ja koripallosta. Tutkimus on osa laajempaa KIHU:n nuorisourheilututkimusta.

Tutkimus antaa koko suomalaiselle palloiluvalmennukselle kokonaisvaltaista tietoa pelaajien ominaisuuksista, harjoittelusta ja kehittymisestä. Tulosten perusteella voimme ohjata suomalaista juniorivalmennusta oikeaan suuntaan ja kehittää pelaajiamme laadukkaammin. Tutkimuksen tuloksia julkaistaan kansallisissa ja kansainvälisissä julkaisuissa sekä käytetään hyväksi Suomen Urheiluopiston ja mukana olevien lajiliittojen valmennuksen ja valmentajakoulutuksen kehittämisessä.

Tutkimuksen hyödyt pelaajalle ja valmentajalle

Tutkimus antaa yksittäiselle joukkueelle, pelaajalle ja valmentajalle arvokasta tietoa pelaajien kehittymisestä sekä harjoittelun laadusta ja määrästä suhteessa muihin suomalaisiin pelaajiin. Tutkimukseen osallistuva pelaaja saa vastineeksi tutkimukseen osallistumisesta käyttöönsä omat testituloksensa sekä yhteenvedon harjoittelustaan ja kehittymisestään tutkimuksen aikana suhteessa muihin samanikäisiin pelaajiin suomessa.

Suostumus testitilaisuuteen osallistumiseen

Tutkimukseen valittujen seurajoukkueiden pelaajat osallistuvat urheilussa yleisesti käytettyihin taito- ja fysiikkatesteihin sekä lomakyselyihin. Testit toteutetaan seurajoukkueen omassa harjoitusympäristössä loka-joulukuussa 2010. Tutkijoilla on kokemusta testien toteuttamisesta ja he ovat ammattilaisia asiassa.

Tutkimuksessa tehtävät mittaukset:

- pituus, paino
- lajitaitotestit
- liikkuvuustestit
- voimantuotto/nopeus/ketteryystestit
- maksimaalinen kestävyystesti (piip-testi)
- lomakkeet: pelaaja- ja valmentaja-arviointi, harjoitushistoria ja harjoittelun seuranta

Olen tutustunut suoritettaviin testeihin ja mittauksiin, ja olen ymmärtänyt mittausten tarkoituksen ja niihin liittyvät riski- ja hyötynäkökohdat. Voin kuitenkin halutessani keskeyttää kokeen tai kieltäytyä mittauksista tai harjoittelusta missä tutkimuksen vaiheessa tahansa.

Tällä lomakkeella vahvistan, että…

- Suostun yllämainitun projektin mittauksiin annettujen ohjeiden mukaisesti
- Annan luvan tulosteni käyttöön tutkimuksen raportoinnissa
- Annan luvan tulosteni säilyttämiseen KIHUn tutkimusrekistereissä
- Annan luvan tulosteni lähettämiseen henkilökohtaiselle ja liiton valmentajalle
- Annan luvan tulosteni käyttöön tuotekehitystoiminnassa
- Annan luvan mittausten yhteydessä otetun video/valokuvani käyttöön tutkimuksen kirjallisessa ja suullisessa raportoinnissa

Yhteystiedot:

Pelaajan nimi: _____

Huoltajan nimi:_____

Huoltajan puhelinnumero:_____

Paikka ja aika_____ Huoltajan allekirjoitus _____

Tutkimuksen vastuullinen tutkija

Hannele Forsman
Urheiluopistontie 373
19120 Vierumäki

Nuorten urheiluharrastustutkimuksen johtaja

Niilo Konttinen
KIHU/Rautpohjankatu 6
40700 Jyväskylä

Appendix 7. Parental consent (studies III, IV) in Finnish

Suostumus kehittymisen seurantatapahtumaan osallistumiseen

Sami Hyypiä Akatemian kehittymisen seurantatapahtumiin osallistuvien joukkueiden pelaajat pelaavat tapahtuman aikana 3-5 peliä ja osallistuvat kehittymisen seurantakokonaisuuteen, joka pitää sisällään jalkapallossa yleisesti käytettyjä käytännön testejä ja kirjallisia kyselyjä. Pelejä ja testejä kuvataan videokameralla. Tapahtumat järjestetään jokaiselle ikäluokalle Eerikkilän Urheiluopistossa kaksi kertaa vuodessa. Tapahtumakokonaisuutta johtaa Sami Hyypiä Akatemian ja Eerikkilän Urheiluopiston ammattitaitoinen henkilöstö.

Kehittymisen seurantakokonaisuuden sisältö
- 3-5 peliä
- paino, pituus
- lajitaitotestit
- yleistaitotestit
- nopeus-, ketteryys-, hyppy-, liikkuvuustestit
- terve –futaaja testit (vammojen ennaltaehkäisy kokonaisuus)
- maksimaalinen kestävyystesti (piip-testi)
- kirjalliset kyselyt ja itsearvioinnit liittyen pelaajan omaan jalkapalloharrastukseen

Olen tutustunut kehittymisen seurantakokonaisuuden sisältöön ja ymmärtänyt kokonaisuuden tarkoituksen. Voin halutessani keskeyttää kokonaisuuden suorittamisen tai kieltäytyä jostain kokonaisuuden osasta missä vaiheessa tapahtumaa tahansa.

Tällä lomakkeella vahvistan, että…
- suostun osallistumaan SHA tapahtuman peleihin ja kehittymisen seurantakokonaisuuteen annettujen ohjeiden mukaisesti
- annan luvan henkilötietojeni (nimi, syntymäaika, yhteystiedot, PalloID), kehittymisen seurannan tulosteni, itsearviointini tulosten, harjoitustietojeni sekä peli- ja testivideoideni säilyttämiseen Sami Hyypiä Akatemian arkistoissa ja sähköisessä järjestelmässä
- annan luvan henkilötietojeni (nimi, syntymäaika, yhteystiedot, PalloID), kehittymisen seurannan tulosteni, itsearviointini tulosten, harjoitustietojeni sekä peli- ja testivideoideni käyttöön nimettöminä Sami Hyypiä Akatemian johtamassa kehitystyössä, tutkimustyössä ja tuotekehitystoiminnassa
- annan luvan tapahtuman yhteydessä otetun video-/valokuvani käyttöön tapahtuman kirjallisessa, sähköisessä ja suullisessa raportoinnissa (video-/valokuvaa ei yhdistetä pelaajan nimeen julkisesti)

Pelaajan nimi:_____Syntymäaika:_____Seura:_____

Huoltajan nimi:_____

Paikka ja aika:_____ Huoltajan allekirjoitus:_____

Lisätietoja

Kyösti Lampinen
Sami Hyypiä Akatemian johtaja

Hannele Forsman
Sami Hyypiä Akatemian kehityspäällikkö

ORIGINAL PAPERS

I

THE ROLE OF SPORT-SPECIFIC PLAY AND PRACTICE DURING CHILDHOOD IN THE DEVELOPMENT OF ADOLESCENT FINNISH TEAM SPORT ATHLETES

by

Forsman, H., Blomqvist, M., Davids, K., Konttinen, N. & Liukkonen, J., 2016

International Journal of Sports Science & Coaching 11 (1), 69-77.

The Role of Sport-specific Play and Practice during Childhood in the Development of Adolescent Finnish Team Sport Athletes

HANNELE FORSMAN[1], MINNA BLOMQVIST[2], KEITH DAVIDS[3,4], NIILO KONTTINEN[2] AND JARMO LIUKKONEN[1]

[1] Department of Sport Sciences, University of Jyväskylä, Jyväskylä, Finland, [2] Research Institute for Olympic Sports, Jyväskylä, Finland, [3] Centre for Sports Engineering Research Faculty of Health and Wellbeing, Sheffield Hallam University, Sheffield, UK and [4]FiDiPro Programme, University of Jyväskylä, Jyväskylä, Finland

Abstract

This study sought to understand the role of sport-specific play and practice in the development of adolescent team sport athletes in the Finnish sports development system. Participants were male, fifteen-year-old soccer (n=141), ice hockey (n=204) and basketball (n=96) players, divided into three groups based on the amount of sport-specific play and practice experienced during childhood. Data were collected with sport-specific inventories of practice history, tactical skills, psychological skills, and sport-specific skill test. Results showed that athletes with more sport-specific play and practice during childhood had more sport-specific play and practice during adolescence, better technical, tactical and psychological skills, and were more likely to be selected for national youth teams at the age of fifteen years. Data highlighted the importance of sport-specific play and practice during childhood in the development of team sport performers in the Finnish athlete development system.

Keywords: Expertise development, practice, play, early engagement, childhood, team sports

INTRODUCTION

The development of youth team sport athletes to expert levels is a major goal of performance development systems in different countries. Expertise in team sports requires mastery of a wide range of performance characteristics from very general, such as physical fitness and psychological characteristics, to very specific elements, such as technical [1], and tactical [2] skills. Performance in team sports is also dependent upon the cohesive interaction among team members. This multidimensional nature of team sports performance [3,4,5] needs to be considered in the development of youth team sport athletes.

Although there are many interacting factors involved in the development of sport expertise [6,7], a most important factor is practice experiences during childhood and adolescence. However, there is a lack of consensus on the type of practice activities athletes should engage in during childhood and early adolescence in order to attain expertise in adulthood. Studies have highlighted benefits of both engaging in a large amount of practice [8,9] and play [10,11,12,13,14], and involvement in a variety of sports [15,16] during childhood and early adolescence.

Sport-specific practice is usually defined as a formal activity engaged in with the aim of improving performance in the specific sport, and it is close to definition of deliberate practice. Engaging in a considerable amount of sport-specific practice during childhood and early adolescence has been

shown to be important in the development of team sport athletes [9,17], and especially the development of technical skills of the athletes [1]. Ericsson and colleagues [8] argued that deliberate practice at an early age is important for future success, because when athletes start adhering to a deliberate practice program, they are more likely to enhance their expertise levels. However, the deliberate practice theory has been criticized because of high levels of inter-individual variability in some of the original data on practice hours [18], and also because of some possibly negative consequences of undertaking such a vast number of hours of intense training during early development. These consequences include burnout, dropout, overuse injuries and lower levels of attainment [19].

It has been suggested that exposure to large amounts of sport-specific play during childhood might result in superior tactical skills compared to those who accumulate less sport-specific play activity [20]. Greater amounts of engagement in sport-specific play during childhood have also been shown to differentiate players who progress to professional status from those who do not [13,14,21]. Côté and colleagues [22] have suggested that a large amount of play activity in the early years may protect athletes against negative consequences of engaging in practice and competition in the primary sport during childhood. This may have a positive effect on an individual's general motivation to engage in practice and competition in a primary sport during adolescence [22]. Enhanced motivation to engage in

70 practice and competition of primary sport may be important for attainment
71 of excellence by enabling athletes to invest requisite time in practice and
72 remain committed to the expertise development process [23,24].

73 Previous research has suggested that involvement in various sports
74 during the early years is an important factor in developing the elite athletic
75 career [15,16,25,26]. Involvement in different sports during childhood and
76 adolescence is thought to lead to enhanced sport expertise because of high
77 levels of intrinsic motivation that stems from children experiencing fun,
78 enjoyment, and competence through sport involvement [15]. It has also been
79 suggested that the skills and physiological conditioning developed through
80 diversified sport involvement in childhood may be transferable, and that less
81 deliberate, sport-specific practice is necessary for expertise if athletes
82 experience and practice a range of activities throughout development [16].

83 One issue that has not been extensively examined is the idea that
84 developmental activities of youth athletes may be country-specific,
85 depending on the cultural and social constraints of sport development
86 systems in different nations. Countries with elite development sport
87 academies that recruit individuals at a young age are likely to have players
88 who have engaged in a lot of practice and competition in their primary sport
89 during childhood. Players in these kinds of countries are also expected to
90 commence performance in the primary sport and formal training earlier than
91 others [9]. On the other hand, in countries with less formal recruitment

92 systems, athletes may start formal activities later and engage in a lot of play
93 activities of the primary sport during childhood [12]. In the Finnish sport
94 system, a significant cultural constraint is that athletic development is based
95 around sport clubs, rather than elite developmental sport academies or
96 schools. There are no academies which recruit athletes at a young age, so all
97 athletes usually compete and practice in their local sport club throughout
98 their childhood and adolescence. In the sports club environment, athletes
99 tend to attend local (i.e. non-specialist) schools and most of the coaches are
100 non-specialist volunteers. Thus, play and practice times are concentrated on
101 evenings and weekends. Four different kinds of climatic seasons makes it
102 challenging to find suitable weather conditions to play and practice
103 outdoors, both in team and individual settings. In winter, weather conditions
104 can make it unsuitable for outdoor soccer and basketball practice, and in
105 summer for outdoor ice hockey practice. These significant environmental
106 constraints may raise the possibility that in countries like Finland, athletes
107 may be led to engage in many different sports during their childhood.
108 The environmental constraints of a sports-club based athletic
109 development system and climatic variations on athlete development from
110 childhood to expert levels in Finland raise questions about the generality of
111 data on expertise pathways in different countries. Differences in socio-
112 cultural constraints between countries suggest that more research is needed
113 to examine how they shape effects of different types of play and practice

during childhood. The aim of the present study was to examine whether the amount of sport-specific play and practice during childhood (6-12 years of age) is related to the amount of sport-specific play and practice during early adolescence (13-15 years of age). It also sought to investigate whether the amount of sport-specific practice and play during childhood is related to development of technical, tactical and psychological skills in youth athletes (15 years of age) in three different team sports in Finland. These skills have been shown to differentiate more skilled athletes from others in previous research in other countries [3,4,5]. However, there has been no previous research on the characteristics of developing athletes under the cultural and environmental constraints of the Finnish sport development system. Furthermore, based on data reported in previous studies [13,21], we examined whether athletes experiencing more sport-specific play and practice during childhood had better prospects of being selected for national youth teams at the age of 15 years in the Finnish system.

METHODS

PARTICIPANTS

A total of 441 males born in 1995 representing 12 soccer teams, 13 ice hockey teams, and 12 basketball teams participated in this study. All teams sampled were among the most successful in their age category in the whole of Finland. The most talented athletes of the teams had been selected for the

Finnish national youth teams at the age of fifteen years (Table 1). The athletes were divided into tertiles based on the average amount of sport-specific play and practice reported by them during early years (6-12 years of age). A Low-Practice group comprised athletes (n=139) whose amount of sport-specific play and practice was low (range 0-3.75 hours per week) during the early years. A Medium-Practice group comprised athletes (n=156) whose amount of sport-specific play and practice was average (range 3.75-5.5 hours per week) during the early years. A High-Practice group (n=146) comprised athletes whose amount of sport-specific play and practice was high (range 5.5-24.5 hours per week) during the early years. Participants' mean ages and anthropometric data are presented in Table 2.

Table 1 here

Table 2 here

PROCEDURE

Participants and parents/guardians were informed about the study procedures one week before data collection. All individuals provided informed consent prior to participation. Data collection occurred in the athletes' own practice environments. All participants completed sport-specific skill test and three sport-specific questionnaires according to standardized instructions provided by researchers.

158 Practice histories

159 A sport-specific questionnaire recorded the amount of sport-specific play,
160 sport-specific practice, and play and practice of other sports. Sport-specific
161 play was defined as sport-specific play undertaken alone or with friends
162 which resulted in informal practice of skills and tactical behaviours. Sport-
163 specific practice was defined as sport-specific practice with the team. Play
164 and practice of other sports were defined as all practice and playing
165 activities in a range of other sports. In order to improve the reliability of
166 practice estimates, our methods for collecting practice data were based on
167 those of Ward and colleagues [9]. Rather than requiring individuals to recall
168 estimates from the start of practice to the present date, practice data were
169 obtained using estimates from the most recent 3 years initially, and from
170 then on, recorded in 3-year intervals. To ensure validity of practice
171 estimates, questionnaires were completed after standardized instructions
172 provided by researchers. Additionally, the questionnaire was pilot tested
173 with a sample of non-participating athletes of the same ages and from the
174 same sports, with no issues of clarity reported.

175 The first section of the questionnaire was designed to elicit
176 information on birthdates and the age that participants first engaged in sport-
177 specific practice in a club. The second section of the questionnaire was
178 designed to elicit information on participants' engagement in sport-specific
179 play, sport-specific practice, and play and practice of other sports at the age

between 6 and 15. The average hours per week during ten months of active play and practice per year spent in each of the activities were recorded.

Technical skills

A sport-specific technical skill test was used to assess the athletes' technical skills in their own sport. Standardized tests developed and used by the Finnish National Federations of different sports were related to observations of athletes' dribbling, passing and ball manipulation skills.

Tactical skills

A Tactical Skills Inventory for Sports [TACSIS; 27], with subscales of declarative and procedural knowledge, was used to assess athletes' perceived tactical skills. Since this was the first time the TACSIS was used in Finland, it was translated into Finnish by a panel of experts in team sport, and later back into English by a native British translator whose first language was English and who understood Finnish. The re-translated English version was compared with the original version for consistency. Items revealed to have a number of possible meanings in Finnish were discussed by the panel of experts in order to redraft them to be as accurate as possible. The TACSIS consists of 22 items representing four dimensions: Positioning and Deciding (9 items), Knowing about Ball Actions (4 items), Knowing about Others (5 items), and Acting in Changing Situations (4

items). Knowing about Ball Actions and Knowing about Others were related to declarative knowledge. Positioning and Deciding and Acting in Changing Situations were related to procedural knowledge. These 22 items were responded to on a 6-point Likert scale regarding sport performance, from 1 (very poor or almost never) to 6 (excellent or always). Participants were asked to compare themselves with the top Finnish athletes in the same age category.

In previous research, the Tactical Skills Inventory for Sports has been revealed as a reliable psychometric instrument with internal consistency coefficients of all four scales. Cronbach's alpha coefficients have been reported, ranging from .72 to .89 [27]. In the current study, the internal consistencies of the four TACSIS sub-scales indicated satisfactory levels, with Cronbach's alpha coefficients ranging from .76 to .91.

Psychological skills

A Psychological Skills Inventory for Sports [PSIS-R-5; 28] was used to assess the athletes' perceived psychological skills. Since this was the first time the PSIS-R-5 was used in Finland, the same translation process was undertaken as for the TACSIS (see above). The scale consists of 29 items, representing four dimensions: Motivation (8 items), Confidence (8 items), Concentration (7 items), and Mental Preparation (6 items). These 29 items

were responded to on a 5-point Likert scale, from 1 (almost never) to 5 (almost always). Items worded negatively were transformed by reversing the aforementioned 1-5 format. In this way, a high score on each scale corresponds to a proposed high value for a psychological skill.

In previous research, the Psychological Skills Inventory for Sports has been shown to be a psychometrically reliable instrument with internal consistency coefficients of all four sub-scales, with Cronbach's alpha coefficients ranging from .67 to .84 [29]. In the current study, the four PSIS-R-5 scales indicated good internal consistency, with Cronbach's alpha coefficients ranging from .67 to .86.

DATA ANALYSIS

One-way ANOVA was applied to: 1) examine group differences in terms of age, height weight, and starting age for sport-specific practice, 2) compare practice histories between groups during childhood (6-12 years of age), 3) compare practice histories during early adolescence (13-15 years of age), and 4) investigate group differences in technical skills. A post-hoc Tukey HSD test was applied to follow up on statistically significant differences observed between different groups. Multivariate analysis of variance (MANOVA) was applied to investigate group differences in terms of tactical and psychological skills. Chi-square goodness-of-fit tests were used to compare national youth team athlete distributions between the three

groups. Effect size values (ES) were calculated to determine the meaningfulness of the differences between groups, classified according to Cohen's [30] suggestion of effect sizes around .20 being small, around .50 as moderate, and around .80 evidencing a large effect.

RESULTS

PRACTICE HISTORY OF ATHLETES SPECIFIED BY AMOUNT OF SPORT-SPECIFIC PLAY AND PRACTICE DURING CHILDHOOD

Play and practice during childhood (6-12 years of age)

The overall group effect was significant for the amount of sport-specific play [$F(2,440) = 175.090$, $p = .000$], and sport-specific practice [$F(2,440) = 126.613$, $p = .000$], undertaken. The amount of sport-specific play and the amount of sport-specific practice were significantly higher in High-Practice group compared to Low- and Medium-Practice groups, and in Medium-Practice group compared to Low-Practice group. The overall group effect marginally failed to achieve conventional levels of statistical significance for the amount of play and practice reported in other sports ($p = .056$). However, a post hoc Tukey HDS test showed that the amount of play and practice of other sport was significantly higher in the High-Practice group compared to the Low-Practice group.

Table 3 here

Play and practice during early adolescence (13-15 years of age)

The overall group effect was significant for the amount of sport-specific play [$F(2,407) = 45.938$, $p = .000$], and sport-specific practice [$F(2,406) = 20.411$, $p = .000$], reported. The amount of sport-specific play and the amount of sport-specific practice was significantly higher in the High-Practice group compared to Low- and Medium-Practice groups, and in the Medium-Practice group compared to the Low-Practice group (Table 4). The overall group effect was not statistically significant for the amount of play and practice in other sport.

Table 4 here

TECHNICAL, TACTICAL AND PSYCHOLOGICAL SKILLS OF ATHLETES SPECIFIED BY AMOUNT OF SPORT-SPECIFIC PLAY AND PRACTICE DURING CHILDHOOD

Technical skills

The overall group effect was significant for technical skills development [$F(2,418) = 7.758$, $p = .000$]. The High-Practice and the Medium-Practice groups had significantly better technical skills than the Low-Practice group (Table 5).

Table 5 here

Tactical skills

A group main effect for tactical skills was significant [F(8,854) =4.050, p= .000, partial eta square= .037]. Univariate tests revealed statistically significant differences between groups in Positioning and deciding [F(2,430) = 10.026, p= .000, partial eta square= .045], Knowing about ball actions, [F(2,430) = 10.221, p= .000, partial eta square= .045], Knowing about others [F(2,430) = 13.214, p= .000, partial eta square= .058] and, Acting in changing situations [F(2,430) = 4.124, p= .017, partial eta square= .019]. The High-Practice group outscored the Low-Practice group in all sub-scales of tactical skills, and Medium-Practice group in Knowing about ball actions and Knowing about others. The Medium-Practice group outscored Low-Practice group in Positioning and deciding (Table 6).

Table 6 here

Psychological skills

A group main effect for psychological skills was significant [F(8,834) =4.324 , p= .000, partial eta square= .040]. Univariate tests revealed statistically significant differences between groups in Motivation [F(2,420) = 14.136, p= .000, partial eta square= .063], Confidence [F(2,420) = 3.811, p= .023, partial eta square= .018], Concentration [F(2,420) = 7.023, p= .001, partial eta square= .032], and Mental preparation [F(2,420) = 4.388, p= .013, partial eta square= .020]. The High-Practice group outscored the Low-Practice group in all sub-scales of psychological skills, and the Medium-

Practice group in Motivation and Mental preparation. The Medium-Practice group outscored the Low-Practice group in Motivation (Table 7).

Table 7 here

DISTRIBUTION OF NATIONAL YOUTH TEAM ATHLETES SPECIFIED BY AMOUNT OF SPORT-SPECIFIC PLAY AND PRACTICE

There were significant differences in distribution of national youth team athletes of three groups at 15 yrs [(X^2=14.702; df=2; p=.001)] (Figure 1). Almost half of the players selected to national youth teams at the age of 15 years were from the High-Practice group.

Figure 1 here

DISCUSSION

The aim of this study was to examine the influence of cultural and social constraints on play and practice data from athletes in the Finnish sport development system. The findings were based on their experiences in local community sports clubs, to understand whether amounts of sport-specific practice and play during childhood were related to the amount of practice and play experienced during adolescence, and expression of technical, tactical and psychological skills of the youth athletes in three different team sports. We observed that in the Finnish sport development system, the amounts of sport-specific play and practice undertaken during childhood

were related to the time spent in sport-specific play and practice during early adolescence, and the level of technical, tactical and psychological skills exhibited by the athletes at 15 years of age in three different team sports. We also observed that athletes with more experience of sport-specific play and practice during childhood had better prospects of being selected for national youth teams at 15 years. Our data suggested that early engagement and experience of sport-specific play and practice during childhood are important in the athlete development within the specific socio-cultural constraints of the Finnish sport developmental system.

Past research has shown that practice is a major feature for the development of technical skills in sport [1,17]. Better players have been shown to have more developed technical skills than other players [1,4,5]. In the present study of the Finnish system, the prominence of play was noted in the reports of developing athletes who experienced a higher amount of sport-specific practice during childhood. In the less formal Finnish sport development system, these athletes revealed better technical skills in their primary sport, suggesting that sport-specific play and practice during childhood is important in developing technical skills in team sports.

Sport-specific play has been found to be an important factor in the development of game intelligence and creative tactical responses [31]. It appears that the most creative players tend to spend more time playing their primary sport [32]. In line with previous work [31,32], data from the present

study suggested that athletes reporting a higher amount of sport-specific play and practice during childhood displayed better tactical skills. The present findings suggest that sport-specific play and practice during childhood are important in the development of tactical skills in team sports in the Finnish system based around participation in local community sports clubs. Previous studies have shown that elite players tend to have better tactical skills than other players [33,34], and that these skills may even predict future performance levels [2]. Considering the importance of tactical skills in team sports environments, athletes with better tactical skills in the present study may have greater potential to attain expertise later in their careers than other athletes.

Past research has shown that psychological skills play an important role in both the acquisition and manifestation of expertise [35]. It has been argued that motivation [23,24] and confidence [23,36] might be necessary factors for attainment of excellence by enabling athletes to invest requisite time to practice and to remain committed to the expertise development process. In line with these ideas, the present study showed that Finnish adolescent athletes reporting higher amounts of sport-specific play and practice during childhood had higher motivation and confidence levels than other athletes. Finnish developing athletes who reported higher amounts of sport-specific play and practice during childhood, also practised their primary sports more during adolescence. This finding supports data from

Côté and colleagues [22], suggesting that a large amount of play activities in the early years may have a positive effect on players' motivation to engage in sport-specific practice later. The Finnish, community-based sports club system seemed to foster an emphasis on play as well as practice. Higher levels of motivation and confidence in athletes with more sport-specific play and practice during childhood may be explained by better developed technical and tactical skills of these athletes.

Development of future elite athletes is a goal of athlete development systems of different countries, but there is a lack of consensus on the activities that they should engage in during childhood and early adolescence to attain expertise in the primary sport in adulthood. The present study suggested that sport-specific play and practice during childhood is important to the development of team sport athletes in the Finnish athlete development system. The socio-cultural constraints of this system are somewhat unique, being based around community sport clubs with involvement of non-specialist volunteer coaches, rather than elite developmental academies or schools. However, the present findings display some similarities with those reported by Ford and colleagues [13,21] in academic settings. The current data show that athletes with more sport-specific play and practice during childhood had better prospects of being selected for national youth teams at fifteen years of age. Almost half of the players selected to national youth

399 teams at the age of 15 years were from the group that had played and
400 practiced most their primary sport during childhood.
401 It should be noted, however, all athletes in this study, had also
402 engaged in a considerable amount of hours in play and practice in other
403 sports during childhood. Along with the Finnish athlete development
404 system, this finding can partly be explained by specific environmental
405 weather constraints in Finland. Previous research has suggested that
406 involvement in a variety of different sports during the early years could be
407 an important factor in developing the elite athletic career [25,26]. Playing
408 involvement in a variety of sports during childhood has been shown to be
409 advantageous in developing and refining fundamental movement skills,
410 which are considered to be the building blocks that lead to specialized
411 movement sequences, including sport-specific skills. At the same time more
412 varied play experiences allows children to experience various physical,
413 cognitive, affective, and psychosocial constraints, which provide children
414 with the foundation required to specialize in one sport during adolescence
415 [37,38].
416 Some limitations of the present study included use of self-reported
417 questionnaires, in which the players were asked to retrospectively recall
418 their practice histories. There may have been some bias in the reported
419 amounts of different practice types, especially in the early years, possibly
420 distributed across groups. Follow up research on the community-based,

Finnish athlete development system needs to include longitudinal designs, and analyses of practice diaries. Previous studies have raised issues regarding early specialization and early selection as a determinant of adult sport expertise [39,40]. According to Barreiros and Fonseca [39] national youth team membership may not be prerequisite for future progression to senior national team and long-term expertise development, particularly in team sports. Due to that, it also needs to be clarified whether Finnish development athletes, with higher amounts of sport-specific play and practice during childhood, eventually reach professional status in adulthood.

Together these results provide important insights into the discussion concerning expertise pathways and athletic development systems in different countries. In the Finnish athlete developmental system, which is based around involvement in local sports clubs, the results clearly highlighted the importance of early engagement and sport-specific play and practice during childhood in the development of youth team sport athletes.

Funding

This work was funded by a grant from the Ministry of Education and Culture of Finland.

References

1. Huijgen, B. C, Elferink-Gemser M.T., Post, W. and Visscher C., Development of Dribbling in Talented Youth Soccer Players Aged 12-19 Years: A Longitudinal Study, Journal of Sports Sciences, 2010, 28(7), 689–698.

2. Kannekens, R., Elferink-Gemser M.T. and Visscher C., Positioning and Deciding: Key Factors for Talent Development in Soccer, Scandinavian Journal of Medicine and Science in Sports, 2011, 21(6), 846-852.

3. Elferink-Gemser, M.T., Visscher, C., Lemmink, K.A.P.M. and Mulder, T.H., Relation between Multidimensional Performance Characteristics and Level of Performance in Talented Youth Field Hockey Players, Journal of Sports Sciences, 2004, 22, 1053-1063.

4. Reilly, T., Williams, A.M., Nevill, A. and Franks, A., A Multidisciplinary Approach to Talent Identification in Soccer, Journal of Sports Sciences, 2000, 18(9), 695-702.

5. Vaeyens R., Malina R.M., Janssens M., Van Renrghem B., Bourgois J., Vrijens J. and Philippaerts R.M., A Multidisciplinary Selection Model for Youth Soccer: The Ghent Youth Soccer Project, British Journal of Sport Medicine, 2006, 40, 928-34.

6. Abbott, A., Button, C., Pepping, G.J. and Collins, D., Unnatural Selection: Talent Identification and Development in Sport, Nonlinear dynamics, Psychology, and Life Sciences, 2005, 9(1), 61-88.

7. Davids, K. and Baker J., Genes, Environment, and Sport Performance: Why the Nature-Nurture Dualism is no longer Relevant, Sports Medicine, 2007, 37(11), 961-980.

8. Ericsson, K.A., Krampe, R.T. and Tesch-Römer, C., The Role of Deliberate Practice in the Acquisition of Expert Performance, Psychological Review, 1993, 100(3), 363-406.

9. Ward, P., Hodges, N.J., Williams, A.M. and Starkes, J.L., The Road to Excellence in Soccer: A Quasi-longitudinal Approach to Deliberate Practice, High Ability Studies, 2007, 18(2), 119–153.

10. Ford, P.R., Carling, C., Garces, M., Margues, M., Miguel, C., Farrant, A., Stenling, A., Moreno, J., Le Gall, F., Holmström, S., Salmela, J.H. and Williams, M., The Developmental Activities of Elite Soccer Players under-16 years from Brazil, England, France, Ghana, Mexico, Portugal and Sweden, Journal of Sport Sciences, 2012, 30(15), 1653-1663.

11. Salmela, J.H., Marques, M.P. and Machado, M., The Informal Structure of Football in Brazil, Insight, 2004, 7(1), 17-19.

12. Salmela, J.H. and Moraes, L.C., Development of Expertise: The Role of Coaching, Families, and Cultural Contexts, in: Starkes, J.L. and Ericsson, K.A, eds., Expert Performance in Sports: Advances in Research on Sport Expertise, Human Kinetics, Champaign, IL, 2003, 275-294.

13. Ford, P.R., Ward, P, Hodges N.J. and Williams, M., The Role of Deliberate Practice and Play in Career Progression in Sport: the Early Engagement Hypothesis, High ability studies, 2009, 20(1), 65-75.

14. Hornig, M., Aust, F. and Güllich, A., Practice and Play in the Development German Top-Level Professional Football Players, European Journal of Sport Science, 2014, DOI: 10.1080/17461391.2014.982204.

15. Côté, J. and Hay, J., Children's Involvement in Sport: A Developmental Perspective, in: Silva, J.M. and Stevens D., eds., Psychological foundations of sport, Allyn and Bacon, Boston, 2002, 484-502.

16. Baker, J., Côté, J. and Abernethy, B., Sport Specific Training, Deliberate Practice and the Development of Expertise in Team Ball Sports, Journal of Applied Sport Psychology, 2003, 15, 12–25.

17. Helsen, W.F., Starkes, J.L. and Hodges, N.J., Team Sports and the Theory of Deliberate Practice, Journal of Sport and Exercise Psychology, 1998, 20, 12–34.

18. Hambrick, D., Oswald, F., Altmann, E., Meinz, E., Gobet, F. and Campitelli, G., Deliberate Practice: Is that all it takes to become an Expert? Intelligence, 2014, 45, 34-45.

19. Baker, J., Cobley, S. and Fraser-Thomas, J., What do we know about Early Sport Specialization? Not much! High Ability Studies, 2009, 20(1), 77-89.

20. Williams, A.M., Bell-Walker, J., Ward, P. and Ford, P.R., Perceptual-cognitive Expertise, Practice History Profiles and Recall Performance in Soccer, British Journal of Psychology, 2012, 103(3), 393-411.

21. Ford, P.R. and Williams, A.M., The Developmental Activities Engaged by Elite Youth Soccer Players who progressed to Professional Status compared to those who did not, Psychology of Sport and Exercise, 2012, 13, 349-352.

22. Côté, J., Baker, J. and Abernethy, B., Practice and Play in the Development of Sport Expertise, in: Tenenbaum, G. and Eklund, R.C., eds.,

525 Handbook of sport psychology John Wiley & Sons, New Yersey, 2007,
526 184-202.

527 23. Durand-Bush, N. and Salmela J.H., The Development and Maintenance
528 of Expert Athletic Performance: Perceptions of World and Olympic
529 Champions, Journal of Applied Sport Psychology, 2002, 14(3), 154-171.

530 24. Ward, P., Hodges, N.J., Williams, A.M. and Starkes, J.L., Deliberate
531 Practice and Expert Performance: Defining the Path to Excellence, in:
532 Williams, A.M. and Hodges, N.J., eds., Skill Acquisition in Sport: Research,
533 Theory and Practice, Routledge, London, 2004, 231-258.

534 25. Soberlak, P. and Côté, J., The Developmental Activities of Professional
535 Ice Hockey Players, Journal of Applied Sport Psychology, 2003, 15(1), 41–
536 49.

537 26. Baker, J., Early Specialization in Youth Sport: A Requirement for Adult
538 Expertise? High Ability Studies, 2003, 14(1), 85–94.

539 27. Elferink-Gemser, M.T., Visscher, C., Richart, H. and Lemmink,
540 K.A.P.M., Development of the Tactical Skills Inventory for Sports,
541 Perceptual and Motor Skills, 2004, 99, 883-895.
542
543 28. Mahoney, M.J, Cabriel, T.J. and Perkins, T.S., Psychological Skills and
544 Exceptional Athletic Performance, The Sport Psychologist, 1987, 1(3), 181-
545 199.

546 29. White, S.A., The Relationship between Psychological Skills,
547 Experience, and Practice Commitment among Collegiate Male and Female
548 Skiers, The Sport Psychologist, 1993, 7(1), 49-57.
549
550 30. Cohen, J., Statistical Power Analysis for the Behavioural Sciences, 2nd
551 edn., Lawrence Erlbaum Publishers, New York, 1988.

552 31. Bell-Walker, J. and Williams, A.M., The Effect of Memory Recall on
553 Perceptual-cognitive Skill in Elite Soccer: Development of Long Term
554 Working Memory, in: Reilly, T., Korkusuz, F. and Ergen, E., eds., Science
555 and Football VI, Taylor & Francis, London, 2008, 340-343.

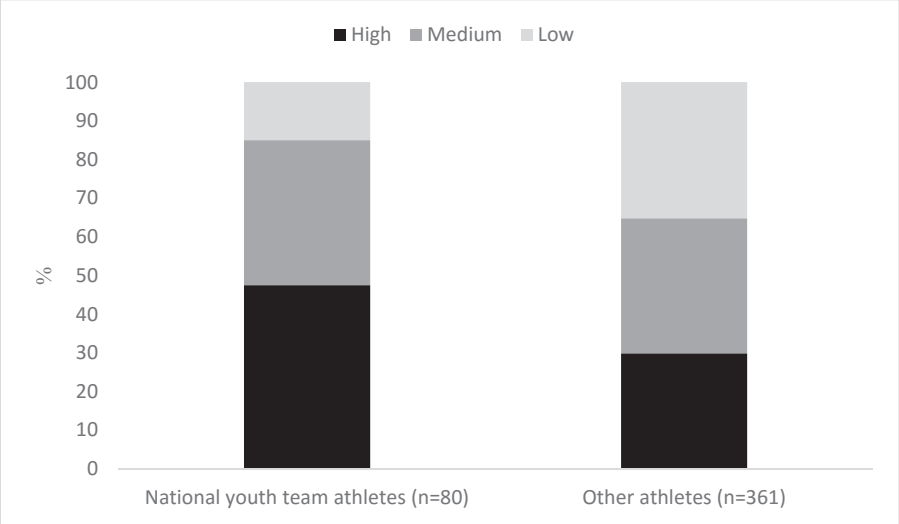
556 32. Memmert, D., Baker, J. and Bertsch, C., Play and Practice in the
557 Development of Sport-specific Creativity in Team Ball Sports, High Ability
558 Studies, 2010, 21(1), 3-18.
559
560 33. Elferink-Gemser, M.T., Kannekens, R., Lyons, J., Tromp, Y. and
561 Visscher, C., Knowing what to do and doing it: Differences in Self-assessed

562 Tactical Skills of Regional, Sub-elite, and Elite Youth Field Hockey
563 Players, Journal of Sports Sciences, 2010, 28(5), 521–528.
564
565 34. Kannekens, R., Elferink-Gemser, M.T. and Visscher, C., Tactical Skills
566 of World-class Youth Soccer Teams, Journal of Sport Sciences, 2009, 27(8),
567 807-812.
568
569 35. Baker, J. and Horton, S., A Review of Primary and Secondary
570 Influences on Sport Expertise, High Ability Studies, 2004, 15(2), 211–228.
571
572 36. MacNamara, Á., Button, A. and Collins, D., The Role of Psychological
573 Characteristics in Facilitating the Pathway to Elite Performance Part1:
574 Identifying Mental Skills and Behaviours, The Sport Psychologist, 2010, 24,
575 52-73.
576
577 37. Gallahue, D. and Ozmun, J., Understanding Motor Development:
578 Infants, Children, Adolescents, Adults, 5th edn., McGraw-Hill Companies,
579 New York, 2002.
580
581 38. Abbott, A., Collins, D., Sowerby, K. and Martindale, R., Developing the
582 Potential of Young People in Sport, Sportscotland, Edinburgh, 2007.

583 39. Barreiros, A.N. and Fonseca, A.M., A Retrospective Analysis of
584 Portuguese Elite Athletes' Involvement in International Competitions,
585 International Journal of Sports Science & Coaching, 2012, 7(3), 593-600.

586 40. Vaeyens, R., Güllich, A., Warr, C.R. and Philippaerts, R., Talent
587 identification and Promotion Programmes of Olympic Athletes, Journal of
588 Sport Sciences, 2009, 27(13), 1367-1380.

589 Figure 1. Distribution of national youth team athletes at the age of fifteen specified by
590 amount of sport-specific play and practice during childhood (6-12 years of age).



591

592

593 Table 1. Distribution of athletes in different sports and level.

Sports	Players		National youth team athletes		Other athletes	
	N	%	N	%	N	%
Soccer	141	32	30	21	111	79
Ice Hockey	204	46	33	16	171	84
Basketball	96	22	17	18	79	82
Total	441	100	80	18	361	82

594

595

596 Table 2. General characteristics (means, SDs) of youth team athletes specified by amount of
597 sport-specific play and practice during early years.

Groups	High (n=146)	Medium (n=156)	Low (n=139)	High vs. Low	High vs. Med	Med vs. Low
Age (years)	15.34 (0.29)	15.32 (0.27)	15.26 (0.29)	* .28	- .05	- .24
Height (cm)	175.07 (7.89)	177.28 (8.07)	175.96 (7.26)	- .12	* .28	- .17
Weight (kg)	66.11 (9.47)	65.90 (9.07)	65.70 (9.46)	- .04	- .02	- .02
Starting age for sport-specific training (years)	5.46 (1.64)	5.65 (1.52)	6.70 (2.36)	*** .61	- .12	*** .53

598 *Note:* * p<0.05, ** p<0.01, *** p<0.001, Cohen's *d* (see below the asterisk)

599

600 Table 3. The amount of sport-specific play, sport-specific practice, and play and practice of
601 other sports (hours/ week) during childhood (means, SDs) of youth team sport athletes
602 specified by amount of sport-specific play and practice during childhood.

Groups	High (n=146)	Medium (n=156)	Low (n=139)	High vs. Low	High vs. Med	Med vs. Low
Sport-specific play	4.36 (3.18)	1.27 (0.85)	0.45 (0.04)	*** 1.78	*** 1.33	*** 1.39
Sport-specific practice	3.95 (1.25)	3.31 (0.79)	2.18 (0.73)	*** 1.73	*** 0.61	*** 1.49
Play and practice of other sports	6.00 (4.51)	5.63 (3.58)	4.81 (4.51)	* .26	- .09	- .20

603 *Note:* * p<0.05, ** p<0.01, *** p<0.001, Cohen's *d* (see below the asterisk)

604

605

606 Table 4. The amount of sport-specific play, sport-specific practice, and play and practice of
607 other sports (hours/ week) during adolescence (means, SDs) of youth team sport athletes
608 specified by amount of sport-specific play and practice during childhood.

Groups	**High (n=146)**	**Medium (n=156)**	**Low (n=139)**	**High vs. Low**	**High vs. Med**	**Med vs. Low**
Sport-specific play	6.48 (3.33)	4.44 (2.59)	3.20 (2.43)	*** 1.13	*** 0.69	** 0.49
Sport-specific practice	8.74 (2.11)	7.94 (2.15)	7.09 (2.01)	*** 0.80	** 0.38	** 0.41
Play and practice of other sports	2.60 (2.21)	2.89 (2.37)	3.20 (2.59)	- 0.25	- 0.13	- 0.12

609 *Note:* * p<0.05, ** p<0.01, *** p<0.001, Cohen's *d* (see below the asterisk)

610

611 Table 5. Sport-specific technical skills (means, SDs) of youth team sport athletes specified
612 by amount of sport-specific play and practice during childhood.

Groups	**High (n=146)**	**Medium (n=156)**	**Low (n=139)**	**High vs. Low**	**High vs. Med**	**Med vs. Low**
Technical skills	37.41 (19.87)	40.81 (23.74)	49.19 (31.42)	** .45	- .16	* .30

613 *Note:* * p<0.05, ** p<0.01, *** p<0.001, Cohen's *d* (see below the asterisk)

614

615

Table 6. Tactical skills (means, SDs) of youth team sport athletes specified by amount of sport-specific play and practice during childhood.

Groups	High (n=146)	Medium (n=156)	Low (n=139)	High vs. Low	High vs. Med	Med vs. Low
Positioning and Deciding	4.29 (0.66)	4.12 (0.58)	3.94 (0.71)	*** .51	- .27	* .28
Knowing about Ball Actions	4.38 (0.72)	4.13 (0.69)	4.00 (0.77)	*** .52	** .36	- .18
Knowing about Others	4.10 (0.75)	3.81 (0.61)	3.68 (0.80)	*** .55	** .44	- .18
Acting in Changing Situations	4.30 (0.73)	4.15 (0.69)	4.06 (0.77)	* .33	- .22	- .12

Note: * p<0.05, ** p<0.01, *** p<0.001, Cohen's *d* (see below the asterisk)

Table 7. Psychological skills (means, SDs) of youth team sport athletes specified by amount of sport-specific play and practice during childhood.

Groups	High (n=146)	Medium (n=156)	Low (n=139)	High vs. Low	High vs. Med	Med vs. Low
Motivation	4.13 (0.62)	3.93 (0.58)	3.73 (0.66)	*** .62	* .33	* .32
Confidence	3.58 (0.66)	3.47 (0.60)	3.37 (0.62)	* .33	- .18	- .16
Concentration	3.95 (0.54)	3.83 (0.49)	3.72 (0.53)	** .44	- .24	- .22
Mental preparation	3.05 (0.77)	2.82 (0.79)	2.80 (0.80)	* .32	* .30	- .03

Note: * p<0.05, ** p<0.01, *** p<0.001, Cohen's *d* (see below the asterisk)

II

IDENTIFYING TECHNICAL, PHYSIOLOGICAL, TACTICAL AND PSYCHOLOGICAL CHARACTERISTICS THAT CONTRIBUTE TO CAREER PROGRESSION IN SOCCER

by

Forsman, H., Blomqvist, M., Davids, K., Liukkonen, J., Konttinen, N., 2016

International Journal of Sports Science & Coaching (in press)

III

DEVELOPMENT AND VALIDATION OF THE PERCEIVED GAME-SPECIFIC SOCCER COMPETENCE SCALE

by

Forsman, H., Gråstén, A., Blomqvist, M., Davids, K., Liukkonen, J. & Konttinen, N., 2015

Journal of Sports Sciences, doi: 10.1080/02640414.2015.1125518

Development and Validation of the Perceived Game-Specific Soccer Competence Scale

Running title: *Perceived Game-Specific Soccer Competence Scale*

HANNELE FORSMAN[1,2], ARTO GRÅSTÉN[1], MINNA BLOMQVIST[3], KEITH DAVIDS[4,5], JARMO LIUKKONEN[1] AND NIILO KONTTINEN[3]

[1] Department of Sport Sciences, University of Jyväskylä, Jyväskylä, Finland, [2] Eerikkilä Sports Institute, Tammela, Finland, [3] Research Institute for Olympic Sports, Jyväskylä, Finland, [4] Centre for Sports Engineering Research Faculty of Health and Wellbeing, Sheffield Hallam University, Sheffield, UK and [5]FiDiPro Programme, University of Jyväskylä, Jyväskylä, Finland

Correspondence:
Hannele Forsman
University of Jyväskylä - Department of Sport Sciences
PL 35
FIN-40014 University of Jyväskylä
Finland
Tel. +358-40-1344392
Fax. +358-14-2602001
E-mail: hannele.forsman@eerikkila.fi

Abstract

The objective of this study was to create a valid, self-reported, game-specific soccer competence scale. A structural model of perceived competence, performance measures and motivation was tested as the basis for the scale. A total of 1,321 soccer players (261 females, 1,060 males) ranging from 12 to 15 years (13.4 ± 1.0 years) participated in the study. They completed the Perceived Game-Specific Soccer Competence Scale (PGSSCS), self-assessments of tactical skills and motivation, as well as technical and speed and agility tests. Results of factor analyses, tests of internal consistency, and correlations between PGSSCS subscales, performance measures and motivation, supported the reliability and validity of the PGSSCS. The scale can be considered a suitable instrument to assess perceived game-specific competence among young soccer players.

Keywords: *perceived competence, game play abilities, talent development, motivation, soccer*

Introduction

Identifying and selecting athletes at an early age, for participation in sport development programmes, has been shown to be very challenging (Reilly, Williams, Nevil, & Franks, 2000), particularly due to the complexity of skill acquisition and the non-linear nature of talent (Phillips, Davids, Renshaw, & Portus, 2010). These insights have suggested that research effort should be transferred from talent identification and selection to talent enrichment programmes (Vaeyens, Lenoir, Williams, & Philippaerts, 2008). Since the goal of talent development programmes is to develop future performance capacity of young athletes, there is a need to get a greater understanding of the characteristics required to reach an elite level in the future (Abbott & Collins, 2004; Simonton, 1999). These ideas emphasise the importance of an individual's capacity to learn and continue developing as an athlete, rather than to simply reach and maintain specific performance level, assessed at one particular time during what may be non-linear development trajectory (subject to jumps, regressions and plateaux in different athletes). Reaching a top performance level in soccer requires a large amount of practice (Ford & Williams, 2012; Haugaasen, Toering, & Jordet, 2014), and the development of a wide range of performance characteristics, including technical and tactical skills, and physiological characteristics (Hujigen, Elferink-Gemser, Lemmink, & Visscher 2012; Reilly et al., 2000). Importantly, psychological characteristics, such as motivation and determination, have also been shown to be particularly important in helping athletes to invest in a requisite amount of time spent in practice and to remain motivated for their continued performance development (Abbott & Collins, 2002; MacNamara & Collins 2011).

Different theoretical approaches to motivation, such as competence motivation theory (Harter, 1978), achievement goal theory (Nichols, 1984), self-efficacy theory (Bandura, 1997), and self-determination theory (Deci & Ryan, 2000), have highlighted the fundamental role of perceived competence in the development of motivation in various contexts, including sports. For instance, according to Harter's competence motivation theory (1978), most individuals are motivated to achieve competence in a number of life domains, such as academia, sports, and social relationships. Competence motivation theory (Harter, 1978) suggests that young people who perceive they have a high competence in a skill, are more likely to enjoy involvement and to invest more effort in an attempt to further improve their skills and knowledge. Success in these attempts leads to positive competence beliefs and enhanced intrinsic motivation, which supports further time investments in practice. In contrast, young people who perceive themselves to have low levels of competence are likely to lose persistence and interest in skill learning (Harter, 1978). High levels of perceived competence have been shown to be related to positive expectations for success (Roberts, Treasure & Conroy, 2007), as well as, enjoyment and sustained sport participation (Ulrich-French & Smith, 2009; Wiersma, 2001).

Perceived competence refers to an individual's evaluation of one's own abilities in a specific performance domain (Horn, 2004). Research indicates that athletes use a variety of sources to determine their ability, such as performance outcomes, personal statistics, learning, goal achievement and coach behaviors (Horn & Amorose, 1998). Earlier studies reported positive associations between perceived competence and performance outcomes in different skills (Bortoli, Bertollo, Comani, & Robazza, 2011; Hopper, Guthrie, & Kelly, 1991; Raudsepp & Liblik, 2002). Positive associations have been found between perceived soccer competence and

soccer skills (Hopper et al., 1991), perceived physical competence and coaches's evalution of athletes' performance level (Bortoli et al., 2011), and perceived motor competence and motor skills (Raudsepp & Liblik, 2002).

Traditionally, perceived competence has been evaluated by using general physical competence or athletic competence scales (Fox & Corbin, 1989; Harter, 1985; Wichstrøm, 1995). Although these scales have been used in different sport domains, they are rather general and do not adequately represent perceived competence in a specific sport. A problem is that young athletes may feel fairly competent generally in sport and athletics but may not feel competent in performing successfully in a specific sport like soccer (Fox & Corbin, 1989; Marsh, Richards, Johnson, Roche, & Tremayne, 1994). In order to obtain more detailed information on athletes' sport-specific perceived competence, researchers have developed perceived competence scales which are specific to a single sport domain (Feltz & Brown, 1984; Hopper et al., 1991; Le Bars, Gernigon, & Ninot, 2009; Sheldon & Eccles, 2005).

In soccer, for example, required skills have to be performed in rapidly changing game situations (Williams, 2000). Therefore, measurement procedures that can adequately assess many different aspects of successful performance are suggested for use in talent development programmes (Vaeyens et al., 2008). The most content-valid way of measuring soccer performance may be through game play, in which performance can be evaluated based on the actions exhibited during game play (Unnithan, White, Georgiou, Iga, & Drust, 2012).

Using this approach, the perceptions of one's competence, based on situational game playing abilities, may be expected to better reflect perceived competence of soccer players rather than just self-perceptions of sport-specific skills isolated from the game. However, while competence motivation theory (Harter,

1978) suggests that young athletes with high levels of perceived competence, are more likely to have higher motivation to practise and develop in their sport, very few attempts have been made to study levels of perceived competence among young competitive soccer players. Concerning the specificity of perceived competence (Fox & Corbin, 1989; Marsh et al., 1994), there is clear need to collect information about how players perceive their sport-specific competence in game situations. Therefore, the objective of this study was to create a valid self-reported perceived game-specific soccer competence scale (PGSSCS) that can be used as a coaching tool to measure levels of perceived soccer-specific competence among young soccer players. This tool might be valuable for collecting information in talent development programmes to enhance understanding of levels of perceived competence in athletes. This information will develop understanding of factors impacting on individual learning and performance needs. Here, we tested a structural model of perceived soccer competence and tactical skills, motivation, technical skills, and speed and agility, to verify whether performance measures and motivation levels would be positively associated with perceived soccer competence. Covariance effects of age and gender were also studied, to examine whether perceived competence is higher among boys compared to girls (Barnett, Morgan, van Beurden, & Beard, 2008; Feltz & Brown, 1984; Rudisil & Mahar, 1993), and among younger or older players (Jacobs, Hyatt, Eccles, Osgood, & Wigfield, 2002; Rodriquez, 2003; Wigfield, Eccles, Mac Iver, Reuman, & Midgley, 1991).

Methods

Instrument development

To construct the self-reporting inventory of perceived competence in soccer, the theoretical elements of game play abilities needed in game situations were

determined with the aid of the experiential knowledge of five highly qualified soccer coaches of Finnish national teams and five experienced coach educators from the Finnish Football Association, all having ten to twenty years of coaching experience. In other studies, experiential knowledge of skilled coaches and teachers, based on their many years of experience in their profession, has been successfully used to design and undertake empirical studies in sport science (e.g., Greenwood, Davids, & Renshaw, 2014). In our study, individual semi-structured interviews were undertaken in which the skilled coaches and coach educators were asked to propose the main elements they considered to be important in offensive (with-the-ball; off-the-ball) and defensive situations of the soccer game (Blomqvist, Vänttinen, & Luhtanen, 2005). After this stage, the items were formulated and reformulated based on insights provided in a focus group of experts until consensus was reached. The preliminary version of the scale consisted of twenty-three items, with a 5-point Likert response scale regarding sport performance, anchored with 1 *(almost never)* and 5 *(almost always).* The original language of the scale was Finnish. After validation of the scale, it was translated into English by a panel of experts in sport psychology and later back into Finnish by a native Finnish translator who understands English. The back-translated Finnish version was compared to the original version for consistency. Items that were shown to have a number of possible meanings in English were discussed by the panel of experts in order to redraft them to be as accurate as possible in meaning.

After initial instrument development, two studies were undertaken in order to develop the final version of the instrument and validate the instrument. Exploratory factor analysis was undertaken in study 1 to examine the structure of relations among items in the original sample in order to bring them into a smaller set of variables

(Nunnally & Bernstein, 1994). After that, confirmatory analysis was used to analyse the construct validity of the scale, and, the latent factor model was implemented in order to analyse the representativeness of the scale in study 2.

Study 1 Exploratory factor analysis

Participants. A total of 1,965 young competitive soccer players (358 females; 1,607 males) ranging from 10 to 15 years (12.3 ± 1.6 years) from 21 soccer clubs participated in the present study. All players were playing in the clubs' highest level teams for their age group, and took part in the Sami Hyypiä Academy's player development programme.

Procedure. All the participants and their parents/guardians had to sign an informed written permission of participation. The objectives and contents of the study were carefully explained in the permission form. The participants were told that their involvement was voluntary and they had a right to withdraw from the study whenever they wanted without any negative repercussions. Data collection was executed during participation in the Sami Hyypiä Academy's player monitoring events at the Eerikkilä Sports Institute. All participants completed the self-reporting inventory of perceived competence in a group setting, according to standardised instructions provided by the researchers.

Measure. Players were asked to respond to the 23 items of the preliminary version of the Perceived Game-Specific Soccer Competence Scale (PGSSCS), with a 5-point Likert scale regarding sport performance, anchored with 1 *(almost never)* and 5 *(almost always).* Players were asked to compare themselves to the top Finnish players representing the same age category.

Statistical analysis. Exploratory factor analysis was undertaken to examine the structure of relations among the items in the perceived soccer competence scale

in order to bring them together into a smaller set of variables or constructs (Nunnally & Bernstein, 1994). Items that met the criterion of loading at >.45 with one factor and <.30 with another factor were selected to enable interpretation of the scale (Klein, 1994).

Results. Based on exploratory analysis, 18 items out of 23 were left for the final version of the Perceived Game-Specific Soccer Competence Scale (PGSSCS), ten of which represented attacking skills factors, five items focused on skills in 1 vs 1 dyadic situations, and three on defensive skills (Table I).

Table I near here

Study 2 Instrument validation

Participants. Those participants of Study 1 who had data of all variables measured in this study, were selected to participate in Study 2 (261 females, 1060 males), resulting a final dataset of 1,321 young (13.4 ± 1.0 years) competitive soccer players.

Procedure. Again, all players gave their informed consent prior to participation, and data collection was executed during the teams' participation in the Sami Hyypiä Academy's player monitoring events at the Eerikkilä Sports Institute. All participants completed the Perceived Game-Specific Soccer Competence Scale (PGSSCS), as well as technical, speed and agility tests and questionnaires related to tactical skills and motivation in a group setting, according to standardised instructions provided by the researchers.

The Perceived Game-Specific Soccer Competence Scale. The perceived Game-Specific Soccer Competence Scale was used to examine players' perceptions

of their soccer competence in three dimensions described in study 1. In the current study, the reliability of the three PGSSCS sub-scales indicated satisfactory levels, with Cronbach's alpha coefficients ranging from .79 to .89, and with Spearman-Brown coefficient ranging from .81 to .86.

Tactical skills. The Tactical Skills Inventory for Sports (TACSIS; Elferink-Gemser, Visscher, Richart, & Lemmink, 2004) was used to examine players' self-consideration of their tactical skills in four dimensions: Positioning and Deciding (9 items, e.g. "I know how to get open during a match"), Knowing about Ball Actions (4 items, e.g. "I know exactly when to pass the ball to a teammate or when not to"), Knowing about Others (5 items, e.g. "I know quickly how the opponent is playing"), and Acting in Changing Situations (4 items, e.g. "I quickly react to changes, as from not possessing the ball but also look over the field"). The inventory was translated into Finnish by a panel of experts and later back into English by a native British translator who understands Finnish. The back-translated English version was compared to the original version for consistency. Items that were shown to have a number of possible meanings in Finnish were discussed by the panel of experts in order to redraft them to be as accurate as possible in meaning. Players responded to the 22 items with a 6-point Likert scale regarding sport performance, anchored with 1 *(very poor or almost never)* and 6 *(excellent or always).* Again, players were asked to compare themselves with the top Finnish players in the same age category. The mean values of all 22 items of tactical skills inventory were selected to represent each player's self-reported levels of tactical skills. In earlier work, the TACSIS was shown to have good psychometric characteristics (Elferink-Gemser et al., 2004). In the current study the internal consistency of the TACSIS items was satisfactory, with Cronbach's alpha coefficient .95.

Motivation. The motivation subscale from The Psychological Skills Inventory for Sports (PSIS-R-5; Mahoney, Gabriel, & Perkins, 1987) was used to examine players' motivation levels. The same translation process was undertaken as for the TACSIS (see above). The scale consists of 8 items representing motivation (e.g. "I want to train very hard to belong to the top in my sport") with a 5-point Likert scale, anchored with 1 *(almost never)* and 5 *(almost always).* Negatively-worded items were recoded. Thus, a high score on the scale corresponds to a high value for motivation. In earlier study, the PSIS-R-5 was shown to have sufficient psychometric characteristics (Mahoney et al., 1987). In the current study the internal consistency of the Motivation scale items was satisfactory, with Cronbach's alpha coefficient .81.

Technical skills. Soccer-specific technical skills were measured with the dribbling (Figure 1) and passing (Figure 2) tests recommended by the Football Association of Finland. Task was to complete these tracks as fast as possible. The best out of two trials was recorded in the case of both tests. The mean of these two tests was calculated representing players' technical skills. The reliability of both these tests for young soccer players has been confirmed with one month interval test-retest correlation coefficient for dribbling r = 0.82 ($P < .001$) and passing r = 0.81 ($P < .001$) (Vänttinen, 2013).

****Figure 1 near here****

****Figure 2 near here****

Speed and agility. All-out running speed over 30 m from stationary start and 8-figure agility track recommended by the national football association, were

measured with photocells (Newtest Oy, Finland). The mean score of the speed and agility tests was calculated representing players' speed and agility characteristics. The reliability and validity of sprinting time tests (Moir, Button, Glaister, & Stone, 2004), and similar type of agility test (Mirkov, Nedeljkovic, Kukolj, Ugarkovic, & Jaric, 2008) had been confirmed.

Statistical analysis. First, normal distribution, outliers, and missing values of the data were examined. No modifications due to normality or outliers were required based on the Mahalanobis distance test ($P < .001$) of standardised values (± 3.00) (Tabachnick & Fidell, 2007). The data included 12.5% of missing values. Little's MCAR -test ($\chi^2 = 1345.168$, df = 730, $P < .001$) and frequencies (gender, age) indicated that the missing values did not represent any particular group. Hence, the missing values were assumed to be missing at random (MAR) (Little & Rubin, 2002).

Next, the descriptive statistics, intraclass correlations, and composite reliability, for each variable were determined. In order to examine the associations of offensive, 1 vs 1, and defensive skills competence, the latent factor model was implemented (Figure 3). Additionally, the relations between competence and tactical skills, motivation, technical skills, and speed and agility characteristics were analysed through the particular model. The proportions of variance predicted by competence for tactical skills, motivation, technical skills, and speed and agility characteristics were investigated using squared multiple correlations (R^2). Figure 3 presents the theorized model of competence, tactical skills, motivation, technical skills, and speed and agility characteristics.

****Figure 3 near here****

Chi-square test ($\chi 2$) was used as a test of the model's overall goodness-of-fit to the data. A statistically non-significant difference between the observed frequency distribution and the theoretical distribution represents an acceptable fit to the data. To determine the appropriateness of the model the standardised root mean square residual (SRMR), the root mean square error of approximation (RMSEA), the comparative fit index (CFI), and the Tucker-Lewis index (TLI) were also examined (Arbuckle, 2007). A value of .05 or less for SRMR indicates the reasonable magnitude of a good fit, a value of .05 or less for the RMSEA indicate an acceptable fit of the model in the relations to the degrees of freedom (Browne & Cudeck, 1993). The CFI and TLI indices range from 0 to greater than 1. Fit indices greater than 0.90 are indicative for an acceptable model fit (Browne & Cudeck, 1993). The missing value analysis was performed using SPSS Statistics Version 22.0 (IBM Corporation, 2012) and all subsequent analyses using Mplus Version 7.11 (Muthén & Muthén, 1998-2013).

Results

Descriptive Statistics

Means, standard errors and correlation coefficients of competence, tactical skills, motivation, technical skills, and speed and agility characteristics were examined for males (Table II) and females (Table III). Descriptive statistics showed that means of all competence dimensions were above the mean, and the highest means were found for defensive skills for males and females. All subscales of competence were positively associated with each other in both genders. The strongest associations between competence and performance measures were found between tactical skills and all subscales of competence in both genders. In addition, perceived competence

in offensive skills was positively associated with motivation and technical skills for males. Perceived competence in 1 vs 1 dyad skills was positively associated with motivation, and speed and agility for both gender. All observed variables showed satisfactory levels of reliability, since composite reliability was relatively high and intraclass correlations were moderate. Composite reliability for offensive skills was .88, for 1 vs 1 dyad skills .84, and for defensive skills .81. Intraclass correlation for offensive skills was .42 ($P < .001$), for 1 vs 1 skills .50 ($P < .001$), and for defensive skills .54 ($P < .001$).

****Table II near here****

****Table III near here****

The factor model of competence, tactical skills, motivation, technical skills, and speed and agility characteristics

The factor model was implemented in order to analyse the associations of competence, tactical skills, motivation, technical skills, and speed and agility characteristics. The theorised model revealed poor fit for the data (χ^2 (234) = 917.778, $P < .001$, CFI = .91, TLI = .90, RMSEA = .047, 90% CI [.04, .05], SRMR = .042). However, the model was still improved based on the modification indices. The residuals of the items y1, y2, y5, y11, y12, y16, and y18 were allowed to correlate, because some of the shared variance of the items occurred due to latent factor. The modified model (Figure 4) was preferable to the original model fit (χ^2 (230) = 787.153, $P < .001$, CFI = .93, TLI = .92, RMSEA = .043, 90% CI [.04, .05],

SRMR = .039). The statistical significance of the Chi Square test is typical in the case of large sample sizes (Browne & Cudeck, 1993).

The standardised results showed that competence was positively associated with tactical skills, motivation, and technical skills. There was no statistically significant association between competence, and speed and agility characteristics. It has to be recognised that technical skills were valued from greater to smaller, although the estimate was negative. In addition, positive associations between tactical skills and motivation, technical skills, and speed and agility characteristics, as well as motivation, and speed and agility characteristics, were observed. The covariance effect of gender on competence ($P < .05$), motivation ($P < .001$), technical skills ($P < .001$), and speed and agility characteristics ($P < .001$) were found, with males scoring higher in competence, technical skills, and speed and agility characteristics, and lower in motivation than females ($P < .01$). In addition, age was negatively associated to players' motivation ($P < .01$). The model showed that the squared multiple correlations for tactical skills, motivation, technical skills, and speed and agility characteristics ranged greatly explaining 74% of variance in tactical skills and 25% in motivation. Only 14% and 11% of variances in technical skills, and speed and agility characteristics, were explained.

****Figure 4 near here****

Discussion

The objective of this study was to create a valid self-reported game-specific soccer competence scale that can be used as part of a suite of coaching assessment procedures to understand levels of perceived competence among young soccer

players. Furthermore, a structural model of perceived competence and tactical skills, motivation, technical skills, and speed and agility characteristics was tested, expecting that these performance measures and motivation would be positively associated with perceived competence. Covariance effects of age and gender were also examined.

Due to the importance of perceived competence in the motivation and development of young athletes (Harter, 1978), there is a clear need to collect information about how players perceive their sport-specific competence in competitive performance situations. These self-reported assessments can add to coaches' understanding of each athlete's perception of personal development needs. The PGSSCS measures three essential categories of game play abilities in soccer. The confimatory factor analysis generally showed acceptable values of goodness-of-fit indices indicating satisfactory construct validity of the three-factor model of the PGSSCS. Positive associations between the subscales for offensive skills, 1 vs 1 dyad skills, and defensive skills suggest that the factors represent distinct, but related, game play abilities in soccer. The results of the study also showed that all three subscales had relatively high composite reliability, internal consistency and intraclass correlation demonstrating that the PGSSCS is a reliable tool when analysing young soccer players’ perceived competence.

Perceived soccer competence of the players was rather high in this study. Mean values of all perceived competence subscales were above mean for both males and females. The highest means were found for defensive skills for both males and females, which may be related to the fact that defensive actions and decisions are generally less complicated than offensive actions. The finding of relatively high perceived soccer competence levels among youth soccer players support the findings

of previous studies (Feltz & Brown, 1984; Hopper et al., 1991). In line with earlier studies (Barnett et al., 2008; Feltz & Brown, 1984; Rudisil & Mahar, 1993), males reported higher competence than females. This may partly be explained by better technical skills and, speed and agility characteristics of the males.

When PGSSCS subscales were compared to the performance measures, it was found that players who reported high soccer competence also achieved higher scores in tactical skills. Tactical skills were explained by perceived comptence more strongly than other performance measures, which may be due to self-assessment used to measure tactical skills, as well as, perceived competence in this study. The TACSIS (Elferink-Gemser et al., 2004), which was used to assess players's tactical skills in this study, includes items related to tactical skills in both defensive and offensive situations of the game. In this study we expected to observe a positive association between tactical skills and each subscale of the PGSSCS, which would support the criterion validity of the PGSSCS.

Motivation was explained by competence in this study, supporting the role of perceived competence in the development process of motivation in sport (Deci & Ryan, 2000; Harter, 1978; Nichols, 1984). The finding of a positive association between perceived competence and motivation is in line with data found in previous studies (Gillet, Berjot, & Gobancé, 2009), indicating the positive association between perceived soccer competence and motivation towards playing soccer. The positive association between PGSSCS and motivation supports the criterion validity of the PGSSCS.

Technical skills were only slightly explained by perceived competence, which may be explained by the highly skillful and homogeneous group of players participating in this study. Players may have perceived themselves to be rather

competent in comparison to their age group in Finland, even if they were not the best players in technical skills among players participating in this study. The positive association between technical skills and perceived offensive skills was expected, because the subscale Offensive skills included items related to with-the-ball situations of the game where technical skills are needed. This associations was found only for males. The positive association between technical skills and perceived soccer competence supports the criterion validity of PGSSCS, and was in line with data reported in earlier studies which found significant relationships between perceived soccer competence and soccer-specific skills (Feltz & Brown, 1984; Hopper et al., 1991). Speed and agility performance measures could not be explained by perceived competence, however the higher scores the players received in speed and agility, the higher they scored in technical skills. It is possible that the level of speed and agility characteristics may have influenced the players' perceived competence by enabling them to perform better in technical skills. A positive association between speed and agility characteristics, and perceived performance in 1 vs 1 dyad skills was expected because the subscale of perceived 1 vs 1 skills included items considering whether players needed to be stronger or faster than an immediate opponent.

Conclusions

In conclusion, this research has led to the initial development of a psychometrically valid and reliable practical coaching tool which can be used as part of a suite of assessment procedures by coaches in analysing the perceived game-specific soccer competence of young soccer players. With the PGSSCS, information can be gathered on developing players' perceptions of their offensive, 1 vs 1 dyadic system and defensive skills, which can be expected to broadly represent their perceived abilities

in actual game situations. This tool will enable soccer coaches to collect information that could be valuable in assessing the personal needs of different athletes in talent development programmes. In its current form the PGSSCS is applicable to the participants in the Finnish soccer development system, but could be easily adapted to suit a range of languages, countries and sports, in further work. Future research is also needed to apply longitudinal designs, including analyses of changes in perceived soccer competence, especially in relation to significant events in the non-linear development trajectories of different players. There is also a need to understand their relations to changes in different soccer performance measures, and triangulate findings with other objective data from actual competitive performances of athletes.

Acknowledgement

This work was supported by Sports Institute Foundation; and Ellen and Artturi Nyyssönen Foundation

References

Abbott, A., & Collins, D. (2002). A theoretical and empirical analysis of a 'state of the art' talent identification model. *High Ability Studies*, *13*, 157-78. doi: 10.1080/1359813022000048798

Abbot, A., & Collins, D. (2004). Eliminating the dichotomy between theory and practice in talent identification and development: Considering the role of psychology. *Journal of Sports Sciences, 22*, 395-408. doi:10.1080/02640410410001675324

Arbuckle, J. (2007). *Amos 18.0 User's Guide*. Chicago, IL: Amos Development Corporation 1995-2009.

Bandura, A. (1997). *Self-efficacy: the exercise of control.* New York: Freeman.

Barnett, L. M., Morgan, P. J., van Beurden, E., & Beard, J. R. (2008). Perceived sports competence mediates the relationship between childhood motor skill proficiency and adolescent physical activity and fitness: a longitudinal assessment. *International Journal of Behavioral Nutrition and Physical Activity*, 5, 1-12. doi: 10.1186/1479-5868-5-40

Blomqvist, M., Vänttinen, T., & Luhtanen P. (2005). Assessment of secondary school students' decision-making and game-play ability in soccer. *Physical Education and Sport Pedagogy, 10,* 107-119. doi: 10.1080=17408980500104992

Bortoli, L., Bertollo, M., Comani, S., & Robazza, C. (2011). Competence, achievement goals, motivational climate, and pleasant psychobiosocial states in youth sport. *Journal of Sports Sciences*, *29,* 171-180. doi: 10.1080/02640414.2010.530675

Browne, M., & Cudeck, R. (1993). Alternative ways of assessing model fit. In K. Bollen & J. Long (Eds.), *Testing structural equation models* (pp. 136-162). Newbury Park, CA: Sage.

Deci, E. L., & Ryan, R. M. (2000). The "what" and "why" of goal pursuits: human needs and the self-determination of behavior. *Psychological Inquiry*, *11*, 227-268. doi: 10.1207/S15327965PLI1104_01

Elferink-Gemser, M. T., Visscher, C., Richart, H., & Lemmink, K. A. P. M. (2004). Development of the Tactical Skills Inventory for Sports. *Perceptual and Motor Skills*, *99,* 883-895. doi: 10.2466/pms.99.3.883-895

Feltz, D. L., & Brown, E. W. (1984). Perceived competence in soccer skills among young soccer players. *Journal of Sport and Exercise Psychology, 6,* 385-394. Retrieved from https://www.ebscohost.com.

Ford, P. R., & Williams, A. M. (2012). The Developmental Activities Engaged in by Elite Youth Soccer Players who progressed to Professional Status compared to those who did not. *Psychology of Sport and Exercise, 13,* 349-352. doi: 10.1016/j.psychsport.2011.09.004

Fox, K. R., & Corbin, C. B. (1989). The Physical Self-Perception Profile: Development and preliminary validation. *Journal of Sport and Exercise Psychology, 11,* 408-430. Retrieved from https://www.ebscohost.com.

Gillet, N., Berjot, S., & Rosnet, E. (2009). A motivational model of performance in the sport domain. *European Journal of Sport Science, 9,* 151-158. doi: 10.1080/17461390902736793

Greenwood, D., Davids, K., & Renshaw, I. (2014). Experiential knowledge of expert coaches can help identify informational constraints on performance of dynamic interceptive actions. *Journal of Sports Sciences, 32,* 328-35. doi: 10.1080/02640414.2013.824599

Harter, S. (1978). Effectance motivation reconsidered toward a developmental model. *Human Development, 21*, 34-64. doi:10.1159/000271574

Harter, S. (1985). *Manual for the self-perception profile for children.* Denver, CO: University of Denver.

Haugaasen, M., Toering, T., & Jordet, G. (2014). From childhood to senior professional football: elite youth players' engagement in non-football activities. *Journal of Sports Sciences, 32,* 1940-1949. doi: 10.1080/02640414.2014.970218

Hopper, C., Guthrie, G. D., & Kelly, T. (1991). Self-concept and skill development in youth soccer players. *Perceptual and Motor Skills, 72,* 275-285. doi: 10.2466/pms.1991.72.1.275

Horn, T. S. (2004). Developmental perspectives on self-perceptions in children and adolescents. In M. R. Weiss (Ed.), *Developmental sport and exercise psychology: A lifespan perspective* (pp. 101-143). Morgantown, WV: Fitness Information Technology.

Horn, T. S., & Amorose, A. J. (1998). Sources of competence information. In J. L. Duda (Ed.), *Advances in sport and exercise psychology measurement* (pp. 49-63). Morgantown, WV: Fitness Information Technology.

Hujigen, B. C, Elferink-Gemser, M. T., Lemmink, K. A. P. M., & Visscher, C. (2012). Multidimensional performance characteristics in selected and deselected talented soccer players. *European Journal of Sport Science, 14*, 1-9. doi: 10.1080/17461391.2012.725102

IBM Corporation (2012). *Statistics for Windows Version 21.0.* Armonk, NY: IBM Corp.

Jacobs, J., Hyatt, S., Eccles, J. S., Osgood, D. W., & Wigfield, A. (2002). Changes in children's self-competence and values: gender and domain differences across grades one through twelve. *Child development, 73,* 509-527. Retrieved from https://www.ebscohost.com.

Klein, P. (1994). *An easy guide to factor analysis.* London: Routledge.

Le Bars, H., Gernigon, C., & Ninot, G. (2009). Personal and contextual determinants of elite young athletes' persistence or dropping out over time. *Scandinavian Journal of Medicine and Science in Sports, 19*, 274-285. doi: 10.1111/j.1600-0838.2008.00786.x

Little, R., & Rubin, D. (2002). *Statistical analysis with missing data*. New York: Wiley.

MacNamara, A., & Collins, D. (2011). Development and initial validation of the psychological characteristics of developing excellence questionnaire. *Journal of Sports Sciences, 29*, 1273-1286. doi: 10.1080/02640414.589468

Mahoney, M. J, Cabriel, T. J., & Perkins, T. S. (1987). Psychological skills and exceptional athletic performance. *The Sport Psychologist, 1,* 181-199. Retrieved from https://www.ebscohost.com.

Marsh, H. W., Richards, G., Johnson, S., Roche, L., & Tremayne, P. (1994). Physical Self Description Questionnaire: Psychometric properties and a multitrait-multimethod analysis of relations to existing instruments. *Journal of Sport and Exercise Psychology, 16*, 270–305. Retrieved from https://www.ebscohost.com.

Mirkov, D., Nedeljkovic, A., Kukolj, M., Ugarkovic, D., & Jaric, S. (2008). Evaluation of the reliability of soccer-specific field tests. *Journal of Strength and Conditioning Research, 22*, 1046-1050. doi: 10.1519/JSC.0b013e31816eb4af.

Moir, G., Button, C., Glaister, M., & Stone, M. H. (2004). Influence of familiarization on the reliability of vertical jump and acceleration sprinting performance in physically active men. *Journal of Strenght and Conditioning Research, 18*, 276-280. Retrieved from https://www.ebscohost.com.

Muthén, L., & Muthén, B. (1998–2013). *Mplus user's guide sixth edition.* Los Angeles, CA: Muthén & Muthén.

Nicholls, J. G. (1984). Achievement motivation: conceptions of ability, subjective experience, task choice, and performance. *Psychological Review, 91*, 328-346. Retrieved from https://www.proquest.com.

Nunnally, J. C., & Bernstein, I. H. (1994). *Psychometric theory.* New York: McGraw-Hill.

Phillips, E., Davids, K., Renshaw, I., & Portus, M. (2010). Expert performance in sport and the dynamics of talent development. *Sports Medicine, 40*, 271-283. doi: 10.2165/11319430

Raudsepp, L., & Liblik, R. (2002). Relationship of perceived and actual motor competence in children. *Perceptual and Motor Skills, 94*, 1059-1070. doi: 10.2466/pms.2002.94.3c.1059

Reilly, T., Williams, A. M., Nevill, A., & Franks, A. (2000). A multidisciplinary approach to talent identification in soccer. *Journal of Sports Sciences, 18,* 695-702. Retrieved from http://www.tandfonline.com.

Roberts, G. C., Treasure, D. C., & Conroy, D. E. (2007). Understanding the dynamics of motivation in sport and physical activity: An achievement goal interpretation. In G. Tenenbaum & R. Eklund (Eds.), *Handbook of sport psychology* (3rd ed., pp. 3-30). New York: Wiley.

Rodriquez, D., Wigfield, A., & Eccles, J. S. (2003). Changing competence perceptions, changing values: implications for youth sport. *Journal of Applied Sport Psychology, 15,* 67-81. doi: 10.1080/10413200390180071

Rudisill, M. E., Mahar, M. T., & Meaney, K.S. (1993). The relationship between children's perceived and actual motor competence. *Perceptual and Motor Skills, 76*, 895-906. doi: 10.2466/pms.1993.76.3.895

Sheldon, J. P., & Eccles, J. S. (2005). Physical and Psychological predictors of perceived ability in adult male and female tennis players. *Journal of Applied Sport Psychology, 17,* 48-63. doi: 10.1080/10413200590907568

589 Simonton, D. (1999). Talent and its development: An emergenic and epigenetic
590 model. *Psychological Review, 106*, 435-457. Retrieved from
591 https://www.proquest.com.
592 Tabachnick, B., & Fidell, L. (2007). *Using Multivariate Statistics*. Boston: Allyn and
593 Bacon.
594 Ullrich-French, S., & Smith, A. L. (2009). Social and motivational predictors of
595 continued youth sport participation. *Psychology of Sport and Exercise, 10*,
596 87-95.
597 Unnithan, V., White, J., Georgiou, A., Iga, J., & Drust, B. (2012). Talent
598 identification in youth soccer. *Journal of Sports Sciences, 30,* 1719-1726. doi:
599 10.1080/02640414.2012.731515
600 Vaeyens, R., Lenoir, M., Williams, M., & Philippaerts, R. M. (2008). Talent
601 identification and development programmes in sport, current models and
602 future directions. *Sports Medicine, 38,* 703-714. Retrieved from
603 https://www.ebscohost.com.
604 Vänttinen, T. (2013). Growth-associated variation in body size, hormonal status,
605 physical performance characteristics and perceptual-motor skills in Finnish
606 young soccer players, a two-year follow-up study in the U11, U13 and U15 age
607 groups. Studies in Sport, Physical Education and Health 197. Jyväskylä:
608 University of Jyväskylä.
609 Wichstrøm, L. (1995). Harter's self-perception profile for adolescents: reliability,
610 validity, and evaluation of the question format. *Journal of Personality*
611 *Assessment, 65,* 100-116. doi: 10.1207/s15327752jpa6501_8
612 Wiersma, L. D. (2001). Conceptualization and development of the sources of
613 enjoyment in youth sport questionnaire. *Measurement in Physical Education*

and Exercise Science, 5, 153–177. Retrieved from https://www.ebscohost.com.

Wigfield, A., Eccles, J., Mac Iver, D., Reuman, D., & Midgley, C. (1991) Transitions at early adolescence: Changes in children's domain-specific self-perceptions and general self-esteem across the transition to junior high school. *Developmental Psychology, 27,* 552-565. Retrieved from http://www.proquest.com.

Williams, A. (2000). Perceptual skill in soccer: Implications for talent identification and development. *Journal of Sports Sciences, 18,* 737-750. doi: 10.1080/02640410050120113

625 TABLE I. Items of the Perceived Game-Specific Soccer Competence Scale.

Item number and content
Offensive skills
1. I have a soft "touch" on the ball
2. I dare to keep the ball to myself even in tight spaces
3. I have clear solution models about how I score in the different situations in the games
4. I can move to the empty spaces on the field, so that my teammates can pass me the ball
5. I can find my teammates with my sharp and accurate passes
6. I can accomplish the typical play for my position in offensive play
7. I know how my teammates are moving in attack situations and it is easy for me to pass them the ball
8. I can solve / create game situations with 1-2 teammates
9. I can move according to our attacking plays during the game, so that my teammates can pass me the ball
10. I can schedule my own movement correctly in offensive and defensive play
1 vs 1 skills
11. I have clear solution models about how to win 1-on-1 situations
12. I am usually the first player to reach the ball
13. I can easily lose my opponent in different game situations
14. I feel strong in match ups
15. In 1-on-1 situations, I am stronger/faster than my opponent
Defensive skills
16. I am able to cover my player in defensive situations in games
17. I can accomplish the typical play for my position in defensive play
18. I can, if necessary, help / support my teammates in defensive situations

626

627 TABLE II. Means, standard errors and correlation coefficients of competence,
628 tactical skills, motivation, technical skills and speed and agility characteristics for
629 males.

	Mean	SE	1.	2.	3.	4.	5.	6.
1.Offensive	3.75	.02						
2.1v1	3.67	.02	.65***					
3.Defensive	3.87	.02	.51**	.49***				
4.Tactical	4.35	.02	.71***	.60***	.60***			
5.Motivation	4.24	.02	.44***	.37***	.27	.50***		
6.Technical	33.43	.15	-.20*	-.19	-.07	-.17	-.10***	
7.Speed and agility	5.92	.01	-.08	-.25***	-.02	-.01	.08***	.52***

630 *Note*: * $P < .05$, ** $P < .01$, *** $P < .001$

631

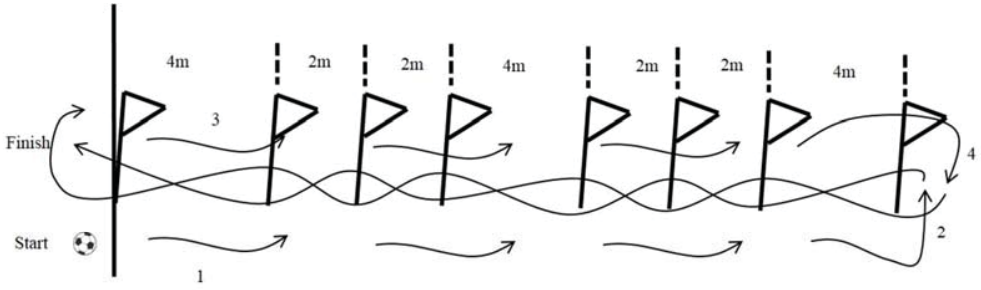
632 TABLE III. Means, standard errors and correlation coefficients of competence,

633 tactical skills, motivation, technical skills, and speed and agility for females.

	Mean	SE	1.	2.	3.	4.	5.	6.
1.Offensive	3.70	.03						
2.1v1	3.52	.04	.70***					
3.Defensive	3.79	.04	.63**	.55**				
4.Tactical	4.32	.04	.82***	.65***	.62***			
5.Motivation	4.35	.03	.34	.40**	.29	.39***		
6.Technical	35.90	.25	.01	.05	.06	.07	.12	
7.Speed and agility	6.19	.01	.09	-.11***	.16	.16*	.04	.35***

634 *Note*: * $P < .05$, ** $P < .01$, *** $P < .001$

635



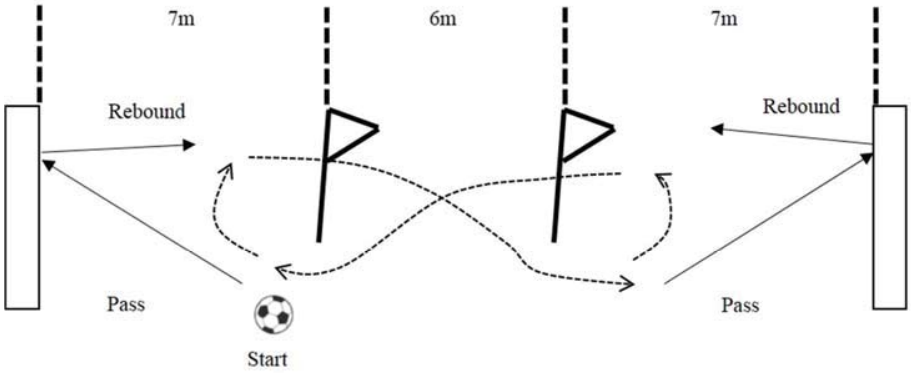
1 = straight run with ball (at least 3 touches before turn)
2 = dribbling back
3= straight run with ball (at least 3 touches before turn)
4 = dribbling back

636

637 Figure 1.Illustrations showing the dribbling test track.

638

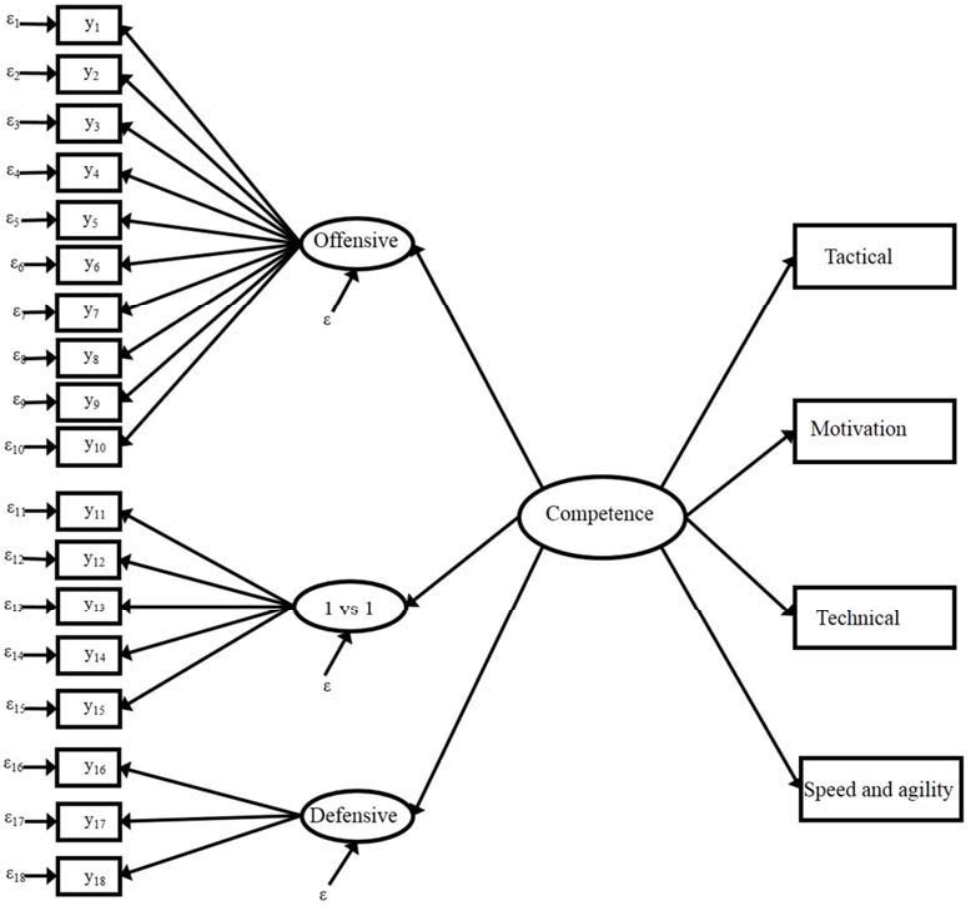
639



640

641 Figure 2. Illustrations showing the passing test track.

642



643

644

645 Figure 3.Theorised model of competence, tactical skills, motivation, technical skills,

646 and speed and agility characteristics.

647

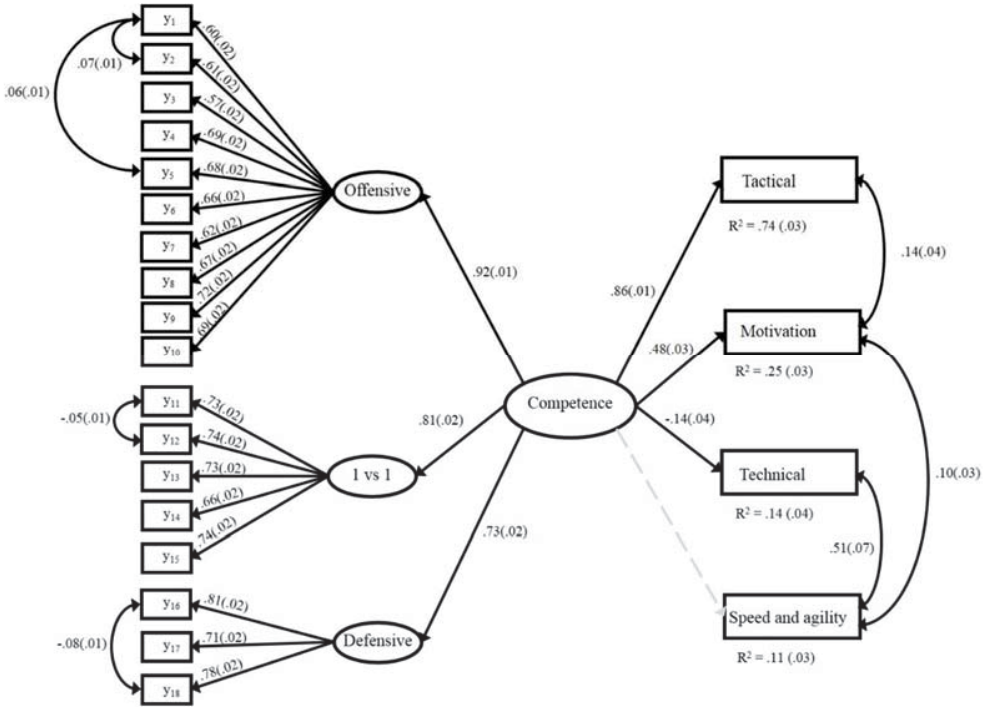


Figure 4. Modified model of competence, tactical skills, motivation, technical skills, and speed and agility characteristics.

IV

DEVELOPMENT OF PERCEIVED COMPETENCE, TACTICAL SKILLS, MOTIVATION, TECHNICAL SKILLS, AND SPEED AND AGILITY IN YOUNG SOCCER PLAYERS

by

Forsman, H., Gråstén, A., Blomqvist, M., Davids, K., Liukkonen, J. & Konttinen, N., 2015

Journal of Sports Sciences, doi: 10.1080/02640414.2015.1127401

Development of perceived competence, tactical skills, motivation, technical skills, and speed and agility in young soccer players

Running title: *Development of performance characteristics in youth soccer*

HANNELE FORSMAN[1,2], ARTO GRÅSTÉN[1], MINNA BLOMQVIST[3], KEITH DAVIDS[4,5], JARMO LIUKKONEN[1] AND NIILO KONTTINEN[3]

[1] Department of Sport Sciences, University of Jyväskylä, Jyväskylä, Finland, [2] Eerikkilä Sports Institute, Tammela, Finland, [3] Research Institute for Olympic Sports, Jyväskylä, Finland, [4] Centre for Sports Engineering Research Faculty of Health and Wellbeing, Sheffield Hallam University, Sheffield, UK and [5]FiDiPro Programme, University of Jyväskylä, Jyväskylä, Finland

Correspondence:

Hannele Forsman
University of Jyväskylä - Department of Sport Sciences
PL 35
FIN-40014 University of Jyväskylä
Finland
Tel. +358-40-1344392
Fax. +358-14-2602001
E-mail: hannele.forsman@eerikkila.fi

Abstract

The objective of this one-year, longitudinal study was to examine the development of perceived competence, tactical skills, motivation, technical skills, and speed and agility characteristics of young Finnish soccer players. We also examined associations between latent growth models of perceived competence and other recorded variables. Participants were 288 competitive male soccer players ranging from 12 to 14 years (12.7 ± 0.6) from 16 soccer clubs. Players completed the self-assessments of perceived competence, tactical skills, and motivation, and participated in technical, and speed and agility tests. Results of this study showed that players' levels of perceived competence, tactical skills, motivation, technical skills, and speed and agility characteristics remained relatively high and stable across the period of one year. Positive relationships were found between these levels and changes in perceived competence and motivation, and levels of perceived competence and speed and agility characteristics. Together these results illustrate the multidimensional nature of talent development processes in soccer. Moreover, it seems crucial in coaching to support the development of perceived competence and motivation in young soccer players and that it might be even more important in later maturing players.

Keywords: *talent development, multidimensionality, perceived competence, performance characteristics, motivation, soccer*

Introduction

Talent development in team sports is a complex process and prediction of long-term success in young players is an extraordinary challenge (Phillips, Davids, Renshaw, & Portus, 2010; Reilly, Williams, Nevil, & Franks, 2000). Differences in maturation and development, learning and experience, and rapid changes in physiological and anthropometric characteristics during adolescence may impact a young player's development (Abbott & Collins, 2002; Meylan, Cronin, Oliver, & Hughes, 2010; Vaeyens, Lenoir, Williams, & Philippaerts, 2008). The development of young players can be nonlinear with periods of sudden performance transitions and jumps, stable plateaux with little progression and even periods of regression (Pinder, Renshaw, & Davids, 2013; Renshaw, Davids, Phillips, & Kerbeyé, 2012).

The goal of talent development in sport is to develop athletes who will reach an expert level in adulthood. Soccer is a complex sport, in which multi-dimensional skills, such as physiological characteristics, and technical, tactical and psychological skills, are needed (Reilly et al., 2000). Speed and agility characteristics are important due to large amounts of high-intensity sprints and fast turns occurring during the game (Bloomfield, Polman, & Donoghue, 2007; Di Salvo, Pigozzi, Gonzalez-Haro, Laughlin, & De Witt, 2013; Mohr, Krustrup, & Bangsbo, 2003). Technical skills, such as dribbling the ball and passing, are critical to performance, because the typical actions during the game are to take possession of the ball and pass or take the possession and dribble and pass (Rampinini, Impellizzerri, Castagna, Coutts, & Wisloff, 2009). Tactical skills are requisite in high-level soccer, since well-developed physiological characteristics and technical skills are not sufficient if the timing of performed actions is not appropriate (Kannekens, Elferink-Gemser, & Visscher, 2009; 2011).

In addition to performance characteristics, psychological skills have also been shown to be important determinants of both performance and development of young athletes (Durand-Bush & Salmela, 2002; MacNamara & Collins, 2011; Van Yperen, 2009). Perceived competence has been suggested to be an especially important determinant of motivation (Deci & Ryan, 2000; Harter, 1978), and a strong predictor of functional psycho-biosocial states in young athletes (Bortoli, Bertolli, Comani, & Robazza, 2011). Perceived competence refers to an individual's self-perception of his/her own abilities in a specific performance domain (Horn, 2004). Harter's competence motivation theory (1978) suggests that young individuals who perceive themselves competence in a skill, are more likely to invest more effort in an attempt to improve their skills further. Improved skills leads to positive competence beliefs and enhanced intrinsic motivation.

Self-perceptions of young athletes are shaped by development of cognitive functioning which can help them to differentiate effort and ability as causes of performance success, and to understand the information sources used to judge competence (Harter, 1999; Horn, 2004). Researchers have also identified various age-related contextual (Papaioannou, Bebetsos, Theodorakis, Christodoulidis, & Kouli, 2006), social (Harter, 2012; Horn, 2004), and biological factors (O'Dea & Abraham, 1999) that may be associated with the development of perceived competence in adolescents. One of the possible contextual contributors of perceived competence in sport is previous sport experience (Bandura, 1997; Papaioannou et al., 2006). When sport-specific characteristics of the athlete correspond to the demands of the sport, positive self-perceptions and behaviours may emerge. Social factors, such as expectations from parents and coaches, feedback given by the coach and performance evaluation, may also influence the development of perceived competence in young

athletes (Harter, 2012; Horn, 2004). Previous studies (Bortoli et al., 2011; Weiss, Amorose, & Wilko, 2009) have shown that a greater emphasis by coaches on a 'task-involving' climate, and less emphasis on an 'ego-involving' climate during development, is positively associated with the development of perceived competence in young athletes.

During adolescence, a number of dramatic age-related biological changes occur, that may affect both the perceived competence (Harter, 2012; Horn, 2004), and performance characteristics of a young soccer player (Malina, et al., 2005; Malina, Eisenmann, Cumming, Ribeiro, & Aroso, 2004; Philippaerts, et al., 2006). The body composition of a young athlete undergoes rapid changes during the maximal growth spurt, which occurs in boys at the age of around 14 years (Malina, Bouchard, & Bar-Or, 2003). During this time, height increases by approximately 10 cm per year in an average male adolescent (Tanner, Whitehouse, & Takaishi, 1966). These changes in body composition reflect an athlete's maturity status, which has been shown to be related to physiological and technical performance development during adolescence (Malina et al., 2005; Meylan et al., 2010; Philippaerts et al., 2006). Although growth and maturity have the greatest impact on physiological capacities, development of technical skills may also be slightly associated with biological maturity status (Malina et al., 2005). The fastest development in technical skills has been shown to emerge in the prepubertal years (Valento-Dos-Santos, et al., 2012), whereas the fastest development in physiological capacities usually occurs at the same time with maximal height spurt at the age of around 14 years (Philippaerts et al., 2006). Tactical skills have been shown to improve with sport-specific practice rather than be growth-mediated in development (Roca, Williams, & Ford, 2012; Vaeyens, Lenoir, Williams, Mazyn, & Philippaerts, 2007; Ward & Williams, 2003). Due to these growth-mediated changes in performance

characteristics, more mature athletes have an increasing and persistent advantage over less mature athletes in soccer (Helsen, et al., 2012). Pubertal status has also been shown to be related to athletic competence, with early developing males displaying greater athletic competence than late developing peers (O'Dea & Abraham, 1999).

Since performance in soccer is multidimensional in nature (Reilly et al., 2000), and rapid age-related changes occur during adolescence (Harter, 2012; Horn, 2004), it follows that measurement of players' development should also be multidimensional and longitudinal. This longitudinal study sought to examine the development of perceived competence, tactical skills, motivation, technical skills, and speed and agility characteristics of young Finnish footballers over a period of 12 months. A question of interest was whether observable changes in variables would be manifest in this period of time. Another aim was to examine the associations of the latent growth models of perceived competence and other study variables. In addition, covariate effects of age, growth, and performance level of the players were examined.

Methods

Participants

A total of 288 competitive male soccer players ranging from 12 to 14 years (average: age 12.7 ± 0.6; height 156.3 ± 8.5 cm; weight 44.9 ± 8.1 kg) from 16 soccer clubs participated in this longitudinal study. All players represented clubs which had been selected for the player development program organised by the training and research centre for Finnish football. Participating clubs were instructed to organise eight to ten hours of formal soccer practice per week including games for their first teams aged 12 to 14 years.

The data were collected from teams participating in the player monitoring event organised by the training and research centre of Finnish football twice a year; at the

beginning of the competitive season (February-April) and near the end of the competitive season (October-December). Data were collected in three measurement phases during a period of one year (T0, T1, T2). Some players missed testing because of injuries, illnesses, exams, or drop-outs. The number of players participating at the different measurement phases was 288, 200 and 288 respectively. The total of 200 players completed all three phases of testing.

Age, growth and performance level of the players were used as covariates. Average growth during one year was 7.1 ± 2.6 cm. Performance level of the players was determined by coaches who were asked to name five most talented players in their teams. Based on that experiential knowledge, players were divided into two groups; most talented (n = 94) and less talented (n =194) at that point in time.

Procedure

All the participants and their parents/guardians were required to provide informed written consent for participation in the study. The aims and execution of the project were carefully explained in the consent form. The participants were provided with information explaining that they had the right to withdraw from the study whenever they wanted, without any negative repercussions. Participation was voluntary and no extra credit was awarded for participation. The clubs and the coaches gave also permission for this study. All participants completed self-assessments of perceived competence, tactical skills and motivation in a lecture hall according to standardised instructions provided by the researchers. Height and weight of the players were measured. Technical, and speed and agility tests were carried out in an indoor soccer hall. The players completed technical tests on an artificial grass soccer field, and speed and agility tests on a running track.

Measures

Perceived competence. A Perceived Game-Specific Soccer Competence Scale (PGSSCS, Forsman, Gråstén, et al., in press) was used to examine players' perceived soccer competence. PGSSCS consists of 18 items representing three dimensions: Offensive skills (10 items, e.g. "I dare to keep the ball to myself even in tight spaces"), 1 vs 1 skills (5 items, e.g. "I have clear solution models about how to win 1-on-1 situations"), and Defensive skills (3 items, e.g. "I am able to cover my player in defensive situations in games"). Players responded to the 18 items with a 5-point Likert scale regarding sport performance, anchored by 1 *(almost never)* and 5 *(almost always)*. Participants were asked to compare themselves with the top Finnish players in the same age category. The mean value of all 18 items was selected to represent each player's perceived soccer competence. In previous research by Forsman, Gråstén, et al. (in press) the PGSSCS model was shown to have good psychometric characteristics (CFI = .93, TLI = .92, RMSEA = .043). Composite reliability for offensive skills was .88, for 1 vs 1 dyad skills it was .84, and for defensive skills it was .81 (Forsman, Gråstén, et al., in press). In the current study, the internal consistency (Cronbach alpha) of the PGSSCS was .89.

Tactical skills. Self-assessed tactical skills were measured with a Tactical Skills Inventory for Sports (TACSIS; Elferink-Gemser, Visscher, Richardt, & Lemmink, 2004). The TACSIS consists of 22 items within the general areas of Positioning and Deciding (9 items, e.g. "Decisions I make during matches about proceeding actions are generally"), Knowing about Ball Actions (4 items, e.g. "I know exactly when to pass the ball to a teammate or when not to"), Knowing about Others (5 items, e.g. I know quickly how the opponent is playing"), and Acting in Changing Situations (4 items, e.g. "I quickly react to changes, as from not possessing the ball but also look over the field"). When rating his own performance, a player was asked to compare himself with

the best Finnish players in his age category, scoring the items on a 6-point Likert scale, anchored with 1 *(very poor or almost never)* and 6 *(excellent or always).* The mean value of all 22 items was selected to represent self-assessed tactical skills. In previous studies, the TACSIS has been revealed as a reliable psychometric instrument with Cronbach's alpha coefficients ranging from .72 to .91 (Elferink-Gemser et al., 2004; Forsman, Blomqvist, et al., in press; Kannekens, Elferink-Gemser, & Visscher, 2011). In the current study, the internal consistency (Cronbach alpha) of TACSIS was .95.

*Motivation***.** Motivation of the players was measured with the subscale Motivation from The Psychological Skills Inventory for Sports (PSIS-R-5; Mahoney, Gabriel, & Perkins, 1987). The Motivation subscale consists of 8 items (e.g. "I want to train very hard to belong to the top in my sport") and scores were measured using a 5-point Likert scale, anchored with 1 *(almost never)* and 5 *(almost always).* A high score on the scale corresponded to motivation being present to a large extent. In previous studies, the Motivation subscale has been revealed as a reliable psychometric instrument with Cronbach's alpha coefficients ranging from .81 to .86 (Forsman, Blomqvist, et al., in press; Forsman, Gråstén, et al., in press). In the current study, the internal consistency (Cronbach alpha) of Motivation was .69.

*Technical skills***.** Dribbling and passing skills were measured to examine technical skills of the players. These tests recommended by the Football Association of Finland, and have earlier been used in same kind of studies (Vänttinen, 2013). The task in both tests (Figure 1 and Figure 2) was to complete test tracks as fast as possible. The best out of two trials was selected for further analysis in both technical tests. The mean score of the dribbling and passing tests was calculated representing players' soccer-specific technical skills. The reliability of these technical tests for young soccer players has been confirmed in earlier studies with one month interval test-retest correlation

coefficient for dribbling $r = 0.82$ ($P < 0.001$) and passing $r = 0.81$ ($P < 0.001$) (Vänttinen, 2013).

Figure 1 here

Figure 2 here

Speed and agility. In 30m all-out run from stationary start, players started 0.70 m behind the photocells, which triggered the timer. Agility was measured with 8-figure test track recommended by the Finnish Football Association (Vänttinen, 2013). Speed and agility were both measured with photocells (Newtest Oy, Finland). The mean score of the speed and agility tests was selected to represent players' speed and agility characteristics. Earlier studies have confirmed the reliability and validity of sprinting time tests (Moir, Button, Glaister, & Stone, 2004) and same type of agility tests (Mirkov, Nedeljkovic, Kukolj, Ugarkovic, & Jaric, 2008).

Data analysis

First, normal distribution, outliers, and missing values of the data were examined. No modifications due to normality were required. Nor were statistically significant outliers detected through the covariance matrix based on the on the Mahalanobis distance test ($P < .001$) of standardised values (± 3.00) (Tabachnick & Fidell, 2007). The data included 24% of missing values. In the case of the longitudinal data, some players did not participate in the second measurement phase (T0, $n = 288$; T1, $n = 200$; T2, $n = 288$). However, Little's MCAR -test ($\chi^2 = 380.538$, df = 269, $P < .001$) and frequencies (level, age) indicated that the missing values did not represent any particular group. Hence, the missing values were assumed to be missing at random (MAR) (Little & Rubin, 2002).

Next, the descriptive statistics for each variable were determined. In order to examine the development of perceived competence, tactical skills, motivation, technical skills, and speed and agility characteristics, latent growth curve models were implemented. The models were constructed by fixing the loadings of variables across T0 to T2 to 1 on the initial level and to 0, 1, 2 on growth. The intercepts, variances, and residuals of the latent variables (Level, Slope) were estimated. Level, growth, and age were added into the models as covariates. Finally, the associations between latent variables of perceived competence, tactical skills, motivation, technical skills, and speed and agility characteristics were tested.

Chi-square test ($\chi 2$) was used as a test of the model's overall goodness-of-fit to the data. A non-significant difference between observed frequency distribution and theoretical distribution had an acceptable fit to the data. To determine the appropriateness of the model the standardised root mean square residual (SRMR) and the root mean square error of approximation (RMSEA), the comparative fit index (CFI) and the Tucker-Lewis index (TLI) were also examined (Arbuckle, 2006). A value of <.05 for SRMR indicated a reasonable magnitude of a varying quantity, a value of <.05 for the RMSEA indicated an acceptable fit of the model in the relations to the degrees of freedom (Browne & Cudeck, 1993). The CFI and TLI indices range from 0 to greater than 1. Fit indices > 0.95 are indicative for an excellent model fit. The missing value analysis was performed using SPSS Statistics Version 22.0 (IBM Corporation, 2012) and all subsequent analyses using Mplus Version 7.11 (Muthén & Muthén, 1998-2013).

Results

Descriptive Statistics

Correlation coefficients, means and standard deviations of perceived competence, tactical skills, motivation, technical skills, and speed and agility are shown in Table I.

Descriptive statistics highlighted that the associations between players' perceived competence, tactical skills and motivation ranged from moderate to high across the monitoring period of one year. In addition, there were moderate positive associations between technical skills, and speed and agility characteristics. Low associations were found between perceived competence, and speed and agility characteristics, tactical skills, and speed and agility characteristics, and technical skills and motivation. The mean scores indicated that the level of perceived competence, tactical skills and motivation were above mathematical means already at T0, and remained stable during the monitoring period of one year. Some development was detected in mean scores of technical skills, and speed and agility characteristics from T0 to T1 and from T1 to T2.

Table I here

Latent growth curve modelling

In order to analyse the development of perceived competence, tactical skills, motivation, technical skills, and speed and agility characteristics across the one-year period, latent growth curve models were implemented. All models revealed an excellent model fit for the data. The standardized results highlighted that players' perceived competence, tactical skills, motivation, technical skills, and speed and agility characteristics were relatively high and sustained stable across the period of one year (Table II). The covariance effect of growth was found in the slope of perceived competence and tactical skills, and the level of speed and agility characteristics, whereas performance level of the players displayed a significant covariance for the level of tactical skills, motivation, technical skills, and speed and agility characteristics. In addition, the age variable related to the level of technical skills, and speed and agility characteristics.

298

299 ***Table II here***

300

301 Next, the associations of latent variables of perceived competence and tactical
302 skills, motivation, technical skills, and speed and agility characteristics were analysed.
303 Significantly positive associations were found between levels of perceived competence
304 and motivation (standardised estimate = .52, $P < .001$), levels of perceived competence,
305 and speed and agility characteristics (standardised estimate = -.18, $P < .01$), and slopes
306 of perceived competence and motivation (standardised estimate = .67, $P < .001$) (Figure
307 3).

308

309 ***Figure 3 here***

310

311 **Discussion**

312 This study examined the development of perceived competence, tactical skills,
313 motivation, technical skills, and speed and agility characteristics among young male
314 soccer players in Finland ranging from 12 to 14 years during a period of one year.
315 Another aim was to examine the associations of the latent growth models of perceived
316 competence and other study variables, and covariate effects of age, growth, and
317 participant performance level. The main finding of this study was that players'
318 perceived competence, tactical skills, motivation, technical skills, and speed and agility
319 characteristics remained relatively high and stable across the period of one year.
320 Positive associations were found between levels of perceived competence and
321 motivation, levels of perceived competence and speed and agility characteristics, and
322 slopes of perceived competence and motivation.

The stability of perceived competence and motivation measured during this period of development may have been due to the participants in this study being highly competitive and skilful players representing the best Finnish teams in their age group. In contrast to findings of earlier studies in a school environment (e.g., Rodriquez, 2003), perceived competence scores did not decline during this period of one year, suggesting that in a competitive sport programme, perceived competence of young players may be more stable than in an educational (school) setting. Findings suggested that the coaching process of the players was successful in supporting a high level of perceived competence and motivation.

Previous research has shown that the fastest development in technical skills occurs in the prepubertal years (Valento-Dos-Santos et al., 2012), whereas the fastest development in physiological capacities usually occurs at the same time as the maximal height spurt at the age of around 14 years (Philippaerts et al., 2006). In this study, some development over 12 months was detected in players' technical skills, and speed and agility characteristics, but these changes were not revealed to be statistically significant. It should also be noted, that the players in this study already displayed a high level of technical, and speed and agility characteristics at baseline, which remained stable and made it more challenging to significantly develop these skills and characteristics during a relatively short period.

During adolescence, a number of rapid age-related biological and social changes occur (Harter, 2012; Horn, 2004), that may affect perceived competence, motivation and performance characteristics of young players. One of these changes is the first growth spurt, which has been shown to reflect each athlete's maturity status (Malina, Bouchard, & Bar-Or, 2004; Meylan et al., 2010). In this study, the average growth in 12 months was 7.1 cm, indicating that some players may have reached peak height, and

others not. A covariance effect of growth was found in the slope of competence and tactical skills, suggesting that perceived competence and tactical skills develop more among players who grew up more. Perceived competence and tactical skills were both measured with self-assessment both reflecting players' own perceptions of their competence in soccer. This finding is line with data reported in earlier studies (O'Dea & Abraham, 1999), which showed that pubertal status is positively related to athletic competence in males, with early developing males having higher athletic competence than their late developing peers. The results of the present study also showed that age was related to the levels of technical skills, and speed and agility characteristics, indicating that older players had better technical skills, and speed and agility characteristics than younger players. In contrast to findings of earlier studies (Philippaerts et al., 2006), growth was negatively associated with level of speed and agility characteristics, indicating that players who grew less, displayed more stable physiological functioning in the 12 month period.

In this study, reported performance level of the players displayed a significant covariance effects for tactical skills, motivation, technical skills, and speed and agility characteristics, indicating that players identified as talents based on their coaches assessments scored better than other players in motivation and all other performance characteristics. Findings support data from earlier cross-sectional studies, which showed that more talented players had higher motivation levels (Ward, Hodges, Williams, & Starkes, 2007). They also scored better than other players in tactical skills (Kannekens et al., 2011), technical skills (Huijgen, Elferink-Gemser, Post, & Visscher, 2009), and physiological characteristics (Gil, Ruiz, Irazusta, Gil, & Irazusta, 2007; Vaeyens, et al., 2006). Our findings in this study highlighted the importance of adopting a multidimensional approach to talent development in soccer.

Earlier studies have emphasised the importance of perceived competence in the development process of motivation in sport (Deci & Ryan, 2000; Harter, 1978). In line with these findings, a positive association between the level of perceived competence and motivation was also found in the present study. In addition, a greater increase in perceived competence was linked with a greater increase in motivation, supporting the role of perceived competence in the development of motivation (Deci & Ryan, 2000; Harter, 1978). In this study, a positive association was found between the level of perceived competence and speed and agility characteristics, indicating that the better speed and agility characteristics, the higher was perceived competence. In contrast to earlier studies among young soccer players (Hopper, Guthrie, & Kelly, 1991), there was no significant association between level of perceived competence and technical skills. This may have been due to the PGSSCS used to measure perceived competence of the players. The PGSSCS includes items related to different game situations, in which different combination of skills are needed instead of only technical skills isolated from the game. Together these findings suggest that speed and agility characteristics have greater influence on perceived competence of these 12-14-year old players than technical skills. Thus it could be even more important to support the development of perceived competence in later maturing players.

A key methodological contribution of this study was the use of a longitudinal design with three measuring points. However, in investigating young developing players the interpretation of the results is challenging due to large variations in the measured variables. Furthermore, the period of 12 months selected for the duration of this longitudinal study may be a relatively short period in the development of an athlete, which could be a reason for the small differences observed in the average scores of the variables. Longitudinal data are always vulnerable to missing values, but in this study,

sample size was acceptable over a period of one year. Limitations of this study were that, data did not include information on practice quality and quantity of participants, and maturity status of the players was not controlled. Further research is needed to apply longer longitudinal designs, such as 2-4 years, analysing quality and quantity of practice and maturity status. This programme of work needs to examine associations between changes in perceived competence relations to changes in different soccer performance measures, and triangulate findings with other objective data from actual competitive performances of athletes. There is also a need to apply longitudinal designs with coaching interventions, in order to understand how it is possible to comprehensively develop players in specific coaching programmes.

Conclusions

To conclude, perceived competence, tactical skills, motivation, technical skills, and speed and agility characteristics of young soccer players remained relatively high and relatively stable during the period of one year. Positive relationships were found between levels and changes in perceived competence and motivation, and levels in perceived competence and speed and agility. Together these results suggest that talent development in soccer should adopt a multidimensional approach, in carefully considering the nature of players' development during childhood and adolescents. Moreover, it seems crucial in coaching to support the development of perceived competence and motivation in young soccer players and that it might be even more important in later maturing players.

Acknowledgements

This work was supported by Sports Institute Foundation; and Ellen and Artturi Nyyssönen Foundation

References

Abbott, A., & Collins, D. (2002). A theoretical and empirical analysis of a 'state of the art' talent identification model. *High Ability Studies*, *13*, 157-178. doi: 10.1080/1359813022000048798

Arbuckle, J. (2007). *Amos 18.0 User's Guide*. Chicago, IL: Amos Development Corporation 1995-2009.

Bandura, A. (1997). *Self-efficacy: the exercise of control.* New York: Freeman.

Bloomfield, J., Polman, R., & O'Donoghue, P. (2007). Physical demands of different positions in FA Premier League Soccer. *Journal of Sport Science and Medicine, 6,* 63-70.

Bortoli, L., Bertollo, M., Comani, S., & Robazza, C. (2011). Competence, achievement goals, motivational climate, and pleasant psychobiosocial states in youth sport. *Journal of Sports Sciences, 29,* 171-180. doi: 10.1080/02640414.2010.530675

Browne, M., & Cudeck, R. (1993). Alternative ways of assessing model fit. In K. Bollen & J. Long (Eds.), *Testing structural equation models* (pp. 136-162). Newbury Park, CA: Sage.

Deci, E. L., & Ryan, R. M. (2000). The "what" and "why" of goal pursuits: human needs and the self-determination of behavior. *Psychological Inquiry*, *11*, 227-268. doi: 10.1207/S15327965PLI1104_01

Di Salvo, V., Pigozzi, F., Gonzalez-Haro, C., Laughlin, M. S., & De Witt, J. K. (2013). Match performance comparison in top English soccer leagues. *International Journal of Sports Medicine, 34*, 526-532. doi: 10.1055/s-0032-1327660

Durand-Bush, N., & Salmela J. H. (2002). The development and maintenance of expert athletic performance: perceptions of world and Olympic champions. *Journal of Applied Sport Psychology, 14*, 154-171. doi: 10.1080/10413200290103473

448 Elferink-Gemser, M. T., Visscher, C., Richart, H., & Lemmink, K. A. P. M. (2004).
449 Development of the tactical skills inventory for sports. *Perceptual and Motor*
450 *Skills*, *99,* 883-895. doi: 10.2466/pms.99.3.883-895
451 Forsman, H., Blomqvist, M., Davids, K., Konttinen, N., & Liukkonen, J. (in press). The
452 role of sport-specific play and practice during childhood in the development of
453 adolescent Finnish team sport athletes. *International Journal of Sport Science*
454 *and Coaching.*
455 Forsman, H., Gråsten, A., Blomqvist, M., Davids, K., Liukkonen, J., & Konttinen, N.
456 (in press). Development and validation of perceived game-specific soccer
457 competence scale. *Science and Medicine in Football.*
458 Gil, S., Ruiz, F., Irazusta, A., Gil, J., & Irazusta, J. (2007). Selection of young soccer
459 players in terms of anthropometric and physiological factors. *Journal of Sports*
460 *Medicine and Physical Fitness*, *47,* 25-32.
461 Harter, S. (1978). Effectance motivation reconsidered toward a developmental model.
462 *Human Development, 21*, 34-64. doi:10.1159/000271574
463 Harter, S. (1999). *The construction of the self: A developmental perspective.* New York:
464 Guilford.
465 Harter, S. (2012). *Construction of the self: Developmental and sociocultural*
466 *foundations*. New York: Guilford.
467 Helsen, W. F., Baker, J., Michiels, S., Schorer, J., Van Winckel, J., & Williams, A. M.
468 (2012). The relative age effect in European professional soccer: did ten years of
469 research make any difference? *Journal of Sports Sciences, 30,* 1665-1671. doi:
470 10.1080/02640414.2012.721929

Hopper, C., Guthrie, G. D., & Kelly, T. (1991). Self-concept and skill development in youth soccer players. *Perceptual and Motor Skills, 72*, 275-285. doi: 10.2466/pms.1991.72.1.275

Horn, T. S. (2004). Developmental perspectives on self-perceptions in children and adolescents. In M. R. Weiss (Ed.), *Developmental sport and exercise psychology: A lifespan perspective* (pp. 101-143). Morgantown, WV: Fitness Information Technology.

Huijgen, B. C, Elferink-Gemser, M. T., Post, W., & Visscher C. (2009). Soccer skill development in professionals. *International Journal of Sports Medicine, 30,* 585-591. doi: 10.1055/s-0029-1202354

IBM Corporation. (2012). *Statistics for Windows Version 21.0*. Armonk, NY: IBM Corp.

Kannekens, R., Elferink-Gemser, M. T., & Visscher, C. (2009). Tactical skills of world-class youth soccer teams. *Journal of Sports Sciences, 27*, 807-812. doi: 10.1080/02640410902894339

Kannekens, R., Elferink-Gemser, M. T., & Visscher C. (2011). Positioning and deciding: Key factors for talent development in soccer. *Scandinavian Journal of Medicine and Science in Sports, 21,* 846-852. doi: 10.1111/j.1600-0838.2010.01104.x

Little, R. & Rubin, D. (2002) *Statistical analysis with missing data*. New York: Wiley.

MacNamara, A., & Collins, D. (2011). Development and initial validation of the psychological characteristics of developing excellence questionnaire. *Journal of Sports Sciences, 29*, 1273-1286. doi: 10.1080/02640414.589468

Mahoney, M. J, Cabriel, T. J., & Perkins, T. S. (1987). Psychological skills and exceptional athletic performance. *The Sport Psychologist, 1,* 181-199.

496 Malina, R., Bouchard, C., & Bar-Or, O. 2004a. Growth, maturation, and physical
497 activity. (2nd ed.) Champaign, IL: Human Kinetics.
498 Malina, R. M., Cumming, S. P., Kontos, A. P., Eisenmann, J. C., Ribeiro, B., & Aroso,
499 J. (2005). Maturity-associated variation in sport-specific skills of youth soccer
500 players aged 13-15 years. *Journal of Sports Sciences, 23,* 515-522. doi:
501 10.1080/02640410410001729928
502 Malina, R. M., Eisenmann, J. C., Cumming, S. P., Ribeiro, B., & Aroso, J. (2004).
503 Maturity-associated variation in the growth and functional capacities of young
504 football (soccer) players 13-15 years. *European Journal of Applied Physiology,*
505 *91,* 555-562. doi: 10.1007/s00412-003-0995-z
506 Meylan, C., Cronin J., Oliver J., & Hughes, M. (2010). Reviews: Talent identification in
507 soccer: The role of maturity status on physical, physiological and technical
508 characteristics. *International Journal of Sports Science and Coaching,* 5, 571-
509 592. doi: 10.1260/1747-9541.5.4.571
510 Mirkov, D., Nedeljkovic, A., Kukolj, M., Ugarkovic, D., & Jaric, S. (2008). Evaluation
511 of the reliability of soccer-specific field tests. *Journal of Strength and*
512 *Conditioning Research, 22*, 1046-1050. doi: 10.1519/JSC.0b013e31816eb4af.
513 Mohr, M., Krustrup, P., & Bangsbo, J. (2003). Match performance of high-standard
514 soccer players with special reference to development of fatigue. *Journal of*
515 *Sports Sciences, 21,* 519-528. doi: 10.1080/0264041031000071182
516 Moir, G., Button, C., Glaister, M., & Stone, M. H. (2004). Influence of familiarization
517 on the reliability of vertical jump and acceleration sprinting performance in
518 physically active men. *Journal of Strength and Conditioning Research, 18*, 276-
519 280.

520 Muthén, L., & Muthén, B. (1998–2013) *Mplus user's guide sixth edition.* Los Angeles,
521 CA: Muthén & Muthén.
522 O'Dea, J. A., & Abraham, S. (1999). Association between self-concept and body
523 weight, gender and pubertal development among female and male adolescent.
524 *Adolescence, 34,* 69-79.
525 Papaioannou, A., Bebetsos, E., Theodorakis, Y., Christodoulidis, T., & Kouli, O.
526 (2006). Causal relationships of sport and exercise involvement with goal
527 orientations, perceived competence and intrinsic motivation in physical
528 education: A longitudinal study. *Journal of Sports Sciences, 24,* 367–382. doi:
529 10.1080/02640410400022060
530 Philippaerts, R. M., Vaeyens, R., Janssens, M., Van Renterghem, B., Matthys, D.,
531 Craen, R., Bourgois, J., Vrijens, J., Beunen, G., & Malina, R. M. (2006). The
532 relationship between peak height velocity and physical performance in youth
533 soccer players. *Journal of Sports Sciences, 24,* 221-230. doi:
534 10.1080/02640410500189371
535 Phillips, E., Davids, K., Renshaw, I., & Portus, M. (2010). Expert performance in sport
536 and the dynamics of talent development. *Sports Medicine, 40*, 271-283. doi:
537 10.2165/11319430
538 Pinder, R. A., Renshaw I., & Davids, K. (2013). The role of representative design in
539 talent development: a comment on "Talent identification and promotion
540 programmes of Olympic athletes". *Journal of Sports Sciences, 31*, 803-806. doi:
541 10.1080/02640414.2012.718090
542 Rampinini, E., Impellizzeri, F. M., Castagna, C., Coutts, A. J., & Wisloff, U. (2009).
543 Technical performance during soccer matches of the Italian Serie A league:

544 effect of fatigue and competitive level. Journal of Science and Medicine in Sport
545 12, 227-233.
546 Reilly, T., Williams, A. M., Nevill, A., & Franks, A. (2000). A multidisciplinary
547 approach to talent identification in soccer. *Journal of Sports Sciences, 18,* 695-
548 702.
549 Renshaw, I., Davids, K., Phillips, E., & Kerhevé, H. (2012). Developing talent in
550 athletes as complex neurobiological systems. In J. Baker, S. Cobley, & J.
551 Schorer (Eds.), *Talent Identification and Development in Sport: International*
552 *Perspectives* (pp. 64-88). London, UK: Routledge.
553 Roca, A., Williams, A. M., & Ford, P. R. (2012). Developmental activities and the
554 acquisition of superior anticipation and decision making in soccer players.
555 *Journal of Sports Sciences, 30,* 1643-1652. doi: 10.1080/02640414.2012.701761
556 Rodriquez, D., Wigfield, A., & Eccles, J. S. (2003). Changing competence perceptions,
557 changing values: implications for youth sport. *Journal of Applied Sport*
558 *Psychology, 15,* 67-81.
559 Tabachnick, B., & Fidell, L. (2007). *Using Multivariate Statistics*. Boston: Allyn and
560 Bacon.
561 Tanner, J. M., Whitehouse, R. H., & Takaishi, M. (1966). Standards from birth to
562 maturity for height, weight, height velocity and weight velocity: British children.
563 *Archives of Disease in Childhood*, *41*, 454-471.
564 Vaeyens, R., Lenoir, M., Williams, A. M., Mazyn, L., & Philippaerts, R. M. (2007). The
565 effects of task constraints on visual search behavior and decision-making skill in
566 youth soccer players. Journal of Sport & Exercise Psychology, *29*, 147-169.
567 Vaeyens, R., Lenoir, M., Williams, M., & Philippaerts, R. (2008). Talent identification
568 and development programmes in sport. *Sports Medicine*, *38,* 703-714.

569 Vaeyens, R., Malina, R. M., Janssens, M., Van Renrghem, B., Bourgois, J., Vrijens, J.,
570 & Philippaerts, R. M. (2006). A Multidisciplinary selection model for youth
571 soccer: The Ghent Youth Soccer Project. *British Journal of Sport Medicine, 40,*
572 928-34. doi: 10.1136/bjsm.2006.029652
573 Valento-dos-Santos, J., Coelho-e-Silva, M. J., Simoes, F., Figueiredo, A. J., Leite, N.,
574 Elferink-Gemser, M. T., Malina, R. M., & Sherar, L. (2012). Modeling
575 developmental changes in functional capacities and soccer-specific skills in male
576 players aged 11-17 years. *Pediatric Exercise Science, 24,* 603-621.
577 Van Yperen, N. W. (2009). Why some make it and others do not: Identifying
578 psychological factors that predict career success in professional adult soccer. *The*
579 *Sport Psychologist, 23,* 317-329.
580 Vänttinen, T. (2013). *Growth-associated variation in body size, hormonal status,*
581 *physical performance characteristics and perceptual-motor skills in Finnish*
582 *young soccer players, a two-year follow-up study in the U11, U13 and U15 age*
583 *groups.* Studies in Sport, Physical Education and Health 197, University of
584 Jyväskylä, Jyväskylä.
585 Ward, P., Hodges, N. J., Williams, A. M., & Starkes, J. L. (2007). The road to
586 excellence in soccer: A quasi-longitudinal approach to deliberate practice. *High*
587 *Ability Studies*, *18,* 119–153. doi: 10.1080/13598130701709715
588 Ward, P., & Williams, A. M. (2003). Perceptual and cognitive skill development in
589 soccer: the multidimensional nature of expert performance. *Journal of Sport and*
590 *Exercise Psychology, 225,* 93-111.
591 Weiss, M. R., Amorose, A. J., & Wilko, A. M. (2009). Coaching behaviors,
592 motivational climate, and psychosocial outcomes among female adolescent
593 athletes. *Pediatric Exercise Science, 21,* 475-492.

Table I. Correlation coefficients, means, and standard deviations of the study variables.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	M	SD
1.Competence T0															3.83	.44
2.Competence T1	.60**														3.77	.45
3.Competence T2	.45**	.55**													3.88	.38
4.Tactical T0	.80**	.63**	.45**												4.45	.56
5.Tactical T1	.57**	.76**	.49**	.67**											4.42	.59
6.Tactical T2	.45**	.56**	.76**	.58**	.53**										4.54	.53
7.Motivation T0	.42**	.37**	.30**	.42**	.29**	.29**									4.18	.39
8.Motivation T1	.36**	.54**	.51**	.47**	.54**	.51**	.58**								4.13	.44
9.Motivation T2	.20**	.31**	.62**	.26**	.25**	.56**	.47**	.64**							4.19	.42
10.Technical T0	-.06	.09	.01	-.07	.03	-.04	-.12*	-.02	-.00						33.86	3.76
11.Technical T1	-.02	-.17	.02	-.03	-.08	.02	-.15*	-.18	-.13	.47**					33.01	3.36
12.Technical T2	-.05	.01	-.09	-.05	.02	-.16	-.09	.02	.00	.34**	.40**				32.69	3.23
13.Speed and agility T0	-.15*	-.11	-.12	-.13*	-.09	-.07	-.08	.02	.02	.40**	.32**	.25**			6.08	.23
14. Speed and agilityT1	-.16*	-.13	-.12	-.11	-.08	-.03	-.13	-.01	.06	.38**	.30**	.32**	.77**		6.01	.22
15. Speed and agility T2	-.10	-.12	-.14*	-.09	-.13	-.09	-.11	-.05	-.03	.45**	.33**	.30**	.74**	.75**	5.87	.23

Note 1. ** $P < .01$, * $P < .05$.

597 Table II. Overall model fit and standardised results for the growth curve models of study variables.

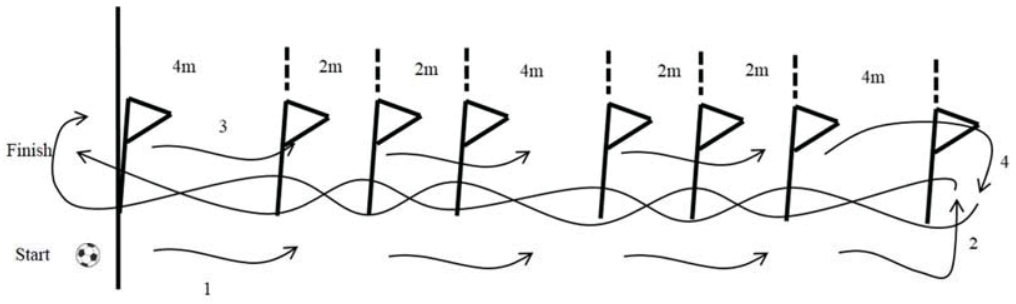
	χ^2(df)	p-value	CFI	TLI	RMSEA	SRMR	90% C.I.	Level	Slope	Cov_1	Cov_2	Cov_3
Competence	151.755(12)	.000	.97	.90	.064	.021	.00 .12	11.29***	-.74	.11	-.08	-.10
										.02	.17*	.02
Tactical	169.039(12)	.000	1.00	1.00	.012	.016	.00 .09	8.88***	1.41	.14*	-0.08	-.03
										.06	.26*	-.09
Motivation	144.648(12)	.000	1.00	1.03	.000	.027	.00 .07	11.95***	-.76	.21***	-.06	-.04
										-.03	.08	.03
Technical	141.388(12)	.000	1.00	1.06	.000	.018	.00 .05	22.711***	-5.66	-.33***	-.11	-.45***
										.07	.17	.18
Speed and agility	490.007(12)	.000	.99	.97	.067	.053	.00 .13	36.884***	.85	-.34***	.14*	-35***
										.17	-.74	-.09

598 Note 1. *** $P < .001$, * $P < .05$

599 Note 2. Cov_1 = performance level, Cov_2 = growth, Cov_3 = age (Value on level above, Slope below)

600

601

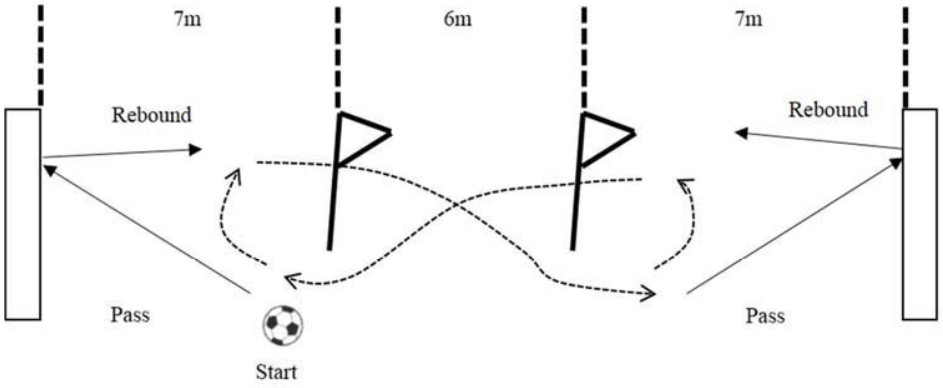


1 = straight run with ball (at least 3 touches before turn)
2 = dribbling back
3= straight run with ball (at least 3 touches before turn)
4 = dribbling back

602

603 Figure 1. Course for the dribbling test.

604



Test begins when a player makes the first pass and finishes when 10th pass hits the wall (5 on each side)

Figure 2. Course for the passing test.

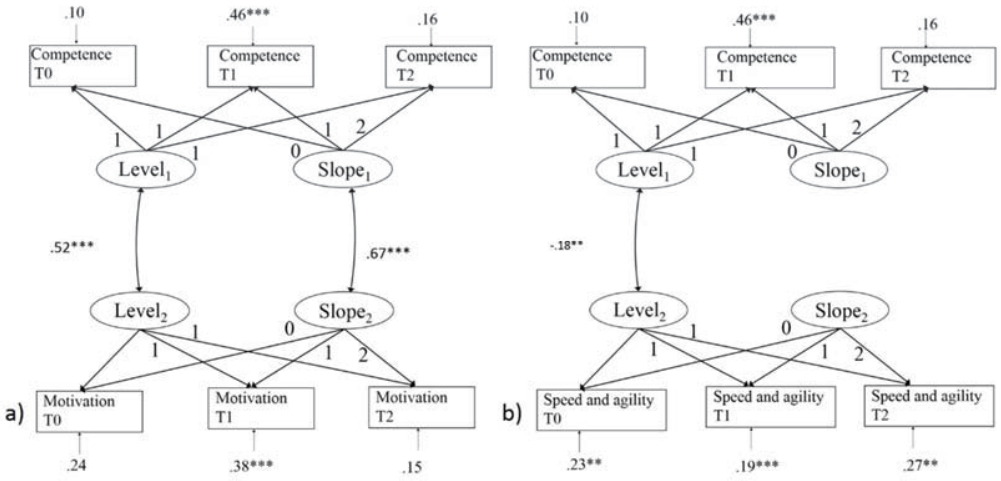


Figure 3. Associations between a) levels and slopes of perceived competence and motivation, and b) levels and slopes of perceived competence, and speed and agility characteristics (**P < 0.01; ***P < .001).