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Identification and Development of Expertise in Golf: A Scoping Review

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ADMINISTRATIVE INFORMATION

Support - NA.

Review Stage at time of this submission - The review has not yet started.

Conflicts of interest - None declared.

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Amendments - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 20 October 2025 and was last updated on 20 October 2025.

INTRODUCTION

Review question / Objective The aim of this review is to identify and synthesize the most relevant literature on the identification and development of expertise in golf athletes.The aim of this review is to identify and synthesize the most relevant literature on the identification and development of expertise in golf athletes.The aim of this review is to identify and synthesize the most relevant literature on the identification and development of expertise in golf athletes.The aim of this review was to identify and synthesize the most relevant literature on the identification and development of expertise in golf athletes.

Background Golf is an individual sport played regularly by around 55 million people worldwide (Farrally et al., 2003) and is regarded as one of the most complex sports, requiring high technical precision (Ferdinands & Kwon, 2012). It combines long periods of low-intensity activity with short bursts of high-intensity effort. Technical skill is critical, involving precise control of multiple joint movements (Wardell, 2019). Performance largely depends on the clubhead's speed and position at impact, making movement accuracy vital (Sinclair et al., 2014; Sprigings & Neal, 2000). A unique aspect of golf is the player's freedom to adopt a stable posture before hitting a stationary ball, creating a controlled setting for research. Shot success is measured by the final position of the ball relative to the target, offering clear indicators of accuracy. These characteristics make golf ideal for studying motor learning in real-life contexts (Barzyk & Gruber, 2024). Skill acquisition in golf involves multiple factors, and the journey from novice to expert is shaped by practice (Ericsson, 2006). Time invested in training, individual traits, and motor effort, all influence the pace of learning (Hambrick et al., 2014). Golf is particularly laborious to learn, often involving errors and frustration. Therefore, guidance from coaches is essential, combining verbal instructions and visual demonstrations to refine technique (Bieńkiewicz et al., 2019). Practice intervals and individual

variability affect performance (Schantz & Conroy, 2009).

The golf swing is a technical, dynamic, and asymmetric movement that uses body rotation to generate power and control, balancing distance and precision (Steele et al., 2018; Zhou et al., 2022). Due to its complexity, mastering the swing is difficult, and poor technique can reduce performance and increase injury risk. Professionals stand out due to the efficiency and smoothness of their movements, where body-generated rotational speed is accurately transferred to the club (Zhou et al., 2022). Power generation in the swing relates to biomechanical factors assessed in professional swings. Biomechanical variables differ markedly between professional and amateur athletes (Meister et al., 2011; Steele et al., 2018), providing benchmarks for development. Coordination, especially following the proximal-to-distal sequence, is crucial, with professionals showing better synchronization and coordination (Cheetham et al., 2000). Self-regulation and emotional control also play roles in golf. While many studies have analyzed putting or pre-competition emotions (Chamberlain & Hale, 2007; Wood & Wilson, 2012), few have explored emotional states before each shot. Schantz and Conroy (2009) linked emotional states and motivation to performance across a round, suggesting that emotion, cognition, and behavior interact during skill development. To effectively identify and nurture golf talent, it's essential to understand which skills align with the game's specific demands. The ecological dynamics approach of sport performance offers insight into how athletes interact with their environment (Araújo et al., 2006; Araújo & Davids, 2018). This perspective integrates biomechanics, physiology, and social interactions, proposing that expertise arises from the dynamic interplay between athlete, task, and environment. Despite growing research, how these different variables interact for identifying and developing golf talent remain uncertain. This study aims to review and organize the existing literature, highlighting key topics, methodologies, and trends in this area.Golf is an individual sport played regularly by around 55 million people worldwide (Farrally et al., 2003) and is regarded as one of the most complex sports, requiring high technical precision (Ferdinands & Kwon, 2012). It combines long periods of low-intensity activity with short bursts of high-intensity effort. Technical skill is critical, involving precise control of multiple joint movements (Wardell, 2019). Performance largely depends on the clubhead's speed and position at impact, making movement accuracy vital (Sinclair et al., 2014; Sprigings & Neal, 2000).

Rationale Despite the growing body of research on golf performance and skill development, the existing literature remains fragmented across various disciplines, including biomechanics, motor learning, psychology, and sports coaching. Many studies focus on isolated aspects of the game—such as swing mechanics, putting accuracy, or emotional control—without explaining how these dimensions integrate for golf expert performance. Moreover, while golf has proven to be an excellent model for studying motor learning due to its repetitive structure and measurable outcomes, few studies have comprehensively analyzed how different domains (e.g., cognitive, physical, emotional) interact to shape performance over time. This gap is especially relevant in light of modern theories such as ecological dynamics, which emphasize the importance of the interaction between athlete, task, and environment. Without a clear synthesis of the research, it remains difficult to determine how their interaction may occur and how such fragmented knowledge could be applied to talent identification and development in golf. There is a need to map not only what has been studied, but how research on golf athletes has evolved, which populations have been prioritized (e.g., elite vs. amateur), and how evidence guides intervention. Given this context, a scoping review that identifies, organizes, and synthesizes the most relevant scientific findings on golf performance and athlete development is both timely and necessary. Such a review will inform how research has addressed the three categories of constraints and highlight gaps. It can also align theory with evidence and inform practice. Finally, this review aims also to critically assess how research in golf has been conducted and how it can better support the daily challenges faced by athletes and their support teams, and inform future investigations for understanding the development of expertise in golf.Despite the growing body of research on golf performance and skill development, the existing literature remains fragmented across various disciplines, including biomechanics, motor learning, psychology, and sports coaching. Many studies focus on isolated aspects of the game—such as swing mechanics, putting accuracy, or emotional control—without integrating these dimensions into a unified understanding of golf expertise. As a result, researchers and practitioners may struggle to draw actionable conclusions about how golfers progress from novice to expert, or which training strategies are most effective in supporting long-term development.

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studies have comprehensively analyzed how different domains (e.g., cognitive, physical, emotional) interact to shape performance over time. This gap is especially relevant in light of modern theories such as ecological dynamics, which emphasize the importance of the interaction between the athlete, task, and environment. Without a clear synthesis of the research, it remains difficult to determine how such theories have been applied—or could be applied—to improve training approaches and talent identification in golf.

Another important issue is the methodological inconsistency across studies. Variability in research design, assessment tools, sample characteristics, and performance indicators makes it challenging to compare findings or establish generalizable conclusions. Some studies use lab-based measures (e.g., motion capture, putting simulators), while others analyze field performance under competition-like conditions. Although both approaches have value, the lack of integration across methodologies further contributes to the fragmentation of knowledge in this field.

In addition, the increased interest in optimizing athlete development—fueled by advances in technology and performance analytics—calls for a clearer understanding of how to identify and nurture golf talent effectively. There is a need to map not only what has been studied, but how research on golf athletes has evolved, which populations have been prioritized (e.g., elite vs. amateur), and what practical tools or strategies have emerged from.

METHODS

Strategy of data synthesis Data synthesis will be performed using a narrative and descriptive framework. Owing to the expected heterogeneity in study designs, the results will be systematically organized and presented in a structured summary table to facilitate cross-study comparison. The search for relevant publications will be performed up to October, 2025 with no restrictions on starting date, using the keyword "golf" combined with terms such as "talent*", "expert*", "elite", "elite athlete", "identification", "career transition," or "career progression". The following electronic databases will be searched: PubMed, Web of Science, Scopus, SPORTDiscus, and PsycINFO. The publications will be reviewed in Rayyan to identify those that met the inclusion criteria. Full versions of the selected articles will be obtained and analyzed to confirm compliance with the inclusion criteria.Data synthesis will be performed using a narrative and descriptive framework. Owing to the expected heterogeneity in study designs, the results will be systematically organized and presented in a structured summary table to facilitate cross-study comparison. The search for relevant publications will be performed up to October, 2025 with no restrictions on starting date, using the keyword "golf" combined with terms such as "talent*", "expert*", "elite", "elite athlete", "identification", "career transition," or "career progression". The following electronic databases will be searched: PubMed, Web of Science, Scopus, SPORTDiscus, and PsycINFO. The publications will be reviewed in Rayyan to identify those that met the inclusion criteria. Full versions of the selected articles will be obtained and analyzed to confirm compliance with the inclusion criteria. The search for relevant publications was performed up to April, 2025 with no restrictions on starting date , using the following equation will be Despite the growing body of research on golf performance and skill development, the existing literature remains fragmented across various disciplines, including biomechanics, motor learning, psychology, and sports coaching. Many studies focus on isolated aspects of the game—such as swing mechanics, putting accuracy, or emotional control—without explaining how these dimensions integrate for golf expert performance. Moreover, while golf has proven to be an excellent model for studying motor learning due to its repetitive structure and measurable outcomes, few studies have comprehensively analyzed how different domains (e.g., cognitive, physical, emotional) interact to shape performance over time. This gap is especially relevant in light of modern theories such as ecological dynamics, which emphasize the importance of the interaction between athletes, task, and environment. Without a clear synthesis of the research, it remains difficult to determine how their interaction may occur and how such fragmented knowledge could be applied to talent identification and development in golf. There is a need to map not only what has been studied, but how research on golf athletes has evolved, which populations have been prioritized (e.g., elite vs. amateur), and how evidence guides intervention. Given this context, a scoping review that identifies, organizes, and synthesizes the most relevant scientific findings on golf performance and athlete development is both timely and necessary. Such a review will inform how research has addressed the three categories of constraints and highlight gaps. It can also align theory with evidence and inform practice. Finally, this review aims also to critically assess how research in golf has been conducted and how it can better support the daily challenges faced by athletes and their support teams, and inform future investigations for understanding the

development of expertise in golf.Despite the growing body of research on golf performance and skill development, the existing literature remains fragmented across various disciplines, including biomechanics, motor learning, psychology, and sports coaching. Many studies focus on isolated aspects of the game—such as swing mechanics, putting accuracy, or emotional control—without integrating these dimensions into a unified understanding of golf expertise. As a result, researchers and practitioners may struggle to draw actionable conclusions about how golfers progress from novice to expert, or which training strategies are most effective in supporting long-term development.

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s used: golf AND

(talent OR "talent development" OR "talent identification" OR expert OR elite OR "elite athlete") AND

("career transition" OR "career development" OR "career progression" OR "athlete development" OR "skill acquisition" OR performance).

The publications will be reviewed in Rayyan to identify those that met the inclusion criteria. Full versions of the selected articles were obtained and analyzed to confirm compliance with the inclusion criteria.

Eligibility criteria Types of participants

This review will include studies involving golf athletes of all performance levels, including novices, amateurs, and professionals, across all age groups and genders. Studies focusing primarily on coaches, parents, or support staff will be excluded unless the data explicitly address variables that influence golfers' performance or expertise development.

Concept

The central concept of this review concerns the identification and development of expertise in golf, analyzed through the lens of the constraints-led approach within ecological dynamics.

Accordingly, studies will be included if they examine how organismic (individual), environmental, or task constraints interact to shape performance, skill acquisition, or the emergence of expertise in golf.

This includes research addressing:

• The interaction between practice structure, perceptual-motor coordination, and performance outcomes;

• The influence of physiological, psychological, or biomechanical factors on the development of golf expertise;

• The processes of talent identification and athlete development as they relate to these interacting constraints.

Studies must explicitly link findings to golf performance or expertise development rather than focusing on isolated aspects of the game.

Context

Eligible studies may be conducted in laboratory, field, or applied performance environments, including training centers, academies, or competitive settings. There will be no geographical or cultural restrictions.

Both quantitative and qualitative empirical studies will be included. Only peer-reviewed publications written in English will be considered.

Grey literature (e.g., theses, dissertations, or conference abstracts) may be consulted to identify emerging evidence or fill gaps in peer-reviewed publications but will not be included in the main synthesis unless they meet the empirical criteria and methodological standards defined for inclusion.

Exclusion criteria

Studies will be excluded if they:
1. Focus on athletes from other sports;
2. Do not provide relevant or empirical data related to talent identification, skill acquisition, or expertise development in golf;
3. Are purely theoretical or conceptual without presenting empirical evidence.

Source of evidence screening and selection The search will be conducted in PubMed/MEDLINE, Scopus, and Web of Science, chosen for their broad coverage of research in sport science, biomechanics, and motor learning. In addition, the reference lists of all included studies and relevant reviews will be screened to identify further eligible records not captured by database searches.
Grey literature (e.g., theses, dissertations, or conference proceedings) will be consulted through Google Scholar to minimize publication bias, but only empirical studies meeting the predefined inclusion criteria will be retained in the synthesis.
Search strategies will combine controlled vocabulary and free-text terms related to golf, talent identification, skill acquisition, and expertise development, adjusted for each database. The search will include studies published up to October 2025, with no restriction on the start date.
All other stages of the selection process will follow the procedures already described above.

Data management All references retrieved from the database searches will be exported to Rayyan to facilitate the organization and removal of duplicates. During the selection process, metadata (e.g., title, authors, year, journal) of all studies will be stored and tracked within the review management system. Each screening stage—title/abstract and full-text review—will be conducted by two independent reviewers, and decisions will be recorded within the platform to maintain an audit trail.
A structured data extraction form will be developed and piloted on a small number of included studies to ensure consistency and reliability. The form will include key variables relevant to the review question, such as study characteristics (e.g., year, country, study design), participant details, focus area (e.g., biomechanics, psychology), outcomes related to golf performance or development, and main findings.
All extracted data will be stored in a secure, shared spreadsheet accessible only to the review team. Regular backups will be maintained to prevent data loss. Any changes made to the data extraction sheet during the review will be documented to ensure transparency and traceability.

Finally, the data will be synthesized descriptively, using tables, charts, and thematic groupings as appropriate, and any emerging patterns will be discussed in the results of the scoping review.

Reporting results / Analysis of the evidence Data analysis will be conducted in a descriptive and narrative manner. Results will be organized into main thematic categories identified in the literature, such as biomechanics, motor learning, psychological aspects, and talent identification. A basic quantitative synthesis of study characteristics (year, country, study type) and qualitative content analysis will be performed to map patterns, gaps, and trends. Tables, frequency charts, and conceptual maps will be used to illustrate relationships and highlight areas of greater or lesser scientific production.Data analysis will be conducted in a descriptive and narrative manner. Results will be organized into main thematic categories identified in the literature, such as biomechanics, motor learning, psychological aspects, and talent identification. A basic quantitative synthesis of study characteristics (year, country, study type) and qualitative content analysis will be performed to map patterns, gaps, and trends. Tables, frequency charts, and conceptual maps will be used to illustrate relationships and highlight areas of greater or lesser scientific production.

Presentation of the results Results will be presented according to PRISMA-ScR recommendations: 1. PRISMA flow diagram of study selection. 2. Descriptive table with author/year/country/design/participants/focus of each study. 3. Conceptual map of central themes. 4. Summary tables of main findings organized by domain (technical, physical, psychological, contextual). 5. Temporal graph of theme evolution. 6. Table of gaps found and suggestions for future research. All data will be accompanied by analytical narrative contextualizing with the most recent findings.Results will be presented according to PRISMA-ScR recommendations: 1. PRISMA flow diagram of study selection. 2. Descriptive table with author/year/country/design/participants/focus of each study. 3. Conceptual map of central themes. 4. Summary tables of main findings organized by domain (technical, physical, psychological, contextual). 5. Temporal graph of theme evolution. 6. Table of gaps found and suggestions for future research. All data will be accompanied by analytical narrative contextualizing with the most recent findings.

Language restriction English.

Country(ies) involved Portugal.

Keywords deliberate practice, golf, development, specialization, diversified activity.

Contributions of each author

Author 1 - Nelson Ribeiro - Conceptualization, methodology, investigation, data curation, writing of original manuscript, project administration. Conceptualization, methodology, investigation, data curation, writing of original manuscript, project administration.Conceituação, metodologia, investigação, curadoria de dados, redação do manuscrito original, administração do projeto.
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