International Journal of Sports Science & Coaching

Fundamental Movement Skills in grassroots soccer: a comparative study of coaches' perceptions and practices in 9 European countries

Journal:	*International Journal of Sports Science & Coaching*
Manuscript ID	SPO-24-0871.R3
Manuscript Type:	Original Research Article
Date Submitted by the Author:	07-Apr-2025
Keywords:	talent development, motor competence, football, coach education, sport pedagogy

Complete List of Authors:
Gilson, Laurens; Ghent University,
Gonçalves Martins, Ricardo Manuel; Coventry University, Centre for Physical Activity, Sports and Exercise
Bjorndal, Christian; Norwegian School of Sports Sciences, Department of Coaching and Psychology
Rudd, James; Norwegian School of Sports Sciences, Department of Coaching and Psychology
Gjesdal, Siv; Norwegian School of Sports Sciences, Department of Coaching and Psychology
Beuckels, Maxime; Ghent University, Department of Movement Sciences
Randers, Morten; University of Southern Denmark, Department of Sports Science and Clinical Biomechanics
Seabra, André; Portuguese Football Federation
Julin, Mikko; Laurea University of Applied Sciences, Research, Development, and Innovation (RDI) Unit
Kokstejn, Jakub; Charles University, Faculty of Physical Education and Sport
Musálek, Martin; Charles University, Faculty of Physical Education
Behan, Stephen; Dublin City University, School of Health & Human Performance; Insight SFI Research Centre for Data Analytics
MacNamara, Aine; Dublin City University, Faculty of Science and Health
Crotti, Matteo; Coventry University, Centre for Physical Activity, Sports and Exercise
Sweeney, Liam ; Dublin City University, School of Health and Human Performance
Lovecchio, Nicola; Università degli Studi di Bergamo Dipartimento di Scienze Umane e Sociali, Human and social science
Bardid, Farid; University of Strathclyde, Strathclyde Institute of Education
Weldon, Anthony; Technological and Higher Education Institute of Hong Kong - Chai Wan Campus,
Lenoir, Matthieu; Universiteit Gent Vakgroep Bewegings- en Sportwetenschappen, Vakgroep Bewegings- en Sportwetenschappen
Duncan, Michael; Coventry University,

Abstract:	Fundamental Movement Skills (FMS) are proven to be beneficial for development across sports domains, including soccer. Grassroots soccer provides a substantial platform to promote and develop FMS. However, coaches often have limited knowledge about FMS. Therefore, this study aimed to explore the perceptions and practices of FMS among grassroots soccer coaches across nine European countries and various coaching profiles. This study surveyed 1055 grassroots coaches from 9 countries based on prior studies to understand their perceptions and practices regarding FMS. Firstly, 14 questions were divided into three components with a Principal Component Analysis to enable clearer analysis: 'Coaching Effectiveness,' 'Influencing Factors,' and 'Importance of FMS.' The second phase involved comparing countries and coaching profiles to see how perceptions and practices varied by coaches' expertise, experience, and the age group they coach. Kruskal-Wallis group comparisons revealed varied awareness and understanding of FMS among grassroots coaches in nine European countries ($p < 0.001$). Post-hoc results showed that perceptions and practices were influenced more by coaching experience ($p < 0.01$) and the age group coached ($p < 0.01$) rather than qualifications. Coaches with over 10 years of experience and those working in the fundamental phase (U7-U12) recognized the benefits of FMS to a greater extent. While FMS awareness exists, deep understanding and practical implementation remain challenging. Differences between countries suggest a unified approach to FMS in coach education is missing. Strengthening FMS education will ensure that grassroots coaches are better equipped to develop young players, ultimately contributing to more effective long-term player development.

Title:

Fundamental Movement Skills in grassroots soccer: a comparative study of coaches' perceptions and practices in 9 European countries

Running Title:

/

Authors:

Laurens Gilson[3], Ricardo Martins[1], Christian Thue Bjørndal[2], James Rudd[2], Siv Gjesdal[2], Maxime Beuckels[3], Morten Bredsgaard Randers[4], André Seabra[5], Mikko Julin[6], Jakub Kokstejn[7], Martin Musalek[7], Stephen Behan[8], Aine Macnamara[8], Liam Sweeney[9], Matteo Crotti[10], Nicola Lovecchio[10], Farid Bardid[11], Anthony Weldon[12,13], Matthieu Lenoir[3], Michael Duncan[1]

[1] Centre for Sport, Exercise and Life Sciences, Coventry University, Coventry, United Kingdom
[2] Department of Coaching and Psychology, Norwegian School of Sport Sciences, Oslo, Norway
[3] Department of Movement Sciences, Ghent University, Ghent, Belgium
[4] Department of Sports Science and Clinical Biomechanics, SDU Sport and Health Sciences Cluster, University of Southern Denmark, Odense, Denmark
[5] Portugal Football School, Portuguese Football Federation, FPF, Oeiras, Portugal
[6] Research, Development, and Innovation (RDI) Unit, Laurea University of Applied Sciences, Espoo, Finland
[7] Faculty of Physical Education and Sport, Charles University, Prague, Czechia
[8] School of Health and Human Performance, Faculty of Science and Health, Dublin City University, Dublin, Ireland
[9]Department of Sport Science and Nutrition, Faculty of Science and Engineering, Maynooth University, Kildare, Ireland
[10] Department of Human and Social Science, University of Bergamo, Bergamo, Italy
[11] Strathclyde Institute of Education, University of Strathclyde, Glasgow, United Kingdom
[12] Centre for Life and Sport Sciences, Birmingham City University, Birmingham, United Kingdom
[13]Aston Villa Foundation, Aston Villa Football Club, Birmingham, United Kingdom

Corresponding author

Laurens Gilson

Department of Movement and Sports Sciences

Ghent University

Watersportlaan 2, 9000 Ghent, Belgium

Laurens.Gilson@UGent.be

https://orcid.org/0000-0002-4304-2679

Total words:

4507~~Title:~~

~~Fundamental Movement Skills in grassroots soccer: a comparative study of coaches' perceptions and practices in 9 European countries~~

~~Running Title:~~

~~/~~

~~Authors:~~

~~REMOVED FOR REVIEW~~

~~Corresponding author~~

~~REMOVED FOR REVIEW~~

~~Total words:~~

~~... words (without tables and figures, after rebuttal)~~

Abstract

250 words

Fundamental Movement Skills (FMS) are proven to be beneficial for development across sports domains, including soccer. Grassroots soccer provides a substantial platform to promote and develop FMS. However, coaches often have limited knowledge about FMS. Therefore, this study aimed to explore the perceptions and practices of FMS among grassroots soccer coaches across nine European countries and various coaching profiles. This study surveyed 1055 grassroots coaches from 9 countries based on prior studies to understand their perceptions and practices regarding FMS. Firstly, 14 questions were divided into three components with a Principal Component Analysis to enable clearer analysis: 'Coaching Effectiveness,' 'Influencing Factors,' and 'Importance of FMS.' The second phase involved comparing countries and coaching profiles to see how perceptions and practices varied by coaches' expertise, experience, and the age group they coach. Kruskal-Wallis group comparisons revealed varied awareness and understanding of FMS among grassroots coaches in nine European countries ($p < 0.001$). Post-hoc results showed that perceptions and practices were influenced more by coaching experience ($p < 0.01$) and the age group coached ($p < 0.01$) rather than qualifications. Coaches with over 10 years of experience and those working in the fundamental phase (U7-U12) recognized the benefits of FMS to a greater extent. While FMS awareness exists, deep understanding and practical implementation ~~remains~~ remain challenging. Differences between countries suggest a unified approach to FMS in coach education is missing. Strengthening FMS education will ensure that grassroots coaches are better equipped to develop young players, ultimately contributing to more effective long-term player development.

Keywords

talent development, motor competence, football, coach education, sport pedagogy

Introduction

The development of young athletes in sports is a complex interplay of physical, cognitive, and social factors that shape their future on the field.[1] Central to this multidimensional interplay are Fundamental Movement Skills (FMS), which can be defined as the motor activities that are believed to be the basis for developing sport-specific skills.[2] By developing FMS, children enhance their overall motor competence, enabling them to perform more complex skills and participate in diverse sports,[3,4] including soccer.[5] While technical and tactical skills are crucial for sport-specific development, FMS embody cross-disciplinary competencies that have been demonstrated to be associated with the advancement of youth soccer athletes.[4,6,7]

Promoting the development of FMS to a broader youth audience is valuable and can effectively be achieved through soccer at the grassroots level. Grassroots soccer can be defined as the recreational format of soccer, with participants ranging from youth leagues to senior divisions.[8] Over 150 thousand grassroots clubs exist in Europe according to the UEFA,[9] and there are approximately 255 million people engaged in grassroots soccer worldwide.[10] Therefore, grassroots soccer is a large and highly accessible sport for young children, providing an opportunity to improve FMS and even create physical, psychological and social health benefits in child development.[11,12]

Fundamental Movement Skills (FMS) are considered valuable for obtaining sport-specific motor skills; supporting its crucial role in athlete development at the grassroots level.[13,14] Children who demonstrate greater competence in FMS have a broader movement repertoire from which they can draw upon and successfully employ in sport-specific situations.[15,16] To support this assumption, research shows that from a holistic perspective, the motor system plays a significant role in a player's present and future performance level.[17,18] Furthermore, Deprez et al.[5] demonstrated that higher levels of FMS in young soccer players might also act as a protective mechanism against dropout in their later soccer careers which contributes to the long-term promotion of health benefits in children.[19] On the other hand, focusing on soccer-specific practices (i.e., early specialization) before a child has fully developed their FMS can result in imbalanced physical development.[20] This one-sided training approach has been associated with an increased risk of injuries at a later stage.[21,22]

Empirical data supports the notion that children with better FMS are more likely to demonstrate superior and more sustainable soccer-specific skill performance,[23] tactical skills,[24] and soccer-related talent.[17,25] Furthermore, awareness and understanding of FMS in soccer are growing, as reflected by FMS being a key feature of many soccer coaches' education programs across Europe, with different federations mentioning FMS as a cornerstone of their youth development strategies to enhance motor skills and overall athletic ability in young players.[26] However, focusing on FMS is not a widespread

practice among soccer coaches. A recent survey involving Strength and Conditioning (S&C) coaches across various sports indicated that motor skills, not directly ~~relating~~ related to sport-specific performance, such as FMS (e.g. throwing, catching, and jumping), were deemed less important than motor skills perceived to directly relate to sport-specific performance (e.g. cutting).[27] Furthermore, interviews with 16 coaches from English professional soccer academies revealed that, despite their knowledge about FMS, significant variations exist in the time and resources allocated to its development across different academies, highlighting persistent barriers in its practical implementation.[28] Lastly, a study by Duncan et al.[29] with English grassroots coaches indicated that although the coaches were aware of the concept of FMS and considered it valuable concerning children's movement and soccer-related skills, there was a poor understanding of the components that the term encompasses and how it translates into practice. While the study by Duncan et al.[29] provides an interesting starting point regarding how coaches perceive and instruct FMS, further research is needed to explore these aspects across diverse contexts. Coaching is context-specific, and perceptions and practices in soccer can therefore differ across European countries due to cultural, social, and historical differences.[30–32] Likewise, differences in ~~coach~~ coaching practices occur due to different coach education programs and at professional academy levels, there are differences in the soccer-specific practices employed by youth coaches.[33,34]

Despite growing recognition of FMS in soccer, its integration into coaching remains inconsistent. While FMS enhances soccer-specific skills, many (soccer) coaches lack a clear understanding of its components and practical application. Given the foundational role of grassroots soccer in player development and as the existing literature is limited, this study explores European grassroots coaches' perceptions and training methods, aiming to bridge knowledge gaps and inform evidence-based strategies for coach education and player development. Therefore, this study aimed (1) to understand the perceptions of FMS among grassroots soccer coaches in nine European countries, (2) to investigate whether these perceptions and training methods are influenced by their country or coaching profile, including their expertise, experience, and age group of the team that they coach, and (3) to investigate the practices, analyzing the resources coaches use and which challenges coaches encounter when applying their knowledge to the field.

Materials and methods

This cross-sectional explorative study was designed to provide quantitative and qualitative data about the practices of grassroots soccer coaches working with children aged 6-16 years from different countries. Following the Research Ethics Committee approval (P142746~~REMOVED FOR REVIEW~~) from

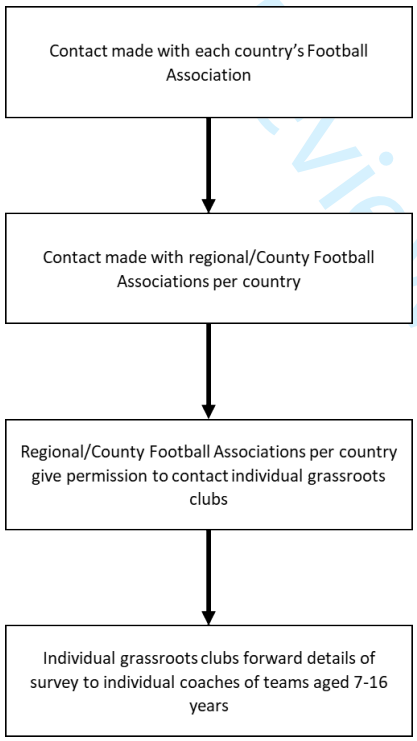
Coventry University, the study used an anonymous online survey, designed for soccer coaches, allowing them to explain their practices and perceptions of FMS. The survey was refined based on previous research examining perceptions and practices of FMS in English grassroots soccer coaches [29].

Participants

A two-stage comprehensive search was conducted to target grassroots coaches. The first stage, relating to the recruitment of researchers and practitioners, comprised an online search of recognized researchers working in youth grassroots soccer via ResearchGate and PubMed and through the available information on European contacts for grassroots soccer for children up to the under 16 age group, within the Union of European Football Associations (UEFA). Relevant contacts within each UEFA member country (N=55) were approached and asked to participate. Of the 55 member countries in UEFA, 11 representatives (i.e. lead researcher of the countries national federation) responded with interest in participating and 9 countries participated in the final survey rollout.

Figure 1 – Flow of participant recruitment

[Insert Figure 1.]



The second stage of this study involved each country's representatives contacting coaches in their country currently involved in grassroots coaching and asking them to participate. This process used

the same scaffold across participating countries but was also flexible to recognize country-by-country differences in grassroots soccer structures (e.g., in the English FA, grassroots soccer is facilitated by 51 county football associations, whereas in Scotland, grassroots soccer is administered by 6 regions through the Scottish FA)[35]. Each country representative on the research team contacted the relevant country FA, and regional/county FAs to ask them to participate. Once approval was given, country representatives contacted individual grassroots clubs to approach their coaches to participate. To be eligible to participate, coaches had to actively coach grassroots soccer in the 2021-22 season with children from U7 to U16 years of age, with a grassroots club that was affiliated with their national FA. The age range selected represents the range of organized grassroots soccer in Europe. All participants provided informed consent to initiate the anonymous survey online. Respondents were informed that a copy of the results may be sent to them upon request.

Table 1 – Background information participants describing country of origin, age, gender, years of experience, expertise of the coach and the age group they currently coach.

[Insert Table 1.]

	N (%)
Country	
Belgium	110 (10,4%)
Czech Republic	176 (16,7%)
Denmark	59 (5,6%)
England	182 (17,3%)
Finland	109 (10,3%)
Ireland	112 (10,6%)
Italy	132 (12,5%)
Portugal	125 (11,8%)
Scotland	50 (4,7%)
Age	
18-24	112 (10,6%)
25-34	185 (17,5%)
35-44	387 (36,7%)
45-54	281 (26,6%)
55-64	73 (6,9%)
65+	17 (1,6%)
Gender coach	
Male	924 (87,6%)
Female	129 (12,2%)
Other	1 (0,1%)
Rather not say	1 (0,1%)
Coaching experience (years)	
No experience (0-2)	166 (15,7%)
Beginner (3-5)	252 (23,9%)
Intermediate (6-10)	302 (28,6%)
Advanced (10+)	335 (31,8%)
Coaching expertise (diploma)	
No diploma	117 (11,3%)
Beginner (UEFA C)	596 (55,7%)

Intermediate (UEFA B)	282 (27,2%)
Advanced (UEFA A - UEFA Pro)	60 (5,8%)
Age groups coached	
Fundamental Phase (U7-U12)	595 (63,5%)
Training to Train Phase (U13-U16)	282 (30,1%)
Training to Compete Phase (U17-U21)	60 (6,4%)

Survey

The survey was adapted from previous research examining perceptions and practices of FMS in English grassroots soccer coaches –and followed a format that has been previously employed to gauge perceptions and practices in strength and conditioning coaches, professional soccer coaches,[29,36] and physical education teachers–.[37] The survey comprised 34 questions in six sections: (a) informed consent, (b) background information, demographics, education, and qualifications, (c) views and practices of FMS, (d) assessment of FMS, (e) importance of constructs related to FMS, and (f) other factors. The survey questions are presented in the supplementary material. The survey included 13 fixed responses, seven open-ended questions, and one section comprising 14 Likert-type responses (scored on a five-point scale from strongly agree to strongly disagree) asking coaches to respond to a series of statements. Based on coaches' feedback, two modifications were made: a question on the influence of FMS on creativity, adaptability, and decision-making was added, along with the option "creativity" in the list of factors contributing to player success. The survey was developed and distributed using the JISC Online Survey (jisc.ac.uk, Bristol, England) administration application and was initially designed in English. Recognizing the different languages of instruction used across the participating European countries, the survey was translated into the different native languages used in the participating countries that were participating and then back-translated with the help of native speakers and the countries' representatives.

The survey began by explaining its purpose, aims, estimated completion time, and data confidentiality. Respondents were first asked to define FMS in their own words before being presented with the study's definition: 'By FMS we refer to a broad base of *movement patterns. They are typically classified into object control skills (e.g., catching, throwing, kicking, striking, and bouncing), locomotor skills (e.g., running, hopping, skipping, leaping, and jumping), and stability skills (e.g., balancing and twisting)'.* Subsequent questions covered physical literacy, FMS, and soccer skills. By asking coaches to define FMS in their own words we sought to subsequently understand country by country variation in how the term is perceived. The subsequent provision of a standard definition of what FMS were served to create a shared awareness amongst respondents of FMS in the context of the survey. This

then enabled coaches to respond to the questions following which were related to coach perceptions of the importance of FMS.

To ensure clarity and validity, the survey underwent three rounds of pilot testing with the research team (including experts in physical education, FMS, and soccer coaching) and three grassroots soccer coaches. An additional round with five grassroots coaches led to wording and structure refinement to avoid ambiguity. For instance, an open-ended question on barriers to integrating FMS into coaching was revised to include some fixed responses and an "Other" category. This approach aligns with previous studies using similar research designs.[36,38]

Analysis

All responses from the survey were exported from the JISC Online Survey tool into Excel (Microsoft Corporation. (2018). *Microsoft Excel*. Retrieved from https://office.microsoft.com/excel). In the first phase, fixed-response questions were assessed using frequency analysis, and open-ended response questions were assessed using a descriptive analysis approach. Furthermore, to obtain interpretable and meaningful results for the quantitative data, a second phase involved conducting a Principal Component Analysis (PCA) with SPSS (IBM Corp. Released 2023. IBM SPSS Statistics for Windows, Version 29.0.2.0 Armonk, NY: IBM Corp) to determine if these questions could be categorized into specific groups for further statistical analyses. Grouping related variables into components allowed for a clearer, more concise analysis of coaching perceptions and practices while preserving key patterns in the data. In the final phase, a group comparison was completed to understand the differences between different groups of participants and the new component variables.

<u>First phase:</u>

Fixed response questions were assessed using frequency analysis. Open-ended response questions were assessed using a descriptive analysis approach. This method of descriptive analysis has been previously used in studies surveying sports coaches.[29,36] After that, overarching clear and identifiably distinct themes, representing the main ideas or patterns emerging from the raw data were generated for each open-ended question and agreed upon by two of the researchers.

<u>Second phase:</u>

To ensure the appropriateness of the quantitative ordinal data for PCA, Bartlett's test of sphericity and the Kaiser-Meyer-Olkin (KMO) test were conducted.[39,40] Data manipulation and extraction involved eliminating participants (n=7) with at least one zero value across 14 variables (*see Appendix 1*), reversing the responses of one variable (Question 6) due to its negative phrasing, and converting

Likert scale responses into numerical values for further analysis. Further analysis in SPSS revealed (1) two variables with a Measure of Sampling Adequacy (MSA) score under 0.5 in the anti-image covariance matrix, (2) a KMO measure exceeding 0.7 indicating sample adequacy and (3) Bartlett's test results were statistically significant ($p < 0.001$, $df = 66$), confirming data sphericity for 12 of the original 14 variables (i.e., removing variable 10 and 11).

A PCA with oblique (Oblimin) rotation was executed to determine significant components. Initially, an analysis of the scree plot was analyzed to identify 'the elbow point', indicating a drop in factor significance. Additionally, the eigenvalues greater than one were retained for further analysis. Both tests indicated four significant components covering a satisfying 60,97% of the total variance of the dataset (*see Table 2*).

An oblique (Oblimin) rotation facilitated clear variable-to-factor assignments, adhering to a threshold of 0.4 for significant loading.[41] Variables with dual loadings above 0.4 prompted a revaluation and potential exclusion for subsequent PCA iterations (*see Table 3)*. Finally, two less robust components were merged due to their inherent theoretical overlap and after the agreement of the research team.

Table 2 – Defining the components of the PCA with eigenvalue

[Insert Table 2.]

# Component	Total	% of Variance	Cumulative %
1	3.423	28.521	28.521
2	1.514	12.617	41.138
3	1.236	10.299	51.437
4	1.144	9.533	60.970
5	0.792	6.599	67.569
6	0.750	6.248	73.817
7	0.683	5.694	79.511
8	0.623	5.190	84.701
9	0.558	4.653	89.354
10	0.458	3.813	93.166
11	0.423	3.528	96.694
12	0.397	3.306	100.000

[Insert Table 3.]

Table 3 – Assigning the variables to the correct component

	Component			
	1	2	3	4
Variable 1	0.322	0.038	0.160	**0.566***
Variable 2	0.252	0.182	0.209	**0.556***
Variable 3	**0.680***	-0.153	0.150	0.022
Variable 4	0.143	-0.074	**0.689***	0.162
Variable 5	-0.180	0.094	**0.829***	-0.200
Variable 6	-0.198	-0.096	-0.157	**0.851***
Variable 7	**0.843***	-0.052	-0.093	-0.253
Variable 8	**0.620***	0.092	0.019	0.130
Variable 9	**0.604***	0.151	-0.010	0.258
Variable 12	-0.108	**0.882***	0.009	0.061
Variable 13	0.028	**0.865***	0.037	-0.137
Variable 14	**0.459***	0.354	-0.101	0.083

The following components were considered in the next phase reducing 12 variables to three variables:

(1) **Component 1** (*"Coaches' perceptions of the effectiveness of coaching in FMS development")* covers statements 3, 7, 8, 9, and 14 and is described hereafter as **'Coaching Effectiveness'**.

(2) **Component 2** *("Coaches' perceptions on factors influencing FMS development")* covers statements 4, 5, 12, and 13 and is described hereafter as **'Influencing Factors'**.

(3) **Component 3** *("Coaches' perceptions of the importance of FMS in soccer")* covers statements 1, 2, and 6 and is described hereafter as **'Importance of FMS'**.

Post-hoc analysis showed good internal consistency for Component 1 (Cronbach's alpha = 0.715) and low internal consistency for Component 2 (0.466) and Component 3 (0.481). Despite this, the variables within Components 2 and 3 exhibit clear theoretical overlap, allowing for further analysis of their structure. An expert panel subsequently confirmed this classification.

Third phase:

The different components were extracted creating 3 new variables in the dataset. Participants were then categorized based on their coaching experience (years) into four levels: No Experience (0–2 years), Beginner (3–5 years), Intermediate (6–10 years), and Advanced (10+ years). Additionally, their coaching expertise was classified according to their highest diploma attained: No Diploma, Beginner

(UEFA C), Intermediate (UEFA B), and Advanced (UEFA A – UEFA Pro) (*see Table 1*). Afterwards, the assumptions for parametric testing were explored using (1) a Shapiro-Wilk test for normality and (2) a Box's M test for homogeneity.[42]

Shapiro-Wilk and Box's M test showed mixed results, requiring additional parametric conditions like (1) equal variance, (2) Q-Q normal plot, and (3) outliers to further interpret the outcomes. All groups showed eligibility for non-parametric testing after interpretation, which puts forward the Kruskal-Wallis test as a good fit for the ordinal data of the survey.

Results:

Knowledge on FMS

In the first phase, we investigated the qualitative questions to understand the perceptions and practices of FMS in European soccer. When asked if they were familiar with the term 'Fundamental Movement Skills' previously, considerable variation in responses across European countries was observed. Most Finnish coaches (87.2%, n=95) had heard of the term FMS, followed by coaches from Portugal (70.4%, n=88), Italy (61%, n = 80), Ireland (59.8%, n = 67), Belgium (57%, n=70) England (53%, n=97), and Scotland (42%, n=23.3%). Few coaches from the Czech Republic (23.3%, n=41) and Denmark (20.3%, n=12) knew the term FMS. Those coaches who had heard of the term FMS were asked how they would explain it, and overall, they demonstrated a grasp of some aspects of the construct, with the majority referring to elements of FMS. The frequency of terms used to describe FMS across countries is presented in *Table 4*. Except for the Czech Republic and Finland, the most frequent explanation of FMS from coaches in the other countries was almost tautological, referring to 'basic motor skills', 'basic movement skills' or just 'movement skills'. Of note, coaches, for the most part, tended not to expand further after using these terms. The terms 'Balance', 'Coordination', 'Agility, Balance and Coordination', 'Running', and 'Jumping' featured heavily in descriptions of the term FMS across countries. There appeared to be some consistency in the conceptualisation of the term FMS across countries except for the Czech Republic, where the most frequently used terms to describe FMS were conflated with aspects of physical fitness such as speed, endurance, and strength. There was also a tendency to refer to singular skills in responses from coaches (e.g., 'Running' and 'Hopping') or pairs of skills, (e.g., 'Running and Jumping', 'Throwing and Catching') but where particular motor skills were cited they did not tend to be comprehensive and go beyond referring to more than three skills (e.g., 'Running, 'Jumping', and 'Throwing'). See supplementary material for the full descriptions used by coaches to describe FMS. Coaches were then directed to a definition of FMS.

Perceptions and practices on FMS

In the second and third phase, component scores of 'Coaching Effectiveness', 'Influencing Factors' and 'Importance of FMS' were analysed and descriptive statistics were measured for coaching experience (see Appendix 2), coaching expertise (see Appendix 3) and age of team coached (see Appendix 4). A Kruskal-Wallis test showed an overall significant result for 'Coaching Effectiveness' ($p<0.001$), 'Influencing Factors' ($p<0.001$), and 'Importance of FMS' ($p<0.001$) between 9 countries (*see Table 4*).

Table 4 – Results of group differences between components

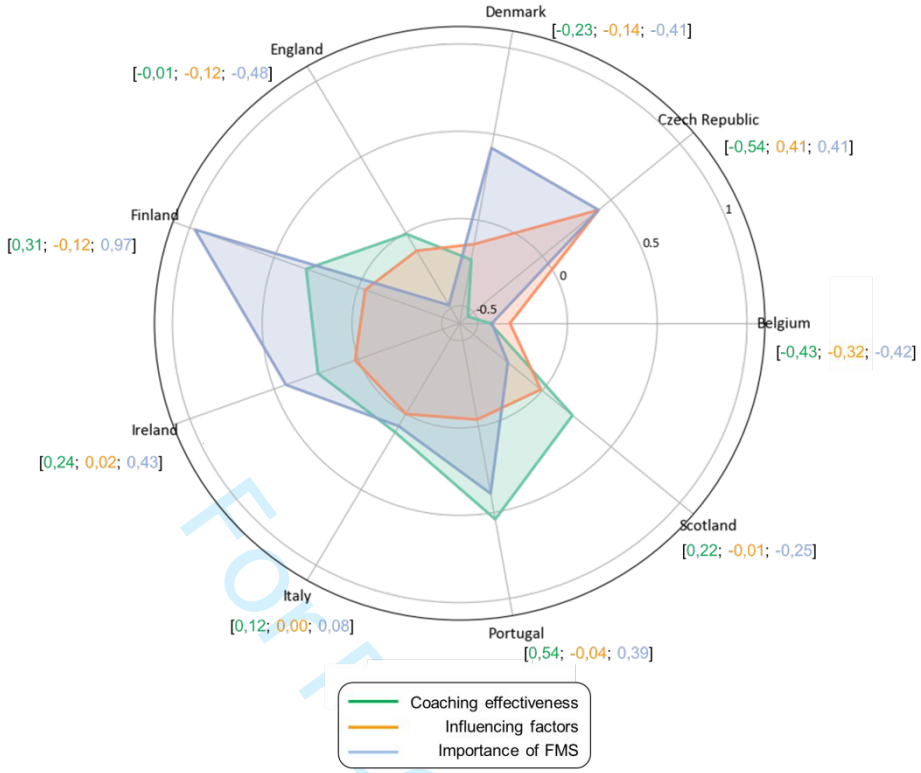
[Insert Table 4.]

	Country	Coach experience	Coach expertise	Age of team
N	**1050**	**1050**	934	847
DOF	**8**	**3**	2	2
Coaching Effectiveness	**p < 0.001***	**p = 0.005***	p = 0.260	p = 0.396
	H = 149.86	H = 12.97	H = 2.69	H = 1.85
Influencing Factors	**p < 0.001***	**p < 0.001***	p = 0.608	p = 0.134
	H = 88.39	H = 20.50	H = 1.49	H = 4.02
Importance of FMS	**p < 0.001***	p = 0.083	p = 0.724	**p = 0.006***
	H = 182.93	H = 6.67	H = 0.65	H = 10.32

Furthermore, a post-hoc analysis (*see Figure 2*) showed significantly higher scores for Portugal and significantly lower scores for the Czech Republic and Belgium in 'Coaching Effectiveness' ($p <0.001$, $H = -348.94$; $p <0.001$, $H = -310.96$) . The Czech Republic scored significantly higher than other countries for 'Influencing Factors' and Belgium scored lower than other countries. Lastly, the pairwise comparisons showed significantly higher scores for Finland and significantly lower scores for England and Belgium in 'Importance of FMS'.

Figure 2 - Post-hoc analysis of the Kruskal-Wallis test between countries (higher scores indicate a more positive attitude towards FMS)

[Insert Figure 2.]



The other analyses focused on the differences between coaching profiles (see Table 1). A Kruskal-Wallis test showed a significant result for 'Influencing Factors' ($p<0.01$), a borderline significant result for 'Coaching Effectiveness' ($p=0.05$), and a non-significant result for 'Importance of FMS' ($p<0.083$) between different groups of coaching experience. Post-hoc analysis (i.e. pairwise comparison) showed significantly higher results for the 'Advanced' experience group compared with the 'No Experience' ($p=0.03$), the 'Beginner' ($p<0.01$) and the 'Intermediate' ($p<0.01$) group for 'Coaching Effectiveness'; compared with the 'No Experience' (pp<0.01), the 'Beginner' ($p<0.01$) and the 'Intermediate' ($p<0.01$) group for 'Influencing Factors'; and compared with the 'No Experience' group ($p=0.01$) for 'Importance of FMS'. Furthermore, no significant results were found for 'Coaching Effectiveness' ($p=0.174$), 'Influencing Factors' ($p=0.608$), and 'Importance of FMS' ($p=0.778$) in the coaches' level of expertise. Lastly, a Kruskal-Wallis test showed a significant result for 'Importance of FMS' ($p=0.006$) and non-significant results for 'Coaching Effectiveness' ($p=0.396$) and 'Influencing Factors' ($p=0.134$) in the age of the team they coach. Post-hoc analysis (i.e. pairwise comparison) showed that coaches of 'Fundamental Phase' teams had a more favourable attitude towards FMS then coaches of the 'Training to Train' phase ($p=0.05$) and 'Training to Compete' phase ($p<0.01$).

Resources and barriers in FMS

In the first phase, it was similarly reported whether coaches used resources to develop FMS in their practice (*see Table 5*). There was a spread of responses in terms of use of resources, the lowest being 50% (Scotland) to 89% (Czech Republic) responding that they did. There appeared to be variation in the most frequently used resources for coaching practice across countries. Social media is the most used resource for English and Scottish coaches, as well as websites for Czech and Irish coaches, and books for Italian and Portuguese coaches. English coaches used a greater number and range of resources, with individual respondents often citing multiple types of resources. Finnish coaches cited the lowest number of resources used in their practice. When asked about potential barriers preventing coaches from incorporating FMS into their current practice, 'Lack of Training' in using FMS in coaching and 'Lack of Time' in training sessions were the most cited barriers across all countries. Inadequate facilities or equipment was a particularly cited barrier by Czech, Italian, English, and Portuguese coaches. English coaches reported a greater number of barriers than coaches from any other country. The frequency of barriers to implementing FMS in practice is presented in *Table 6.*

Table 5 - Types of resources used to develop Fundamental Movement Skills (FMS) knowledge and practice

[Insert Table 5.]

Type of Resource	Belgium (N=122)	Czech (N=176)	Denmark (N=59)	England (N=182)	Finland (N=109)	Ireland (N=114)	Italy (N=133)	Portugal (N=125)	Scotland (N=50)
Social media (Facebook, X, Instagram, TikTok)	6 (5%)		8 (13,6%)	54 (29,7%)		15 (13,2%)	15 (11,3%)	11 (8,8%)	12 (24%)
Websites (including subscription-based coaching, FA websites)	9 (7,5%)	35 (19,9%)	6 (10,2%)	20 (11%)		21 (18,4%)	13 (9,8%)	38 (30,4%)	5 (10%)
Resource direct from the national association	24 (19,7%)		7 (11,9%)	2 (1,1%)	3 (2,8%)		1 (0,8%)		
Other coaches	2 (1,6%)		1 (1,7%)	2 (1,1%)	3 (2,8%)	6 (5,3%)	6 (4,5%)	1 (0,8%)	3 (6%)

Books	11 (9%)	20 (11,3%)	5 (8,5%)	24 (13,2%)		12 (10,5%)	51 (38,3%)	40 (32%)	2 (4%)
Discussion boards									
YouTube	7 (5,7%)		6 (10,2%)	21 (11,5%)		7 (6,1%)	2 (1,5%)	3 (2,4%)	2 (4%)
Scientific Research			1 (1,7%)	2 (1,1%)		6 (5,3%)	22 (16,5%)	11 (8,8%)	
Other sports experiences	9 (7,3%)				7 (6,4%)	5 (4,4%)			

Table 6 - Types of barriers faced to implement Fundamental Movement Skills (FMS) in practice

[Insert Table 6.]

Type of barrier	**Belgium** (N=122)	**Czech** (N=176)	**Denmark** (N=59)	**England** (N=182)	**Finland** (N=109)	**Ireland** (N=114)	**Italy** (N=133)	**Portugal** (N=125)	**Scotland** (N=50)
Lack of training in using FMS in coaching	49 (26,3%)	82 (30%)	26 (22,8%)	105 (21%)	24 (11,82%)	59 (24,7%)	40 (14,4%)	32 (14,5%)	27 (22,5%)
Inadequate facilities or equipment	43 (23,1%)	73 (26,7%)	20 (17,5%)	53 (10,6%)	34 (16,75%)	29 (12,1%)	59 (21,2%)	57 (25,8%)	18 (15%)
Low levels of personal interest for focusing on FMS in coaching	1 (0,5%)	25 (9,2%)	10 (8,8%)	39 (7,8%)	2 (1%)	12 (5%)	18 (6,5%)	19 (8,6%)	9 (7,5%)
Lack of confidence in employing FMS in coaching sessions	8 (4,3%)	11 (4%)	8 (7%)	60 (12%)	8 (3,9%)	20 (8,4%)	20 (7,2%)	11 (5%)	11 (9,2%)

Negative parental attitudes to focusing on FMS in coaching	12 (6,5%)	13 (4,8%)	1 (0,9%)	55 (11%)	3 (1,5%)	17 (7,1%)	30 (10,8%)	22 (10%)	11 (9,2%)
Training sessions to big	8 (4,3%)	11 (4%)	20 (17,5%)	19 (3,8%)	17 (8,4%)	9 (3,8%)	11 (4%)	10 (4,5%)	5 (4,2%)
Lack of time in training sessions	53 (28,50%)	23 (8,4%)	17 (14,9%)	120 (24%)	62 (30,5%)	61 (25,5%)	64 (23%)	52 (23,5%)	26 (21,7%)
Lack of space in Training sessions	9 (4,8%)	16 (5,9%)	4 (3,5%)	40 (8%)	38 (18,7%)	24 (10%)	22 (7,9%)	11 (5%)	11 (9,2%)
Other	3 (1,6%)	19 (7%)	8 (7%)	9 (1,8%)	15 (7,4%)	8 (3,4%)	14 (5%)	7 (3,2%)	2 (1,7%)

16

Discussion:

The present study investigated the perceptions and practices of FMS among grassroots soccer coaches in nine European countries, whether these perceptions and practices were influenced by the profile of the coaches, including their expertise, experience, and age group of the team they coach and which barriers the grassroots coaches face in translating their knowledge to the field. The analysis revealed that grassroots soccer coaches across nine European countries demonstrated varied knowledge and understanding of FMS and were influenced by factors such as coaching experience and phase specialization, rather than solely by qualifications. Qualitative results relating to perceptions of FMS and barriers to implementation indicate that irrespective of country, coaches had a general understanding of FMS and could only describe sub-components of it. However, no coaches provided what could be considered a holistic definition of what they thought FMS was. Most coaches used some form of resource to deliver practices related to FMS with the children they coached. The nature of these resources varied across countries. While coaches used resources to incorporate FMS into their practices, they also reported significant barriers to implementing FMS. Lack of formal training and lack of time in practice consistently hindered the implementation of FMS by soccer coaches across countries. Examining this issue is crucial for effectively shaping coaching practices in developing FMS and bridging the theoretical understanding into the field. For the first time, we present data on how different coaching profiles from multiple European countries perceive and practice FMS. Such a cross-country examination facilitates understanding possible barriers and facilitators in further implementing FMS in practice.

Cultural differences in perceptions and practices on FMS:

Grassroots coaches from different European countries showed both similarities and differences in their perception of FMS. These observed differences were not entirely uniform, as certain countries demonstrated more progressive responses to one component, whereas others exhibited more forward-thinking perspectives regarding a different concept (*see Figure 2*). Of note, while coaches from various countries described elements related to FMS, such as motor coordination or object manipulation, no coaches provided a definition of FMS that fully adhered to the term FMS used in this study. This would suggest that coaches do not have a consolidated/accurate understanding of the term.

Furthermore, Czech coaches tended to provide explanations for FMS that were more aligned to components of fitness than FMS. In contrast, coaches from Finland emphasized a broader range of FMS aspects, such as balance, body control, and object manipulation, highlighting a more holistic approach to motor skills development. Upon initial review, integrating federation-specific data (such

as FIFA rankings and UEFA country coefficients) or geographical information did not reveal a definitive cause for the observed differences. Previous research has revealed cultural differences in coaches' practices in soccer. A study by Feng et al.[43] showed that coaches from two different countries had distinct coaching behaviours during training activities. Furthermore, differences in coaching practices across European countries for decision-making training types were already underlined.[33,44] Still, our findings contribute to comprehending coaching practices and perceptions on a continental level by adding new insights to this important component of youth athlete development and can be used to design new interventions in these European countries (e.g., by tackling nation-specific barriers to implementing FMS in practice). Addressing these cultural differences in FMS understanding and implementation may also support the development of a more unified framework for grassroots coaching education, ensuring a more consistent and evidence-based approach to motor skills development across Europe.

Differences between different profiles of the coach:

The analysis of the current study highlighted that fundamental phase coaches (i.e. U7 until U12) and coaches with >10 years of experience see the benefits of FMS (i.e. 'Influencing Factors' and 'Importance of FMS') in soccer development, but undermine their role in this development with youth soccer players (i.e. 'Coaching Effectiveness'). A possible barrier may be the performance-oriented approach of clubs and federations,[45] even on a grassroots level at younger ages, negating long-term development.[46] Traditional practices in youth soccer have tended to focus on physical fitness, physical attributes, and body size as key factors for success and selection.[47] Research shows that current coaching practices are often based on personal experience and expertise instead of evidence-based information and tend to neglect 'Playing Activities' in youth soccer development.[48,49] Williams et al.[50] also demonstrated that basketball coaches from different countries had a similar awareness of FMS, but noted a lack of transfer to practical application on the field. This illustrates that further intentions are needed to transfer this awareness into sustainable coaching practices and behaviors among the different UEFA members.

Furthermore, our findings showed that a higher coaching qualification is not associated with a difference in perception of FMS, meaning that this more expert group does not have a deeper understanding of FMS. A possible explanation is that higher-qualified coaches often coach older age groups (i.e., U13 – Seniors)[51] where more focus might be on specific football skills at the expense of FMS. In a recent publication, Duncan et al.[29] highlighted the need for a more in-depth understanding and clearer guidance on FMS. Therefore, it would be beneficial to integrate FMS throughout the UEFA coaching diploma curriculum, ensuring that coaches at all levels receive adequate training. This could

motivate coaches to develop their expertise further while coaching lower age categories[52], strengthening the practices and perceptions in the fundamental phase (i.e., U7-U12) of grassroots soccer.

The current study is not without limitations. Firstly, the data distributions did not conform to parametric statistics, making it non-feasible to explore interaction effects between countries and coaching profiles. Furthermore, of the 55 member countries of the UEFA, only 11 federations responded, meaning the sample is not fully representative of all UEFA Member Associations. However, the current study represents the largest exploration to date on this issue and the consortium of federations represents a diverse sample from various large and small countries across Europe with varied demographics, positions on the FIFA ranking, and level of development of FMS.

Although this study responds to a gap in the literature, 'country' is an umbrella term for various cultural aspects, such as education and the nationwide popularity of a sport. A deeper exploration of these differences is therefore warranted in future research.

In conclusion, grassroots soccer coaches demonstrated awareness of FMS across nine European countries. However, while coaches were aware of the term FMS, none could fully explain what FMS is, suggesting only a partial understanding of the concept. Significant differences emerged indicating that every FA has a unique vision of FMS. Additionally, results regarding the coach profile highlighted that more experienced coaches and those coaching in the fundamental phase are more progressive towards FMS. Still, there remains a gap in translating this knowledge into practice, specifically a lack of training in FMS and a lack of time to embed FMS in training. Finally, a higher qualification did not mean that coaches had a more profound understanding of FMS. This shows that FMS is undervalued in more advanced levels of coach education across European countries. Targeting these outcomes should allow for the development of practical shared and good-quality resources for coaches, to enable them to develop FMS within soccer practice may be a useful practical step to help coaches embed FMS in their coaching.

Acknowledgments:

The authors would like to thank all the coaches who participated in the survey for their cooperation.

Author contribution:

M.D. and A.W. participated in the study's design and drafted the method section. All other authors collected the data in their country. L.G. and R.M. performed the formal analysis. F.B. revised the statistical analysis. M.L. and M.D. supervised and coordinated the development of this paper. L.G. wrote the original draft of the manuscript. All authors reviewed and approved the final version of the manuscript, and agreed with the order of presentation of the authors.

Statements and declarations:

Ethics approval and informed consent:

The author(s) confirm that this study was approved by the Coventry University Ethics Committee (P142746), and informed consent was obtained from all participants before their participation.

Consent for publication:

Not applicable.

Funding detail:

The author(s) received no financial support for the research, authorship, and/or publication of this article.

Conflict of interest statement:

No potential conflict of interest was reported by the authors.

Data availability statement:

The corresponding/first author can provide data from this study upon reasonable request.

Code availability statement:

The corresponding/first author can provide the code from this study upon reasonable request.

Data deposition:

Not applicable.

Acknowledgments:

The authors would like to thank all the coaches who participated in the survey for their cooperation.

Author contribution:

REMOVED FOR REVIEW

Statements and declarations:

Ethics approval and informed consent:

Added after reviewing process.

Consent for publication:

Not applicable.

Funding detail:

The author(s) received no financial support for the research, authorship, and/or publication of this article.

Conflict of interest statement:

No potential conflict of interest was reported by the authors.

Data availability statement:

The corresponding/first author can provide data from this study upon reasonable request.

Code availability statement:

The corresponding/first author can provide the code from this study upon reasonable request.

Data deposition:

Not applicable.

References:

1. Bailey R, Collins D, Ford P, et al. *Participant Development in Sport: An Academic Review*. Report, Sports Coach UK, UK, March 2010.
2. Tompsett C, Burkett B, McKean M. Development of physical literacy and movement competency: a literature review. *Journal of Fitness Research* 2014; 3: 53–74.
3. Lloyd RS, Oliver JL, Faigenbaum AD, et al. Long-term athletic development- part 1: a pathway for all youth. *J Strength Cond Res* 2015; 29: 1439–50.
4. Wormhoudt R, Savelsbergh GJP, Teunissen JW, et al. *The Athletic Skills Model*. Routledge. Epub ahead of print 12 October 2017. DOI: 10.4324/9781315201474.
5. Deprez DN, Fransen J, Lenoir M, et al. A Retrospective Study on Anthropometrical, Physical Fitness, and Motor Coordination Characteristics That Influence Dropout, Contract Status, and First-Team Playing Time in High-Level Soccer Players Aged Eight to Eighteen Years. *J Strength Cond Res* 2015; 29: 1692–1704.
6. Jukic I, Prnjak K, Zoellner A, et al. The Importance of Fundamental Motor Skills in Identifying Differences in Performance Levels of U10 Soccer Players. *Sports* 2019; 7: 178.
7. Deprez D, Valente-Dos-Santos J, Coelho-e-Silva M, et al. Longitudinal Development of Explosive Leg Power from Childhood to Adulthood in Soccer Players. *Int J Sports Med* 2015; 36: 672–679.
8. Fenton SAM, Duda JL, Barrett T. The Contribution of Youth Sport Football to Weekend Physical Activity for Males Aged 9 to 16 Years: Variability Related to Age and Playing Position. *Pediatr Exerc Sci* 2015; 27: 208–218.
9. Financial Sustainability & Research Division. *The European Club Talent and Competition Landscape*. Report, UEFA, Nyon, 18 October 2024.
10. Haugaasen M, Jordet G. Developing football expertise: a football-specific research review. *Int Rev Sport Exerc Psychol* 2012; 5: 177–201.
11. Holfelder B, Schott N. Relationship of fundamental movement skills and physical activity in children and adolescents: A systematic review. *Psychol Sport Exerc* 2014; 15: 382–391.
12. Stodden DF, Goodway JD, Langendorfer SJ, et al. A Developmental Perspective on the Role of Motor Skill Competence in Physical Activity: An Emergent Relationship. *Quest* 2008; 60: 290–306.
13. Duncan M, Eyre ELJ, Noon M, et al. Fundamental movement skills and perceived competence, but not fitness, are the key factors associated with technical skill performance in boys who play grassroots soccer. *Science and Medicine in Football* 2022; 6: 215–220.
14. Duncan MJ, Eyre ELJ, Clarke N, et al. Importance of fundamental movement skills to predict technical skills in youth grassroots soccer: A machine learning approach. *Int J Sports Sci Coach* 2024; 19: 1042–1049.

15. O'Brien W, Khodaverdi Z, Bolger L, et al. Exploring Recommendations for Child and Adolescent Fundamental Movement Skills Development: A Narrative Review. *Int J Environ Res Public Health* 2023; 20: 3278.

16. Duncan MJ, Eyre ELJ, Noon MR, et al. Actual and perceived motor competence mediate the relationship between physical fitness and technical skill performance in young soccer players. *Eur J Sport Sci* 2022; 22: 1196–1203.

17. Zibung M, Zuber C, Conzelmann A. The Motor Subsystem as a Predictor of Success in Young Football Talents: A Person-Oriented Study. *PLoS One* 2016; 11: 1–11.

18. Höner O, Votteler A. Prognostic relevance of motor talent predictors in early adolescence: A group- and individual-based evaluation considering different levels of achievement in youth football. *J Sports Sci* 2016; 34: 2269–2278.

19. Cohen KE, Morgan PJ, Plotnikoff RC, et al. Improvements in fundamental movement skill competency mediate the effect of the SCORES intervention on physical activity and cardiorespiratory fitness in children. *J Sports Sci* 2015; 33: 1908–1918.

20. Williams MD, Strafford BW, Stone JA, et al. Parkour-Based Activities in the Athletic Development of Youth Basketball Players. *Front Physiol*; 12. Epub ahead of print 15 October 2021. DOI: 10.3389/fphys.2021.771368.

21. Lloyd RS, Oliver JL, Faigenbaum AD, et al. Long-Term Athletic Development, Part 2: Barriers to Success and Potential Solutions. *J Strength Cond Res* 2015; 29: 1451–1464.

22. Johnson D, Williams S, Bradley B, et al. Can we reduce injury risk during the adolescent growth spurt? An iterative sequence of prevention in male academy footballers. *Ann Hum Biol* 2023; 50: 452–460.

23. Jukic I, Prnjak K, Zoellner A, et al. The importance of fundamental motor skills in identifying differences in performance levels of U10 soccer players. *Sports*; 178. Epub ahead of print 1 July 2019. DOI: 10.3390/sports7070178.

24. Duncan MJ, Clarke ND, Bolt L, et al. Fundamental Movement Skills and Physical Fitness Are Key Correlates of Tactical Soccer Skill in Grassroots Soccer Players Aged 8–14 Years. *J Mot Learn Dev* 2022; 10: 290–308.

25. Leyhr D, Kelava A, Raabe J, et al. Longitudinal motor performance development in early adolescence and its relationship to adult success: An 8-year prospective study of highly talented soccer players. *PLoS One* 2018; 13: 1–16.

26. North J, Lara-Bercial S, Morgan G, et al. *Project report: The identification of good practice principles to inform player development and coaching in European youth football*. Leeds, 6 May 2014.

27. Burton AM, Eisenmann JC, Cowburn I, et al. Developing motor competency in youths: Perceptions and practices of strength and conditioning coaches. *J Sports Sci* 2021; 39: 2649–2657.

28. Smothers N, Cropley B, Lloyd R, et al. An exploration of the landscape of fundamental movement skills and strength development in UK professional football academies. *Int J Sports Sci Coach* 2021; 16: 608–621.

29. Duncan MJ, Weldon A, Barnett LM, et al. Perceptions and practices of fundamental movement skills in grassroots soccer coaches. *Int J Sports Sci Coach* 2022; 17: 761–771.

30. Sapp RM, Spangenburg EE, Hagberg JM. Trends in aggressive play and refereeing among the top five European soccer leagues. *J Sports Sci* 2018; 36: 1346–1354.

31. Sarmento H, Pereira A, Matos N, et al. English Premier League, Spain's La Liga and Italy's Serie's A – What's Different? *Int J Perform Anal Sport* 2013; 13: 773–789.

32. Smith M, Cushion CJ. An investigation of the in-game behaviours of professional, top-level youth soccer coaches. *J Sports Sci* 2006; 24: 355–366.

33. Roca A, Ford PR. Decision-making practice during coaching sessions in elite youth football across European countries. *Science and Medicine in Football* 2020; 4: 263–268.

34. International Council for Coaching Excellence, Association of Summer Olympic International Federations, Leeds Metropolitan University. *International sport coaching framework*. 2nd ed. Illinois: Human Kinetics, 2013.

35. Scottish FA, UEFA Grow. *Football For All 2022-2025: Scottish FA Grasroots Strategy*, https://www.scottishfa.co.uk/media/9722/scottish-fa-football-for-all-strategic-plan-interactive2.pdf (2022, accessed 7 April 2025).

36. Weldon A, Duncan MJ, Turner A, et al. Practices of Strength and Conditioning Coaches: A Snapshot From Different Sports, Countries, and Expertise Levels. *J Strength Cond Res* 2022; 36: 1335–1344.

37. Morgan PJ, Hansen V. Physical education in primary schools: Classroom teachers' perceptions of benefits and outcomes. *Health Educ J* 2008; 67: 196–207.

38. Morgan PJ, Hansen V. Classroom teachers' perceptions of the impact of barriers to teaching physical education on the quality of physical education programs. *Res Q Exerc Sport* 2008; 79: 506–516.

39. Bartlett M. Tests of significance in factor analysis. *British Journal of Statistical Psychology* 1950; 3: 77–85.

40. Kaiser HF. An index of factorial simplicity. *Psychometrika* 1974; 39: 31–36.

41. Hatcher L, O'Rourke N. *A Step-by-Step Approach to Using SAS for Factor Analysis and Structural Equation Modeling*. 2nd ed. SAS Institute, 2013.

42. Shapiro SS, Francia RS. An Approximate Analysis of Variance Test for Normality. *J Am Stat Assoc* 1972; 67: 215–216.

43. Feng R, Gómez-Ruano MA, Liu T, et al. Comparison of training activities and coaching behaviours in youth football coaches from Spain and China: a case study. *Int J Perform Anal Sport* 2023; 23: 296–318.

44. Vaughan J, Mallett CJ, Potrac P, et al. Football, Culture, Skill Development and Sport Coaching: Extending Ecological Approaches in Athlete Development Using the Skilled Intentionality Framework. *Front Psychol*; 12. Epub ahead of print 8 July 2021. DOI: 10.3389/fpsyg.2021.635420.

45. Gil S, Ruiz F, Irazusta A, et al. Selection of young soccer players in terms of anthropometric and physiological factors. *J Sports Med Phys Fitness* 2007; 47: 25–32.

46. Martindale RJJ, Collins D, Abraham A. Effective Talent Development: The Elite Coach Perspective in UK Sport. *J Appl Sport Psychol* 2007; 19: 187–206.

47. O'Connor D, Larkin P, Williams AM. Observations of youth football training: How do coaches structure training sessions for player development? *J Sports Sci* 2018; 36: 39–47.

48. Partington M, Cushion C. An investigation of the practice activities and coaching behaviors of professional top-level youth soccer coaches. *Scand J Med Sci Sports* 2013; 23: 374–382.

49. Williams AM, Hodges NJ. Practice, instruction and skill acquisition in soccer: Challenging tradition. *J Sports Sci* 2005; 23: 637–650.

50. Williams MD, Hammond AM, Moran J. Youth Basketball Coaches' Perceptions and Implementation of Fundamental Movement Skills Training: Toward a Realist Evaluation. *Journal of Teaching in Physical Education* 2021; 41: 1–8.

51. Istvan B, Way R, Higgs C. Long-Term Athlete Development Model. In: *Long-Term Athlete Development*. Human Kinetics, 2013, pp. 5–18.

52. Barrero AM, Abad Robles MT, Giménez Fuentes-Guerra FJ. Profile of grassroots football coaches of Spanish professional clubs. *Kinesiology* 2022; 54: 325–334.

Appendices:

Quantitative question	Variable
"Developing a broad base of FMS is useful for the players I coach"	Variable 1
"A broad base of FMS helps children engage meaningfully with physical activity and sport throughout life"	Variable 2
"Children can learn FMS through good instruction and coaching"	Variable 3
"Some children more naturally have better FMS than others"	Variable 4
"Not every individual can master FMS"	Variable 5
"Development of FMS proficiency is not an important and/or valuable concept for football"	Variable 6
"Football coaches play a pivotal role in developing children's FMS"	Variable 7
"It is possible to design football coaching sessions that develop both general FMS and specific FMS to support all round FMS development"	Variable 8
"Quality grassroots football coaching should develop children's FMS"	Variable 9
"My own coaching sessions contribute to development of children's FMS"	Variable 10
"My own coaching sessions develop FMS that will be useful beyond football and help them to participate in many different sports and physical activities"	Variable 11
"Children who play other sports as well as football have better FMS than those that only play football"	Variable 12
"Children who play other sports as well as football show greater creativity, adaptability and decision making than those who only play football"	Variable 13
"Focusing on FMS development (other than kicking) in my football coaching sessions will make my players better footballers"	Variable 14

Appendix 1: Quantitative questions used for the PCA

Coaching Effectiveness	No experience	Beginner	Intermediate	Expertise
N	166	252	302	335
Mean	- 0,09	- 0,09	- 0,03	- 0,06
Maximum	1,79	1,60	1,79	1,72
Minimum	-3,06	-2,30	-2,52	-4,11
Variance	1,08	0,86	0,93	1,16
Standard deviation	1,04	0,93	0,97	1,16

Influencing Factors	No experience	Beginner	Intermediate	Expertise
N	166	252	302	335
Mean	-0,04	-0,07	-0,11	0,09
Maximum	1,53	1,44	1,53	1,53

Minimum	-2,06	-1,88	-2,05	-2,26
Variance	0,55	0,44	0,59	0,53
Standard deviation	0,74	0,66	0,77	0,73

Importance of FMS	**No experience**	**Beginner**	**Intermediate**	**Expertise**
N	166	252	302	335
Mean	-1,08	-0,01	0,02	0,09
Maximum	1,43	1,69	1,66	1,84
Minimum	-2,97	-2,58	-3,09	-4,52
Variance	0,95	1,02	1,05	1,06
Standard deviation	0,97	1,01	1,03	1,03

Appendix 2: Descriptive statistics of the new components by coaching experience (years).

Coaching Effectiveness	No diploma	Beginner	Intermediate	Expertise
N	117	596	282	60
Mean	-0,14	-0,14	-0,08	-1,88
Maximum	1,58	1,79	1,67	1,58
Minimum	-3,02	-3,06	-4,11	-3,45
Variance	0,78	0,92	1,10	2,21
Standard deviation	0,88	0,96	1,05	1,48

Influencing Factors	No diploma	Beginner	Intermediate	Expertise
N	117	596	282	60
Mean	-0,11	-0,02	0,00	-0,17
Maximum	1,53	1,53	1,53	1,53

Minimum	-2,03	-2,05	-1,88	-2,26
Variance	0,55	0,49	0,51	1,15
Standard deviation	0,74	0,70	0,72	1,07

Importance of FMS	**No diploma**	**Beginner**	**Intermediate**	**Expertise**
N	117	596	282	60
Mean	-0,81	0,01	0,02	-0,1
Maximum	1,83	1,69	1,66	1,33
Minimum	-4,52	-2,97	-3,80	-2,74
Variance	1,46	0,94	1,01	1,39
Standard deviation	1,21	0,97	1,00	1,18

Appendix 3: Descriptive statistics of the new components by coaching expertise (diploma).

Coaching Effectiveness	Fundamental Phase	Training to Train Phase	Training to Compete Phase
N	467	311	73
Mean	-0,09	-0,01	0,05
Maximum	1,79	1,72	1,65
Minimum	-4,11	-3,45	-3,01
Variance	1,01	0,96	-3,01
Standard deviation	1,01	0,98	1,05

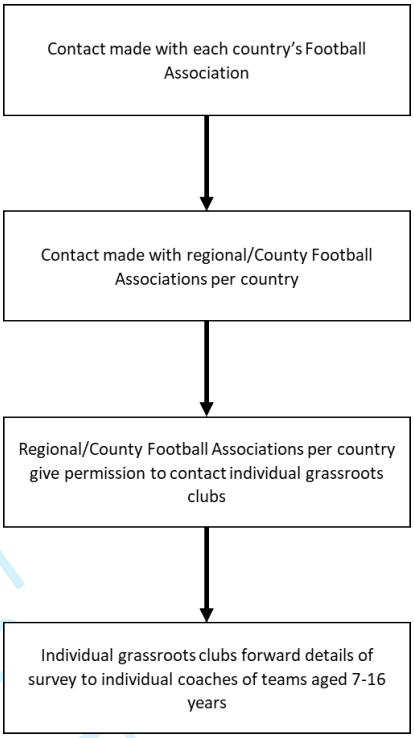
Influencing Factors	Fundamental Phase	Training to Train Phase	Training to Compete Phase
N	467	311	73
Mean	-0,01	-0,04	-0,18

Maximum	1,53	1,53	1,53
Minimum	-2,06	-2,26	-1,87
Variance	0,48	0,58	0,63
Standard deviation	0,69	0,76	0,79

Importance of FMS	**Fundamental Phase**	**Training to Train Phase**	**Training to Compete Phase**
N	467	311	73
Mean	0,05	0,01	-0,40
Maximum	1,69	1,66	1,84
Minimum	-3,80	-4,51	-3,09
Variance	0,96	1,02	1,36

Standard deviation	0,98	1,01	1,17

Appendix 4: Descriptive statistics of the new components by age group coached.

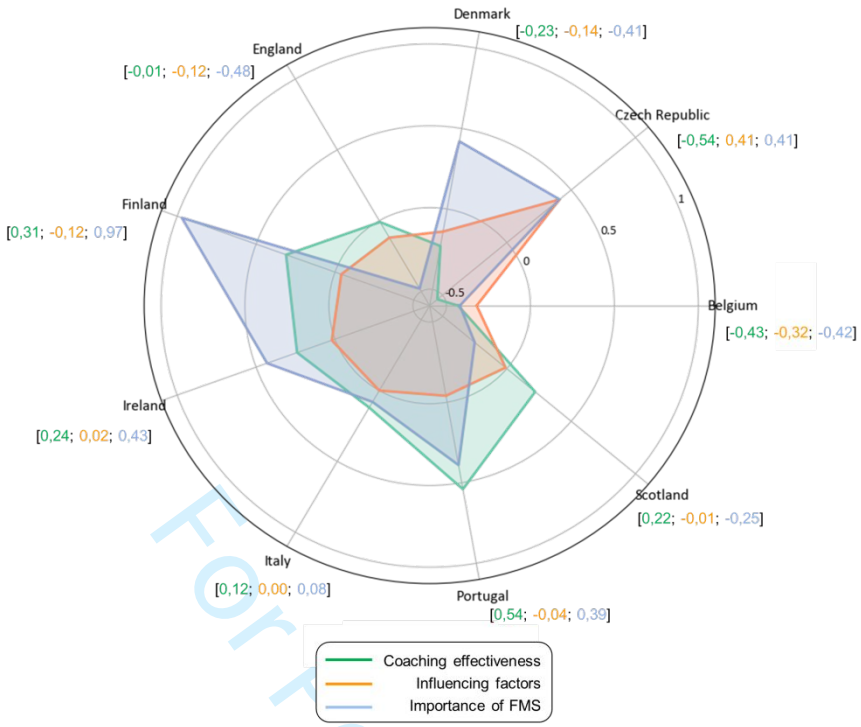


	N (%)
Country	
Belgium	110 (10,4%)
Czech Republic	176 (16,7%)
Denmark	59 (5,6%)
England	182 (17,3%)
Finland	109 (10,3%)
Ireland	112 (10,6%)
Italy	132 (12,5%)
Portugal	125 (11,8%)
Scotland	50 (4,7%)
Age	
18-24	112 (10,6%)
25-34	185 (17,5%)
35-44	387 (36,7%)
45-54	281 (26,6%)
55-64	73 (6,9%)
65+	17 (1,6%)
Gender coach	
Male	924 (87,6%)
Female	129 (12,2%)
Other	1 (0,1%)
Rather not say	1 (0,1%)
Coaching experience (years)	
No experience (0-2)	166 (15,7%)
Beginner (3-5)	252 (23,9%)
Intermediate (6-10)	302 (28,6%)
Advanced (10+)	335 (31,8%)
Coaching expertise (diploma)	
No diploma	117 (11,3%)
Beginner (UEFA C)	577 (55,7%)
Intermediate (UEFA B)	282 (27,2%)
Advanced (UEFA A - UEFA Pro)	60 (5,8%)
Age groups coached	
Fundamental Phase (U7-U12)	595 (63,5%)
Training to Train Phase (U13-U16)	282 (30,1%)
Training to Compete Phase (U17-U21)	60 (6,4%)

# Component	Total	% of Variance	Cumulative %
1	3.423	28.521	28.521
2	1.514	12.617	41.138
3	1.236	10.299	51.437
4	1.144	9.533	60.970
5	0.792	6.599	67.569
6	0.750	6.248	73.817
7	0.683	5.694	79.511
8	0.623	5.190	84.701
9	0.558	4.653	89.354
10	0.458	3.813	93.166
11	0.423	3.528	96.694
12	0.397	3.306	100.000

	Component			
	1	2	3	4
Variable 1	0.322	0.038	0.160	**0.566***
Variable 2	0.252	0.182	0.209	**0.556***
Variable 3	**0.680***	-0.153	0.150	0.022
Variable 4	0.143	-0.074	**0.689***	0.162
Variable 5	-0.180	0.094	**0.829***	-0.200
Variable 6	-0.198	-0.096	-0.157	**0.851***
Variable 7	**0.843***	-0.052	-0.093	-0.253
Variable 8	**0.620***	0.092	0.019	0.130
Variable 9	**0.604***	0.151	-0.010	0.258
Variable 12	-0.108	**0.882***	0.009	0.061
Variable 13	0.028	**0.865***	0.037	-0.137
Variable 14	**0.459***	0.354	-0.101	0.083

	Country	Coach experience	Coach expertise	Age of team
N	**1050**	**1050**	934	847
DOF	**8**	**3**	2	2
Coaching Effectiveness	**p < 0.001*** H = 149.86	**p = 0.005*** H = 12.97	p = 0.260 H = 2.69	p = 0.396 H = 1.85
Influencing Factors	**p < 0.001*** H = 88.39	**p < 0.001*** H = 20.50	p = 0.608 H = 1.49	p = 0.134 H = 4.02
Importance of FMS	**p < 0.001*** H = 182.93	p = 0.083 H = 6.67	p = 0.724 H = 0.65	**p = 0.006*** H = 10.32



Type of Resource	Belgium (N=122)	Czech (N=176)	Denmark (N=59)	England (N=182)	Finland (N=109)	Ireland (N=114)	Italy (N=133)	Portugal (N=125)	Scotland (N=50)
Social media (Facebook, X, Instagram, TikTok)	6 (5%)		8 (13,6%)	54 (29,7%)		15 (13,2%)	15 (11,3%)	11 (8,8%)	12 (24%)
Websites (including subscription-based coaching, FA websites)	9 (7,5%)	35 (19,9%)	6 (10,2%)	20 (11%)		21 (18,4%)	13 (9,8%)	38 (30,4%)	5 (10%)
Resource direct from the national association	24 (19,7%)		7 (11,9%)	2 (1,1%)	3 (2,8%)		1 (0,8%)		
Other coaches	2 (1,6%)		1 (1,7%)	2 (1,1%)	3 (2,8%)	6 (5,3%)	6 (4,5%)	1 (0,8%)	3 (6%)
Books	11 (9%)	20 (11,3%)	5 (8,5%)	24 (13,2%)		12 (10,5%)	51 (38,3%)	40 (32%)	2 (4%)
Discussion boards									
YouTube	7 (5,7%)		6 (10,2%)	21 (11,5%)		7 (6,1%)	2 (1,5%)	3 (2,4%)	2 (4%)
Scientific Research			1 (1,7%)	2 (1,1%)		6 (5,3%)	22 (16,5%)	11 (8,8%)	
Other sports experiences	9 (7,3%)				7 (6,4%)	5 (4,4%)			

Type of barrier	Belgium (N=122)	Czech (N=176)	Denmark (N=59)	England (N=182)	Finland (N=109)	Ireland (N=114)	Italy (N=133)	Portugal (N=125)	Scotland (N=50)
Lack of training in using FMS in coaching	49 (26,3%)	82 (30%)	26 (22,8%)	105 (21%)	24 (11,82%)	59 (24,7%)	40 (14,4%)	32 (14,5%)	27 (22,5%)
Inadequate facilities or equipment	43 (23,1%)	73 (26,7%)	20 (17,5%)	53 (10,6%)	34 (16,75%)	29 (12,1%)	59 (21,2%)	57 (25,8%)	18 (15%)
Low levels of personal interest for focusing on FMS in coaching	1 (0,5%)	25 (9,2%)	10 (8,8%)	39 (7,8%)	2 (1%)	12 (5%)	18 (6,5%)	19 (8,6%)	9 (7,5%)
Lack of confidence in employing FMS in coaching sessions	8 (4,3%)	11 (4%)	8 (7%)	60 (12%)	8 (3,9%)	20 (8,4%)	20 (7,2%)	11 (5%)	11 (9,2%)
Negative parental attitudes to focusing on FMS in coaching	12 (6,5%)	13 (4,8%)	1 (0,9%)	55 (11%)	3 (1,5%)	17 (7,1%)	30 (10,8%)	22 (10%)	11 (9,2%)
Training sessions to big	8 (4,3%)	11 (4%)	20 (17,5%)	19 (3,8%)	17 (8,4%)	9 (3,8%)	11 (4%)	10 (4,5%)	5 (4,2%)
Lack of time in training sessions	53 (28,50%)	23 (8,4%)	17 (14,9%)	120 (24%)	62 (30,5%)	61 (25,5%)	64 (23%)	52 (23,5%)	26 (21,7%)
Lack of space in Training sessions	9 (4,8%)	16 (5,9%)	4 (3,5%)	40 (8%)	38 (18,7%)	24 (10%)	22 (7,9%)	11 (5%)	11 (9,2%)
Other	3 (1,6%)	19 (7%)	8 (7%)	9 (1,8%)	15 (7,4%)	8 (3,4%)	14 (5%)	7 (3,2%)	2 (1,7%)

Appendices:

Quantitative question	Variable
"Developing a broad base of FMS is useful for the players I coach"	Variable 1
"A broad base of FMS helps children engage meaningfully with physical activity and sport throughout life"	Variable 2
"Children can learn FMS through good instruction and coaching"	Variable 3
"Some children more naturally have better FMS than others"	Variable 4
"Not every individual can master FMS"	Variable 5
"Development of FMS proficiency is not an important and/or valuable concept for football"	Variable 6
"Football coaches play a pivotal role in developing children's FMS"	Variable 7
"It is possible to design football coaching sessions that develop both general FMS and specific FMS to support all round FMS development"	Variable 8
"Quality grassroots football coaching should develop children's FMS"	Variable 9
"My own coaching sessions contribute to development of children's FMS"	Variable 10
"My own coaching sessions develop FMS that will be useful beyond football and help them to participate in many different sports and physical activities"	Variable 11
"Children who play other sports as well as football have better FMS than those that only play football"	Variable 12
"Children who play other sports as well as football show greater creativity, adaptability and decision making than those who only play football"	Variable 13
"Focusing on FMS development (other than kicking) in my football coaching sessions will make my players better footballers"	Variable 14

Appendix 1: Quantitative questions used for the PCA

Coaching Effectiveness	No experience	Beginner	Intermediate	Expertise
N	166	252	302	335
Mean	- 0,09	- 0,09	- 0,03	- 0,06
Maximum	1,79	1,60	1,79	1,72
Minimum	-3,06	-2,30	-2,52	-4,11
Variance	1,08	0,86	0,93	1,16
Standard deviation	1,04	0,93	0,97	1,16

Influencing Factors	No experience	Beginner	Intermediate	Expertise
N	166	252	302	335
Mean	-0,04	-0,07	-0,11	0,09
Maximum	1,53	1,44	1,53	1,53
Minimum	-2,06	-1,88	-2,05	-2,26
Variance	0,55	0,44	0,59	0,53
Standard deviation	0,74	0,66	0,77	0,73

Importance of FMS	No experience	Beginner	Intermediate	Expertise
N	166	252	302	335

Mean	-1,08	-0,01	0,02	0,09
Maximum	1,43	1,69	1,66	1,84
Minimum	-2,97	-2,58	-3,09	-4,52
Variance	0,95	1,02	1,05	1,06
Standard deviation	0,97	1,01	1,03	1,03

Appendix 2: Descriptive statistics of the new components by coaching experience (years).

Coaching Effectiveness	**No diploma**	**Beginner**	**Intermediate**	**Expertise**
N	117	596	282	60
Mean	-0,14	-0,14	-0,08	-1,88
Maximum	1,58	1,79	1,67	1,58
Minimum	-3,02	-3,06	-4,11	-3,45
Variance	0,78	0,92	1,10	2,21
Standard deviation	0,88	0,96	1,05	1,48

Influencing Factors	**No diploma**	**Beginner**	**Intermediate**	**Expertise**
N	117	596	282	60
Mean	-0,11	-0,02	0,00	-0,17
Maximum	1,53	1,53	1,53	1,53

Minimum	-2,03	-2,05	-1,88	-2,26
Variance	0,55	0,49	0,51	1,15
Standard deviation	0,74	0,70	0,72	1,07

Importance of FMS	**No diploma**	**Beginner**	**Intermediate**	**Expertise**
N	117	596	282	60
Mean	-0,81	0,01	0,02	-0,1
Maximum	1,83	1,69	1,66	1,33
Minimum	-4,52	-2,97	-3,80	-2,74
Variance	1,46	0,94	1,01	1,39
Standard deviation	1,21	0,97	1,00	1,18

Appendix 3: Descriptive statistics of the new components by coaching expertise (diploma).

Coaching Effectiveness	**Fundamental Phase**	**Training to Train Phase**	**Training to Compete Phase**
N	467	311	73
Mean	-0,09	-0,01	0,05
Maximum	1,79	1,72	1,65
Minimum	-4,11	-3,45	-3,01
Variance	1,01	0,96	-3,01

Standard deviation	1,01	0,98	1,05

Influencing Factors	**Fundamental Phase**	**Training to Train Phase**	**Training to Compete Phase**
N	467	311	73
Mean	-0,01	-0,04	-0,18
Maximum	1,53	1,53	1,53
Minimum	-2,06	-2,26	-1,87
Variance	0,48	0,58	0,63
Standard deviation	0,69	0,76	0,79

Importance of FMS	**Fundamental Phase**	**Training to Train Phase**	**Training to Compete Phase**
N	467	311	73
Mean	0,05	0,01	-0,40
Maximum	1,69	1,66	1,84
Minimum	-3,80	-4,51	-3,09
Variance	0,96	1,02	1,36
Standard deviation	0,98	1,01	1,17

Appendix 4: Descriptive statistics of the new components by age group coached.