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Research Trends on Small-Sided Games in Soccer: A Bibliometric Analysis

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ABSTRACT

A valid, credible, and comprehensive literature meta-study determines the level of accuracy in diagnosing previous research findings. It determines the development of more meaningful and useful future research. The purpose of this study was to examine the development of research articles on small-sided games in soccer. This study is quantitative research with bibliometric study method. Data were collected using the Publish or Perish application applying keywords "small-sided games in soccer" and "small sided games" for articles published in the last 10 years (2014-2024). The collected data were verified using Mendeley and analyzed using the VOSviewer tool. The results of the examination found that research on the small-sided game model had not experienced significant development. It was because most of the 163 papers analyzed still discussed training models for mastering and improving physiology aspects, biomotor performance, techniques, and soccer tactics. Future research is needed to develop a small-sided game training model that complements mental or character values, including perseverance, discipline, teamwork, and respect. This study contributes as an evaluation of the small-sided game model article publication that can be used by advanced researchers to create more significant future research on more impactful, meaningful, and futuristic training models for young athletes to become elite athletes with strong characters.

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INTRODUCTION

Soccer game is highly developing and competitive today. This is characterized by the development of training methods directed at the characteristics of soccer matches and assistance for compiling training programs for coaches to improve the performance of the players (Becerra Patiño et al., 2022; Becerra Patiño & Escorcia-Clavijo, 2023). Soccer is considered competitive because soccer has now been categorized as a sport with a very high-intensity status (Rivilla-García et al., 2019). The very high tempo of the game affects the demands on prime player endurance. The average VO2Max requirement for soccer players ranges from 55 ml kg1 to 65 ml kg1 (Metaxas, 2021). During the match, soccer players make several movements such as sprinting, jumping, accelerating, decelerating, and changing directions (Leontijević et al., 2019; Silva et al., 2023). Apart from the physical need development of players, soccer also demands the ability to understand tactics to win matches (Holienka et al., 2020). Tactical skills combine technical skills and the utilization of the player physical condition. Passing skills, one of the technical actions in soccer, is important because the present soccer playing style is dominated by the ball possession style (Bush et al., 2015; Sgro et al., 2015; Göral, 2015; Kusuma et al., 2022).

Previous studies had examined efforts to improve the performance of soccer players, both isolated and holistic. Parachute resistance training for 4 weeks to increase running speed (Kusuma et al., 2021), plyometric exercises and full-back squats to increase explosiveness in muscles (de Hoyo, Moises, 2016), fartlek training for 16 meetings (every 3 weeks) to increase endurance (Bahtra et al., 2024), and drill method to improve passing skills (Amalia et al., 2023) are some efforts carried out in previous studies that used an isolated approach. The popular holistic approach studied by researchers and applied by coaches is the small-sided games (SSG) model. SSG presents the real situation of the match to the players because the actions in a match are presented in the training, but in a smaller playing area (Kusuma et al., 2024). Players, during training using the SSG model, can improve their physical capacity, playing technique, and tactics (Ouertatani et al., 2022; Kunrath et al., 2020; Bergkamp et al., 2020) and raise their mood during training (Selmi et al., 2020) at the same time. Therefore, SSG is a situation and condition of a soccer match with a reduced, restricted, conditioned version of the 11 versus 11 game format (Benítez et al., 2024). For this reason, SSG is considered as a training with a holistic approach since it can intervene in all aspects needed by players in a soccer match.

The development of the SSG training model had also been carried out by researchers through the integration of other training models. The combination of core strength on the field and SSG was conducted to examine its influence on the dominant physical performance needed by soccer players (Ersan Arslan et al., 2021). The combination of SSG and a running-based method could increase acute mechanical loads and stimulate high-intensity running in soccer players (Filipe Manuel Clemente & Sarmento, 2021). However, the findings were limited to physical, technical, and tactical capacity in soccer. In fact, in a soccer match, the mental capacity or the player character is needed to support optimal performance. Leadership, respect, and collaboration skills are character values that should be acquired by every player when competing. To get out of the opponent pressure, a strong leadership character of the players on the field is needed. An attitude of respect for the referee decision or the opponent action due to collisions, which are difficult to avoid in a soccer game, is important so that players can focus on implementing the coach tactics. Meanwhile,

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collaborative attitude is important to perform more effective defends and attacks (Rein et al., 2022; Forcher et al., 2024).

Based on the aforementioned problems and findings and to diagnose previous findings accurately, researchers need a literature meta-study to design a more comprehensive, meaningful, and impactful future research developments. Bibliometric studies are currently considered as literature review meta-studies aimed to assess and examine the nuances of the publication evolution in each field of science while highlighting currently developing aspects (Donthu et al., 2021; Zheng et al., 2023). The bibliometric study has been used as a tool for developing studies on different topics, such as teacher leaderships (Zheng et al., 2023), sport tourism and sustainability (Jiménez-García et al., 2020), artificial intelligence and human resource managements (Palos-Sánchez et al., 2022), and development of scientific publications on physical education in reputable international journals (Hanief et al., 2021). Therefore, bibliometric study is a credible alternative solution to provide future research opportunities on certain topics, including research on the development of soccer training models, through overlay, network, and density visualizations (Blegur et al., 2023).

This study was aimed to map studies based on observations on the articles on the SSG training model published in the last 10 years, 2014-2024. The scope of the research was not limited only to one aspect supporting football player performance. The findings of the current research can be used as one of the bases for developing a more comprehensive training model oriented to improve all aspects needed by soccer players, including physical, technical, tactical, mental/character aspects. Therefore, in the future, coaches can improve all of these aspects with a holistic approach to help players achieve excellent physical capacity, good technical and tactical qualities, and good characters when competing.

METHODS

This research is quantitative research using the bibliometric study method. Bibliometric studies with a quantitative approach are used to measure, track, and analyze social and structural relationships among the literature components (Rojas-Sánchez et al., 2023). This method helps researchers improve their understanding of previous research findings in a particular field and allows them to scientifically identify gaps in the body of literature which potentially serve as future research (Kraus et al., 2022; Chigbu et al., 2023) by employing inclusion criteria such as types of journal, types of article, and year of publication (Snyder, 2019). In this study, the inclusion criteria included the articles published from 2014 to 2024, articles from a scientific journal and conference proceedings, and small-sided games in soccer as the keywords.

Data collection began with documenting articles using the Publish or Perish (PoP) application by entering the keywords "small-sided games in soccer" and "small sided games in soccer" in the Google Scholar database from the 2014 to 2024 period. In the next stage, the collected articles were verified using the Mendeley Reference Manager application to ensure that the papers were not duplicated and the data met the inclusion criteria previously mentioned. Then, the data were exported into the Research Information System (RIS) format to be compatible with VOSviewer software version 1.6.20 for the data analysis process. The advantage of using VOSviewer is that the data are easy to interpret through the bibliometric map display (Kemeç & Altınay, 2023).

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RESULTS

Data (documents/articles) were collected on 10 June 2024, using the PoP application by inputting the title words "Small-Sided Games in Soccer" and "Small Sided Games in Soccer" in Google Scholar search from 2014 to 2024. From the 2 titles, the researchers partially found 200 articles for each (Table 1).

Table1. Results of Citation Metrics

Small-Sided Games in Soccer	Citation Metrics	Small Sided Games in Soccer
2014-2024	Publication years	2014-2024
10 (2014-2024)	Citation years	10 (2014-2024)
200	Papers	200
6976	Citations	6809
697.60	Cites/years	680.90
34.88	Cites/paper	34.05
3.54	Author/paper	3.55
47	h-index	46
77	g-index	76
25	hI, norm	25
2.50	hI, annual	2.50
15	hA-index	15

Based on the collection of 400 articles, the data were then verified based on its author, title, publication, and abstract using the Mendeley Reference Manager application. The purpose of the verification was to ensure that there were no duplicate documents and the data came from articles published in journals or proceedings. As the result, 163 articles met the criteria. The data were then exported in RIS format for analysis using VOSviewer.

Research on Small-Sided Games in Soccer fluctuated in one decade (see Figure 1). The highest publication was apparent in 2021 with 26 documents. Although there was a downward trend in publications in 2018 and 2019, it was not more than the number of documents recorded in 2016 (12 documents). While in 2024, only 9 documents were detected. This might be due to the data collection process was carried out on 10 June 2024.

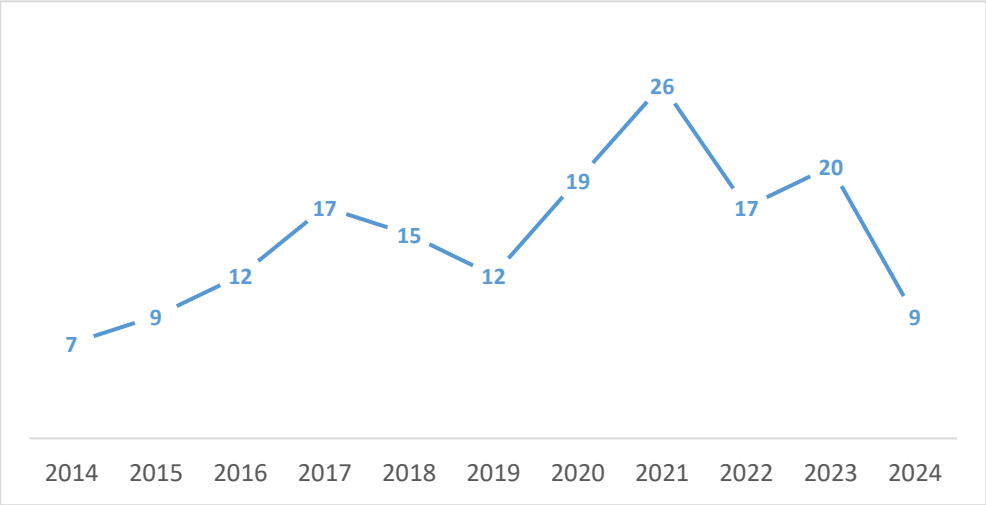

Figure 1. Publication Trends

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Citation trends and publication data were confirmed by Google Scholar, including the title, author, affiliation, and year of publication. Although there was a significant increase in article publications in 2021, according to the citation trend, there was no article in that year included in the most cited publications (see Table 2). On the other hand, the age of publication also does not guarantee a citation trend. In 2014-2015, there was no article included in the citation trend. From the top 5 most cited articles, the research written by M. Lacome, B.M. Simpson, Y. Cholley, P. Lambert, and M. Buchheit on small-sided games in elite soccer had been cited by 212 authors or researchers.

Table 2. The Five Most Cited Articles

Citation	Title	Authors	Affiliation	Year
212	Small-sided games in elite soccer: does one size fit all?	M. Lacome, B.M. Simpson, Y. Cholley, P. Lambert, M. Buchheit	Paris Saint Germain FC	2018
194	Mental fatigue: impairment of technical performance in small-sided soccer games	O.O Badin, M.R. Smith, D. Conte, A.J. Coutts	University of Technology Sydney	2016
182	Heart rate, technical performance, and session-RPE in elite youth soccer small-sided games played with wildcard players	J. Sanchez-Sanchez, D. Hernaindez, D. Casamichana, C. Martanez-Salazar, R. Ramirez-Campillo, J. Sampaio	Pontifical University of Salamanca, Spain	2017
170	Soccer small-sided games in young players: Rule modification to induce higher physiological responses	J. Halouani, H. Chtourou, A. Dellal, A. Chaouachi, K. Chamari	National Centre of Medicine and Science in Sports Tunis – El Menzah, Tunisia	2017
152	Match-derived relative pitch area changes the physical and team tactical performance of elite soccer players in small-sided soccer games	S. B. H. Olthof, W. G. P. Frencken, K. A. P. M. Lemmink	Center for Human Movement Sciences, University of Groningen, University Medical Center Groningen, Groningen, the Netherlands	2018

In the co-authorship analysis process, the full count method was used with the number of co-authorship authors determined to have published at least three articles, so that 33 authors that met the threshold of 550 authors appeared on the VOSviewer network map were obtained. The results of the analysis (selected no on unconnected items) verified that 33 authors were spread across 10 clusters forming 41 links and 91 total link strengths. Cluster 1 (7 authors) includes Bouassida, Nakamura, Pino-Ortega, Ramirez-Campillo, Sampaio, Sanchez-Sanchez, and Selmi. Cluster 2 (6 authors) includes Borges, Chagas, Greco, Moreira, Praça, and Teoldo. Cluster 3 (4 authors) includes Clemente, Rabbani, Sarmento, and Younesi. Cluster 4 (3 authors) includes Babic, Holienka, and Nagy. Cluster 5 (3 authors) includes Clemente, Knechtle, and Sarmento. Cluster 6 (3 authors) includes Ferraz, Marques, and Travassos. Cluster 7 (2 authors) includes Alemdaroğlu, Kòklù. Cluster 8 (2 authors) includes

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Padròn-Cabro, Rey. Cluster 9 (2 authors) includes Cofano, Sannicandro. Cluster 10 (1 author) includes Frencken.

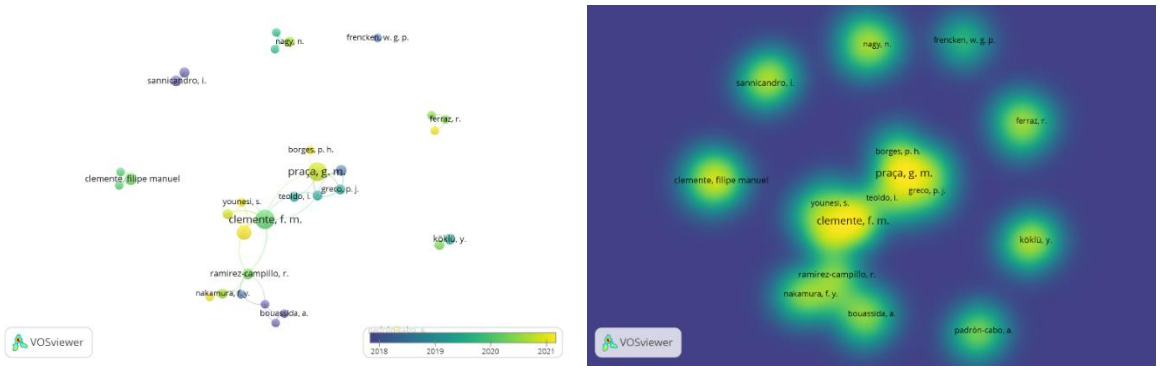

Figure 2. Co-Authorship Overlay and Density Visualization

Of the 33 authors, all of them are popular in publishing articles on small-sided games in soccer due to their high density (see Figure 2 on the right). It was identified that 14 authors, namely Selmi, Sampaio, Bouassida, Padròn-Cabro, Ferraz, Travassos, Frencken, Babic, Holienka, Sarmento, Knechtle, Borges, Younesi, Rey published 3 documents. This means that of the 14 researchers, none of them published articles on the small-sided games in soccer term more than three documents. This data also confirm that the publication trend of authors in this field needs improvement.

The co-occurrence analysis process was used to determine the structured arrangement of keywords in the article so that, from the articles verified by PoP and Mendeley, trending keywords in each author publication could be examined. This analysis stage visualized future research opportunities based on article keywords by using a full calculation method with the number of co-occurrence keywords set at a minimum of three. The results of the analysis verified that there were 60 keywords spreading across 9 clusters, forming 262 links and 434 total link strengths.

Cluster 1 (10 keywords) includes association soccer, fatigue, game-based training, global positioning system, monitoring, motivation, physiological response, physiological responses, training load, and young players. Cluster 2 (8 keywords) includes athletic performance, coaching, conditioned games, drill-based games, individualization, interval training, motor skills, and SSGS. Cluster 3 (8 keywords) includes game-based training, match analysis, performance, soccer training, sprint, SSG, team sports, and technical analysis. Cluster 4 (7 keywords) includes assessment, ball possession, performance analysis, tactical assessment, tactical behavior, task constraints, and youth sport. Cluster 5 (7 keywords) includes conditioning, creativity, high-intensity interval training, physical education and training, small-sided games, and soccer. Cluster 6 (6 keywords) includes acceleration, deceleration, external load, GPS, internal load, and metabolic power. Cluster 7 (5 keywords) includes motion analysis, sport, tactics, training, and women. Cluster 8 (5 keywords) includes soccer, physical fitness, recreational soccer, sports, and team sport. Cluster 9 (4 keywords) includes heart rate, RPE, small-sided games, and young soccer players.

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Of the 60 keywords, the most frequent appeared keywords are soccer (50 occurrences; 80 total link strengths), soccer (39 occurrences; 92 total link strengths), small-sided games (32 occurrences; 65 total link strengths), heart rate (17 occurrences; 35 total link strengths), association soccer (14 occurrences; 19 total link strengths), training load (13 occurrences; 30 total link strengths), performance analysis (13 occurrences; 24 total link strengths).

Figure 3. Co-Occurrence Network and Overlay Visualization

The VOSviewer operation returned 380 items; 60 met the threshold, with 60 terms selected. In the next stage, six terms were eliminated, including GPS, association soccer, global positioning system, team sports, assessment, and sport, resulting in 54 items, 8 clusters, 201 links, and a total link strength of 358. Eight clusters were formed in Figure 4-left (network visualization) (see Table 3).

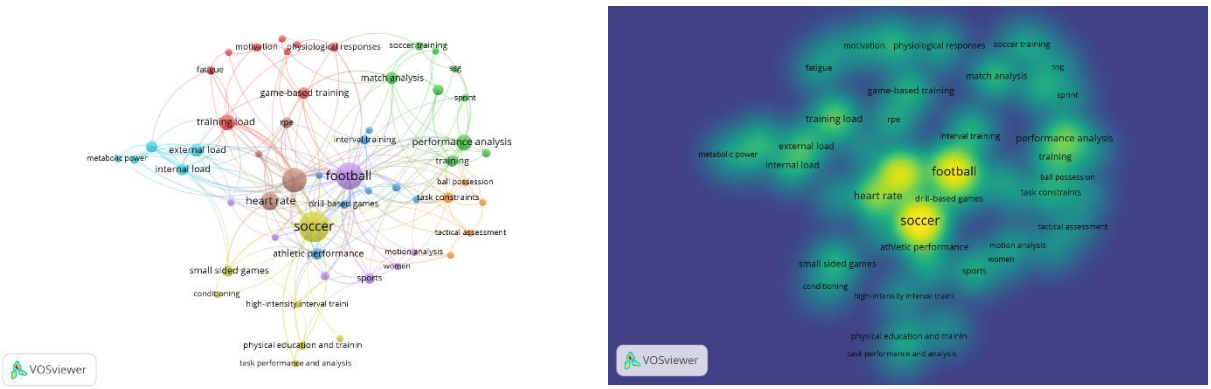

Figure 4. Title and Abstract Network and Density Visualization

The overlay visualization display (Figure 4) presents that, for the "small-sided games in soccer" term, the oldest studied term is "young soccer player" (cluster 8) and the most recent terms are "motor skills" (cluster 3) and "youth sport" (cluster 7). For density visualization (Figure 4- Right), it is apparent that the "recreational soccer", "young player", "sprint", "motivation", "physical fitness", and "small side games" terms have low density. While the "soccer", "heart rate", "soccer", "training load", "athletic performance", "performance

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analysis", "external load", and "internal load" terms have high density. The VOSviewer visualization indicates that the study on the small-sided games training model, especially those with the "character values" term, such as fighting spirit, discipline, teamwork, and respect, is limited. The development of a small-sided game training model to improve these variables is essential to equip young soccer players pursuing their future professional careers.

Table 3. Cluster Results of Bibliometric Analysis

Cluster	Color	Item	Total
1	Red	fatigue, game-based training, game-based training, monitoring, motivation, physiological response, physiological responses, training load, young players	9
2	Green	match analysis, performance, performance analysis, soccer training, sprint, SSG, tactics, technical analysis, training	9
3	Blue	athletic performance, coaching, conditioned games, drill-based games, individualization, interval training, motor skills, SSGs	8
4	Yellow	conditioning, creativity, high-intensity interval training, physical education and training, small-sided games, soccer, task performance and analysis	7
5	Purple	soccer, motion analysis, physical fitness, recreational soccer, sport, team sport, women	7
6	Cyan	acceleration, deceleration, external load, internal load, metabolic power	5
7	Orange	ball possession, tactical assessment, tactical behavior, task, constraints, youth sport	5
8	Brown	heart rate, RPE, small-sided games, young soccer players	4

DISCUSSION

The answer to the research problem from the results of the VOSviewer examination is that the "small-sided games in soccer" and "small sided games in soccer" terms have a fluctuating trend and are more directed at the conditioning or physical performance aspects in academic literature (journal articles). This means that studies on the development of small-sided game training models have not received serious attention as an effort to improve character values, such as never giving up, discipline, respect, and teamwork, in young players. In addition, the trend of small-sided games in soccer research is still oriented to mastering physical, technical, and tactical aspects. Of course, these results provide a visualization for further research on the development of a more holistic small-sided games training model, considering that the study on the development of small-sided games training models has not optimally targeted the essential areas needed by young players to achieve a professional career in the future or to realize positive youth development.

Previous studies had reported the effectiveness of the Small-Sided Games (SSG) training model in soccer on physical performance (Xu et al., 2024; Kusuma et al., 2023; Umam & Suherman, 2023; Clemente et al., 2021; Arslan et al., 2021). Apart from influencing physical performance, SSG was also reported to be effective in intervening in the technical and tactical aspects of players (Badari et al., 2021; Machado et al., 2024; Rochael & Praça, 2024). Cognitive intelligence in playing soccer (Almeida et al., 2023; Fenner et al., 2022), psychological aspects such as player mood (Ouertatani et al., 2022), and the motivation of the players while playing SSG (Badin et al., 2016) had also been reported. These results certainly provide a stimulus for future research to develop SSG training models to improve player performance from all

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aspects, namely physiology, technique-tactics, mental or psychology, and character value aspects.

SSG is known as a training model that can effectively integrate the specific demands of the soccer game and a representative solution in increasing the efficiency of the training process (Sarmento et al., 2018; Fernández-Espínola et al., 2020). Interventions that are relevant to the demands of soccer matches become the characteristic of SSG training and bring a more significant impact than general trainings (Sarmento et al., 2018). Producing potential athletes to become elite athletes in the future does require physical aspects, technique, and good tactical understanding (Gollin et al., 2016; Riboli et al., 2023; Praça et al., 2020; de Dios-Álvarez et al., 2024). However, the mental or character value is also a determinant of success in achieving peak performance (Henriksen et al., 2020). Character values should be naturally integrated into the training process so that athletes have the never giving up, discipline, teamwork, and respect values.

There is a strong correlation between character quality and football player performance. It is reported that athletes with low mental capacity are easily frustrated and do not have many smart options in defeating their opponents (Komarudin, 2016). Moreover, the poor physical status of the player also has a negative impact on the player reaction to the surrounding environment. Several behaviors related to self-confidence, anxiety, stress, and fatigue to stress will be displayed by the player (Lindegård et al., 2019; Tanguy et al., 2018). Seeing the demands of today sports for achieving achievements as well as being a motor in realizing people with good character values and supporting positive youth development programs (Bruner et al., 2023; Falcão et al., 2020; Ronkainen et al., 2021), it is important to develop a more holistic training model from the current findings.

Based on the findings of this study, a holistic training model can significantly influence the physical, technical, tactical, and character or mental aspects needed by young soccer players to become elite soccer players and realize the goal of positive youth development through soccer trainings. The results of this study provide a new alternative for further research to conduct an in-depth study on the development of the SSG training model by integrating local or national wisdom values for long-term changes to the soccer player profile so that they can become elite soccer players with strong characters.

CONCLUSION

The results of the investigation into the development of research on SSG in soccer over the past ten years found that research on SSG had not experienced significant development. From the 163 papers analyzed, the scope of the discussion was mostly still in the physiological aspects, biomotor performance, techniques, and tactics. Until now, the direction of research on SSG has not been focused on the formation of soccer player characters to support their careers in the future as elite soccerer and to support positive youth development programs, such as discipline, respect, teamwork, and never giving up values. Sports lecturers in universities and soccer practitioners need to formulate and develop various transformative experiences for young soccer players to be an elite player in the future and accelerate it by sharing quality of life issues that change periodically according to the demands of the times.

AUTHORS' NOTE

The authors declare that there is no conflict of interest regarding the publication of this article. The authors confirmed that the paper was free of plagiarism.

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