



A Bibliometric Analysis of Trends in Real-Time Coach Feedback Technologies in Sports

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Article History

Received December 2024
Accepted February 2025
Published Vol.14 No.(1) 2025

Keywords:

Feedback ; Coach;
Relationship

Abstract

This study explores the role of coach feedback in improving athlete performance through a bibliometric analysis approach. Coach feedback is proven to be crucial in enhancing skills, motivation, and the relationship between coaches and athletes. Using data from Scopus (2014–2024), this study maps publication trends, international collaborations, and dominant research themes related to coach feedback. The findings indicate that a combination of positive and corrective feedback is more effective, while context-based and interpersonal approaches enhance its effectiveness. Despite providing comprehensive insights, this study faces limitations in terms of language scope, database coverage, and a lack of in-depth qualitative analysis. This study serves as an important foundation for further research development on feedback in the sports domain.

How to Cite

Cornelia, S., Sidik, D. Z., Rusdiana, A., & Fitri, M. (2025). A Bibliometric Analysis of Trends in Real-Time Coach Feedback Technologies in Sports. *Journal of Physical Education, Sport, Health and Recreation*, 14 (1), 72-79.

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INTRODUCTION

Coach feedback is a fundamental element in the learning process and skill development of athletes in the sports world (Corbett et al., 2024). As a form of direct communication between coaches and athletes, feedback plays a significant role in helping athletes understand their performance and set clearer goals (Jug et al., 2019; Purnomo et al., 2024). According to (Atkinson et al., 2022), effective feedback not only strengthens athletes' understanding of their strengths and weaknesses but also motivates them to continue striving for self-improvement. This process forms the basis for a harmonious relationship between coaches and athletes, which is essential in building trust and achieving optimal results.

Previous research shows that the type of feedback provided can differently affect athletes' performance and motivation levels (Weakley et al., 2020). For instance, a study by (Drews et al., 2020) revealed that positive feedback, such as praise for good performance, can enhance athletes' intrinsic motivation and self-confidence. Conversely, constructive corrective feedback enables athletes to identify specific mistakes and correct them, ultimately helping them achieve more significant improvements in both technical skills and game strategies (Lee et al., 2023). An integrated approach combining both types of feedback has been proven more effective than relying on just one type of feedback (Fabian W. Otte et al., 2020).

Furthermore, several studies highlight the importance of context in delivering feedback. Raya-Castellano stated that feedback effectiveness depends not only on the message conveyed but also on its relevance, specificity, and delivery method (Raya-Castellano et al., 2021). For example, a study by (Mossman et al., 2024) found that athletes tend to respond better to feedback provided in a supportive and non-authoritarian environment. This underscores that interpersonal relationships between coaches and athletes, team culture, and coaches' communication skills are key elements supporting feedback success (Davis et al., 2022). To optimize the benefits of feedback in coaching leadership, various analytical approaches, including bibliometric analysis, have been employed to identify trends and patterns in research on coach feedback in sports.

Bibliometric analysis has provided valuable insights into how leadership concepts in sports coaching have evolved. This analysis helps identify key themes, influential authors, and frequently cited references in related studies (Çiri & Ünal, 2024). For instance, a bibliometric study by (Cruz & Kim, 2023) revealed that the most rele-

vant main themes include coach characteristics, coaching leadership styles, exhibited coach behaviors, and the relationship between leadership styles and psychological outcomes for athletes, such as motivation and team cohesion. Additionally, the study suggested expanding generalization and providing a broader database while analyzing the role and impact of coaching leadership. Therefore, this study focuses on coach feedback in sports using bibliometric analysis with Scopus data.

The purpose of this study is to analyze research trends related to coach feedback in sports through a bibliometric approach, identify dominant themes, and provide recommendations for future research. By mapping publication trends, international collaborations, and key research themes, this study aims to offer a comprehensive understanding of how coach feedback has evolved over the past decade.

The novelty of this research lies in its comprehensive bibliometric analysis, which covers a 10-year period (2014-2024) and identifies the optimal combination of positive and corrective feedback. Additionally, this study emphasizes the importance of context and interpersonal relationships in delivering feedback, which has not been extensively explored in previous research. The use of VOSviewer software to visualize research networks and collaboration patterns also adds a unique dimension to this study.

METHODS

Bibliometric analysis is utilized in this study to gather a large body of literature related to coach feedback in sports. This analysis serves as a method to map extensive scientific literature, ensuring the quality and accuracy of the information used and the findings produced (Karki et al., 2024). By applying the bibliometric analysis approach, researchers can gain a comprehensive understanding by identifying trends, patterns in specific fields, and relationships among existing studies (Tang et al., 2018).

The research process began by carefully selecting the theme through an extensive review of the Scopus scientific database, with publication years limited to 2014-2024. Relevant articles were identified using the keywords "coach," "feedback," and "sports." Data collection was conducted on December 6, 2024. Boolean logic functions such as "AND" and "OR" in Scopus led to the following search topic shown in **Figure 1**.

TITLE-ABS-KEY (coach AND feedback AND sports) AND PUBYEAR > 2014 AND PUBYEAR < 2024

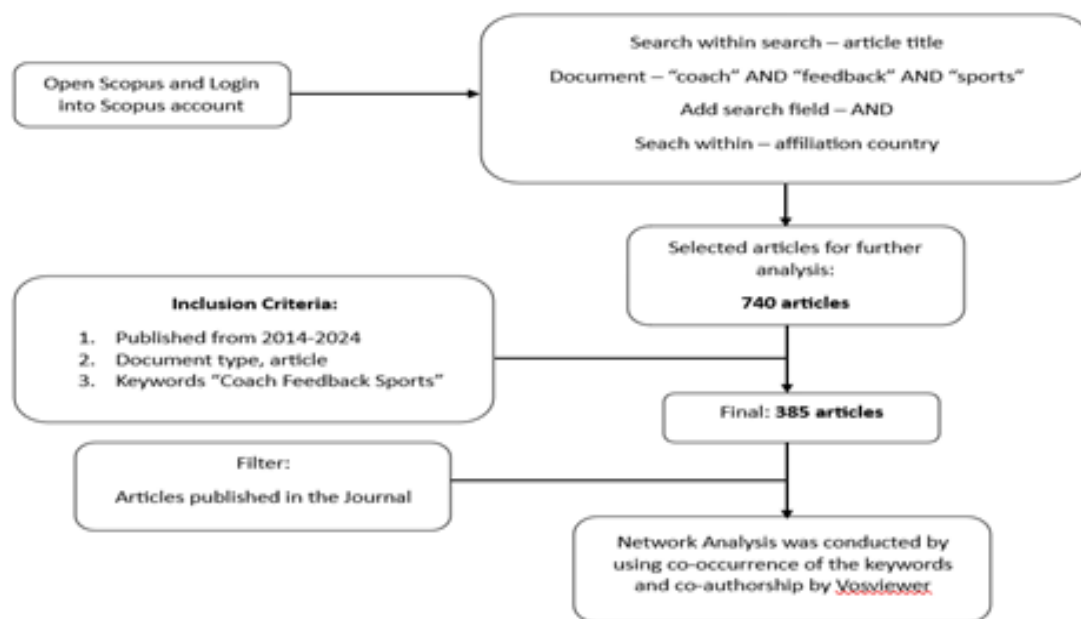


Figure 1. Data Search Process in Scopus and Research Flow.

After the data was collected, it was analyzed using VOSviewer software to visualize trends, collaboration patterns among authors, and the geographical distribution of research. The results of this analysis provide an overview of the development of research on this topic and identify areas that remain underexplored in the literature.

RESULTS AND DISCUSSION

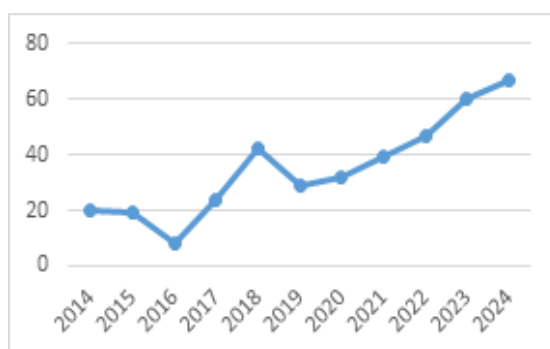


Figure 2. Documents Published in the Scopus Database

From **Figure 2** (2014 to 2024) research from 65 countries has published articles related to coach feedback in sports. The overall publication trends in aesthetic in sports from 2014 to 2024 are illustrated in Figure 2. An analysis based on the Scopus database shows that in 2014, the number of articles published was 19. In 2015, the number of published articles decreased to 8. In 2017, the number of articles published increased

to 24. In 2018, the number of published articles surged significantly to 42. In 2019, the number of published articles decreased again to 29. In 2020, there was a slight increase in the number of articles published, reaching 32. Another slight increase occurred in 2021, with 39 articles published. In 2022, the number of publications rose further, with 47 articles published. In 2023, the number of articles grew substantially, reaching 60. By 2024, the number of published articles increased to 67. Thus, there has been a significant increase in publications between 2014 and 2023, indicating a growing interest in research on A Bibliometric Analysis of Trends in Real-Time Coach Feedback Technologies in Sports.

Table 1 lists the top 10 authors with the most influential articles in research on feedback in sports. The first position is held by the article published by Neumann, D. L., et al., with a total of 206 citations. The second position is occupied by the article published by Grooms, D., et al., with 163 citations. The third and fourth positions are held by Cheron, G., et al., and Kleynen, M., et al., with 133 and 128 citations, respectively. Meanwhile, articles by Keegan, R. J., et al., Weston, M., Raiola, G., Otte, F. W., et al., Faure, C., et al., and Thornton, H. R., et al., have a total of fewer than 100 citations each, in descending order. **Table 1** summarizes the most influential articles and their respective citation counts in the field of coach feedback in sports, providing insights into impactful research contributions by various authors.

Table 1. The top 10 articles with the most citations in Scopus.

Document Title	Authors and Year	Citations Total
A systematic review of the application of interactive virtual reality to sport	(Neumann et al., 2018)	206
Neuroplasticity following anterior cruciate ligament injury: A framework for visual-motor training approaches in rehabilitation	(Grooms et al., 2015)	163
Brain oscillations in sport: Toward EEG biomarkers of performance	(Cheron et al., 2016)	133
Using a Delphi technique to seek consensus regarding definitions, descriptions and classification of terms related to implicit and explicit forms of motor learning	(Kleynen et al., 2014)	128
A qualitative investigation of the motivational climate in elite sport	(Keegan et al., 2014)	99
Training load monitoring in elite English soccer: a comparison of practices and perceptions between coaches and practitioners	(Weston, 2018)	87
Motor control and learning skills according to cognitive and ecological dynamic approach in a vision on behaviorism, cognitive, Gestalt and phenomenology theories	(Raiola, 2014)	83
When and How to Provide Feedback and Instructions to Athletes?—How Sport Psychology and Pedagogy Insights Can Improve Coaching Interventions to Enhance Self-Regulation in Training	(F W Otte et al., 2020)	68
Virtual reality to assess and train team ball sports performance: A scoping review	(Faure et al., 2020)	64
Developing athlete monitoring systems in team sports: Data analysis and visualization	(Thornton et al., 2019)	63

**Figure 3.** Productive Authors based on Documents and Citation**Table 2.** Authors, documents and citations

Author	Doc	Cite
Cote, Jean	4	45
Kos, Anton	4	49
Umek, Anton	4	35
Winkelman, Nick	3	43
Turnnidge, jennifer	3	35
James, Nic	3	35
Schaffert, Nina	3	16
Wells, Julia	3	35
Hoigaard, Rune	3	18
Davids, Keith	3	12

Figure 3 and **Table 2** illustrate that among the 10 most productive authors in the field of coach feedback in sports, several researchers have made significant contributions through their publications. Table 2 shows that Cote, J., Kos, A., and Umek, A. have contributed valuable insights with four articles on coach feedback in sports. They are followed by Winkelman, N., Turnnidge, J., James, N., Schaffert, N., Hoigaard, R., and Davids, K., who have made important contributions with three articles each, highlighting key aspects of research on coach feedback in sports. However, in terms of highest citation counts, one researcher stands out, showcasing a high level of productivity with seven articles. These researchers reflect their commitment to innovation and advancing knowledge in the field of coach feedback in sports.

Table 3. Country, documents and citations

Author	Doc	Cite
UK	71	1024
USA	58	595
Australia	49	862
Canada	32	332
Spain	31	266

China	31	188
Germany	22	324
Netherlands	16	285
Portugal	14	79
Italy	12	265



Figure 4. Most productive countries based on documents and citations

Table 3 lists the top 10 countries based on document production in the field, with the United Kingdom leading with 71 documents, followed by the United States with 58 documents. Australia, Canada, and Spain contribute 49, 32, and 31 documents, respectively. Table 3 also reveals the top 10 countries based on citation counts, where the United Kingdom ranks first with 1,024 citations, followed by Australia surpassing the United States with 862 citations, while the United States has only 595 citations. Additionally, Germany and the Netherlands, with only 22 and 16 documents, respectively, outpaced Spain and China in citation counts, with 324 and 285 citations. Figure 4 illustrates the collaboration network distribution, highlighting the United Kingdom as the most central country, followed by the United States, Australia, and Canada. These countries demonstrate strong academic collaboration and significant presence in the field, reflecting the impact of coach feedback on the success of athletes in the world of sports.



Figure 5. Network Visualization of Coach Feedback in Sports

Table 4. Clusters and Keywords based on VOS-Viewer.

Rank	Item	Cr	Pt	Total
1	Coach education, feedback system, leadership, motivation, motor learning, motor performance, negative feedback, pedagogy, perception, physical conditioning, physical education, positive feedback, psychology, self concept, social support, sports psychology	Red	23,9%	16
2	Attitude to health, basketball, coach, coaching, communication, development, education, health knowledge, learning, middle aged, reflection, team sport, tennis, visualization, volleyball, young adult	Green	23,9%	16
3	Accident prevention, exercise, exercise therapy, injury, kinesiotherapy, knowledge, physical activity, physician, resistance training, sport injury, sports medicine, warm up	Blue	20,8%	14
4	Athlete, athletic performance, biomechanics, decision making, fatigue, inertial measurements, kinematics, machine learning, mhealth, motion analysis, physiology, sports, swimming	Yellow	19,4%	13
5	Child, coaches, emotion, expectation, football, skill, soccer, youth sport.	Purple	12%	8

In the framework of this investigation, co-keyword analysis was employed to discern trends in research topics and delineate the boundaries of the field (Ullah et al., 2023). This methodological approach was executed by visualizing keyword networks using the analytical features provided by VOSViewer, where the fractional counting method was implemented to establish a minimum threshold for the occurrence of specific keywords. The analysis was based on author-designated keywords, serving as the primary units of analysis. The resulting thematic clusters have been categorized and illustrated in **Table 4**, and visualized in **Figure 5** through comprehensive cluster analysis.

Figure 5 presents a knowledge map that depicts trends in keyword analysis related to coach feedback in the domain of sports. This bibliometric analytical method facilitates the identification of critical themes and emerging trends in the literature, while simultaneously offering a structured understanding of interrelated ideas, paving the way for future research efforts. By mapping these keyword clusters, this investigation significantly contributes to the advancement and expansion of the scholarly literature related to coach feedback technologies targeted at athletes in the sports domain.

This topic warrants further exploration, considering the impact of coach feedback on athlete achievement. This is evidenced by recurring keyword clusters and their respective relational percentages, exemplified by Cluster 1, which includes terms such as: "Coach education, feedback system, leadership, motivation, motor learning, motor performance, negative feedback, pedagogy, perception, physical conditioning, physical education, positive feedback, psychology, self-concept, social support, sports psychology." These keywords reflect a significant review of coach feedback in the sports field.

The findings presented here not only provide an overview of contemporary research but also establish a foundation for future investigations. The aim of this research is to elucidate aspects of coach feedback technologies targeted at athletes in sports. However, several limitations must be acknowledged.

First, the investigation relies on English-language publications indexed in Scopus, which may introduce language bias and overlook related studies published in other languages. Second, reliance on Scopus as a database introduces potential publication bias, as it does not encompass all relevant literature, particularly from unindexed sources or more specialized research domains.

Third, the analysis is limited to data available up to 2024, potentially excluding recent developments beyond this period. Fourth, although the keyword selection process was conducted meticulously, some relevant articles may have been inadvertently missed, impacting the breadth of this study. Lastly, while bibliometric approaches provide quantitative insights, they may fall short in capturing qualitative nuances or complex contexts articulated by individual studies.

These limitations underscore the need for ongoing research to address these shortcomings and provide a more comprehensive understanding of the implications of coach feedback in the sports world.

CONCLUSION

Coach feedback is a key element in the development of skills, motivation, and athlete performance, with a combination of positive and corrective feedback proving to be more effective than using only one approach. Positive feedback enhances self-confidence and intrinsic motivation, while corrective feedback helps athletes address specific weaknesses. The effectiveness of feedback is also highly influenced by relevance, context, and the interpersonal relationship between the coach and athlete, with a supportive atmosphere and a non-authoritarian communication style proven to enhance feedback acceptance. Bibliometric analysis in this study reveals significant global trends, with countries such as the United Kingdom, the United States, and Australia dominating publications, and the identification of main themes such as coach education and the impact of feedback on athlete performance. While providing broad insights, this study has limitations, such as language bias and a quantitative focus, thus further research is needed that includes qualitative and cross-cultural perspectives to expand understanding of the role of coach feedback in sports.

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