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Key factors promoting professional development in golf: a mixed-studies systematic review

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ABSTRACT

Globally, millions participate in golf, however, the likelihood of transitioning to a professional level is only 0.006%. Success as a professional golfer is uncertain, even for individuals who attain this status. This systematic review aimed to synthesize the most significant research findings identifying factors that promote professional development in golf, thereby aiding aspiring golfers in their journey toward becoming professional athletes. Following a segregated design, quantitative and qualitative research findings were analysed using meta- and thematic analyses. Electronic searches were conducted in Scopus, Google Scholar, SPORTDiscus™, Web of Science™, and EbscoHost™. Search terms included golf, athlete development, professional golfer, and golfer transition. The eligibility criteria included studies written in English from 2007 to present. The electronic search yielded 7216 records, and after evaluation, the review included 24 qualitative and 33 quantitative studies. The study identified seven main topics related to the professional development of golfers, namely the expertise of the caddie, the quality of coaching, the developmental environment of golfers, availability of funds, competition-specific training, strong psychological skillset, and physical conditioning. The review highlights the need for all stakeholders in a professional golfer's environment to adopt a holistic approach to enhance golfers' professional development and maximize their performance potential.

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Introduction

Golf is played globally by more than 66 million people (Royal & Ancient Golf Club, 2023) and is the 11th most popular sport in the world, played on ~34,011 golf courses worldwide (Smolianov et al., 2021). Alcaraz et al. (2019) noted that golf is among the most frequent sports played on amateur and recreational levels. The top tours that professional golfers compete on are the Dubai Ports (DP) World Tour (previously European tour) and the Professional Golfers Association of America (PGA) Tour (Botha et al., 2021). The level of golf, appearance fees, and golfers' prize money has increased significantly in recent years (Roos & Muller, 2023). In 2021, LIV Golf emerged as an additional league, and the amount of prize money for professional golfers increased even more. Golfers were offered lucrative signing deals to join the LIV Golf league, and the prize money for a winner of one of the events was $4 million. In addition, golfers earn more, pay less, and have a guaranteed income at each event (Nite et al., 2024). Lucrative names in the game of golf, such as Phil Mickelson, have signed to LIV Golf, receiving $200 million to join (Cannizzaro, 2022). As a result, professional golf has developed so that the sports endorsement deals golfers can acquire are some of the wealthiest in the world (Botha et al., 2021). To get a competitive advantage over their peers, golfers employ experts in various areas, such as swing coaches, putting

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coaches, sports psychologists, caddies, sports medicine personnel, equipment representatives, agents, nutritionists, and physical conditioning specialists (Gordin, 2016).

According to Portenga (2019), golf is challenging and requires significant precision. The clubhead speed of golfers performing a full swing can reach over 160 km/h (Portenga, 2019). Also, professional golf requires golfers to perform a specific swing and shot while dealing with intrinsic thoughts and environmental constraints. Similarly, Bertram et al. (2017) state that golf is a demanding sport as golfers must consistently perform a specific skill with mental, physical, and emotional challenges. For golfers to succeed, technical, physical, tactical, mental, and life-skill capabilities are required (Smith, 2010). During tournament play, golfers may experience intense pressure when facing a final putt that could win them a considerable sum of prize money (Hickman & Metz, 2015). Therefore, golfers must achieve an appropriate physiological and psychological state for the complex technical skill required for a specific shot (Robertson et al., 2014). Aparicio et al. (2021) state that certain golfers play on a professional tour and never win. As such, only a few can compete at a high level, develop into a professional golfer, and maintain this status for an extended period (Montague & Milne, 2014; Roos et al., 2022; Ryan, 2017; Williams & MacNamara, 2020).

Consequently, the career pathway of professional golfers remains a popular topic among researchers (Den Hartigh et al., 2018). Research from Club and Tee (2020) indicated that a golfer's probability of developing into a professional golfer and competing on one of the leading professional tours is only 0.006% (1 in 16,486). Montague and Milne (2014) alluded to the realities and challenges that golfers face in the journey to reach a professional level, emphasizing that professional development requires vast commitment and time. Even then, an elite golfer competing on a professional tour is not guaranteed to succeed. For this reason, the development of a model to assist elite athletes in this developmental process is essential (Woods et al., 2021).

Various sports development models have been developed to depict the optimal transition pathways athletes need to follow to succeed. However, several developmental frameworks have a generic approach focusing on sports in general. Also, these frameworks and models fail to take a holistic approach and focus on practice, psychology, and athletes in isolation (Abbott & Collins, 2004; Balyi et al., 2016; Bloom & Sosniak, 1985; Côté & Vierimaa, 2014; Ericsson et al., 1993; Gagné, 2010; Gulbin et al., 2013; Henriksen et al., 2010; Starkes et al., 2004). As mentioned, the transitioning process for golfers from amateur to professional status remains an unanswered question (Roos, 2018). The possibility may be for golfers to employ a holistic approach to their development, such as the Athletic Development Environment (ATDE) model and the Environmental Success Factors (ESF) Model identified by Henriksen et al. (2010). However, these models focus on athlete development, not on a golfer's development. Furthermore, Bronfenbrenner (1977, p. 513) regards the ecological approach to human development as essential and defines it as:

> *"The ecology of human development is the scientific study of the progressive, mutual accommodation, throughout the lifespan, between a growing human organism and the changing immediate environments in which it lives, as this process is affected by relations obtaining within and between these immediate settings, as well as the larger social contexts, both formal and informal, in which the settings are embedded"* (Bronfenbrenner, 1977, p. 513).

Again, the ecological approach proposed by Bronfenbrenner (1986) also fails to focus on golfers specifically but on human development as a whole. In this regard, the ecological approach by Bronfenbrenner (1986) and Henriksen et al. (2010) formed an essential foundation for this study. This approach refers to the individual not being isolated in their environment (Human, 2015). According to Larsen et al. (2012), the environment of athletes significantly affects athlete development (Larsen et al., 2012; Visser, 2007; Witt, 2011). Human (2015) agrees, conceding that the various role-players in the environment of athletes, such as coaches and parents, form a unit and are essential for athletic development. In addition, golfers use psychologists, fitness trainers, and agents (Roos, 2018) and therefore, they all significantly influence golfers' performance (Gordin, 2016).

Hayman et al. (2014) embarked on a study to delineate the factors contributing to the transition of pre-elite adolescent golfers to elite status. Their objective was to discern the most predictive theoretical framework for success in golf, explicitly comparing the efficacy of the Deliberate Practice Theory (DPT) and The Developmental Model of Sports Participation (DMSP). The DPT suggests that athletes must engage in specialized deliberate practice early to reach elite status in sports (Ericsson et al., 1993).

The DMSP, on the other hand, recommends long-term development that is done playfully at a young age and acquire expert skills at a later stage (Côté & Fraser-Thomas, 2007). As such, the environment that golfers find themselves in must be non-competitive, including golf, but also integrate several other sporting codes (Hayman et al., 2011; Roos et al., 2022). Based on their observations, Hayman et al. (2014) found that the DMSP offers a more accurate portrayal of golfers' transition from pre-elite to elite status. However, the study highlighted several critical themes in this transition, including the shift from diversified to focused training, the importance of family support, creating an appropriate environment, and developing psychological skills.

Similarly, Roos et al. (2022) embarked on developing a framework for professional golfers in South Africa, employing an interpretative approach utilizing semi-structured interviews with various stakeholders, including former or current Sunshine Tour golfers ($N=2$), members of the Professional Golfers' Association of South Africa (PGA of SA) ($N=1$), PGA of SA teaching professionals ($N=8$), and golf administrators ($N=1$). The outcomes of this investigation revealed that psychology, social support, lifestyle, specialization, finance, branding, and coaching emerged as pivotal factors influencing the transitional trajectory of a junior golfer towards achieving professional status. However, the study had certain limitations, such as a one-sided qualitative approach, a homogenous representation of pro golfers, and a lack of consideration for the multifaceted factors involved in sustaining a professional level of play.

While numerous golf academies cater for promising amateur golfers, uncertainties persist regarding their ability to navigate this transition successfully (Roos, 2018). Small adjustments may be needed for golfers to achieve optimal performance levels, yet the literature lacks a comprehensive framework for professional development based on the experiences of current professional golfers (Bliss, 2021).

To address this gap, the study will investigate current trends in golf development to identify and analyse the factors essential for golfers' professional growth. The findings will offer valuable insights for aspiring professional golfers seeking to establish themselves on tour and amateur golfers aiming to elevate their game. Educational institutions like the PGA can leverage these findings to support teaching professionals in enhancing their coaching programs for optimal client results.

Methods

Research design

This study used a segregated design to analyse quantitative and qualitative research findings. According to Sandelowski et al. (2006), a segregated design requires a clear distinction between quantitative and qualitative studies. For a holistic understanding that covers the breadth and depth of the essential factors promoting professional development in golf, quantitative and qualitative research findings in this systematic review are required. Meta-analysis was used exclusively for the syntheses of quantitative studies, while thematic analyses were utilized for qualitative studies (Sandelowski et al., 2006). Employing a segregated design is most appropriate when qualitative and quantitative studies in the same domain attempt to complement each other and answer the same research question (Sandelowski et al., 2006).

Search strategy: databases, inclusion, and exclusion criteria

The systematic review complied with the principles outlined in the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) 2020 statement (The Joanna Briggs Institute, 2014). The initial systematic database searches (Figure 1) resulted in 6436 studies from databases, and 817 studies were identified from other sources (experienced authors in professional development and subject-related journals). The search used Google Scholar, EBSCOhost, ScienceDirect, SPORTDiscus, Scopus, and Web of Science. The following keywords were used, 'golfer development' OR 'golf performance', 'golfer' AND 'golfer' AND 'development'. The data was then exported to Endnote X20, a reference management software program. Duplicates ($n=37$) were removed, whereafter, the remaining 7216 studies were screened based on their title and abstracts. The full text of the remaining 80 studies was further evaluated, with 23 studies being excluded because they did not meet the inclusion criteria.

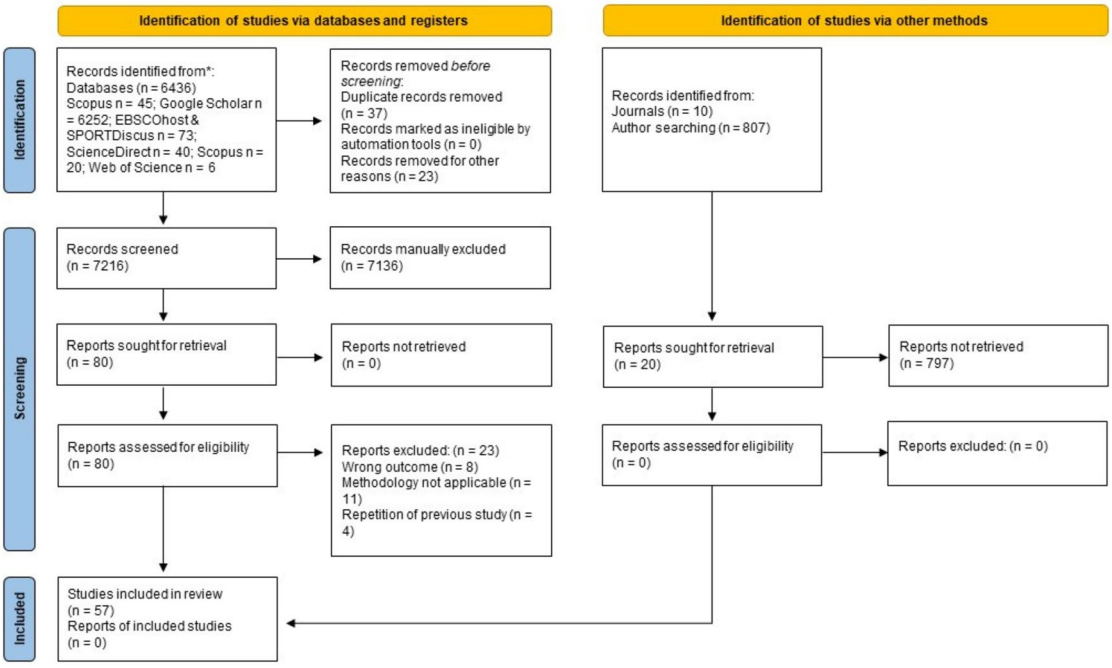

Figure 1. Reporting items for a systematic review and meta-analyses (PRISMA) flow diagram (Page et al., 2021).

Studies incorporated in the systematic review were screened using the PICO framework (population, intervention, comparison, and outcomes). Furthermore, the publications were included according to the following criteria: (1) contained relevant data regarding golfer, performance, development, and transition strategies; (2) publications on the social interactions that golfers experience in their natural environment; and (3) written in English from 2007 to present. The year 2007 emerged as a pivotal time marked by notable achievements from esteemed golfers, including Tiger Woods. Moreover, it witnessed the inauguration of the prestigious FedEx Cup, heralding a new era of competitive vigour within professional golf. Studies were excluded if (1) they included other sports; (2) if they did not contain relevant data that may assist in the professional development of golfers; (3) academic papers older than 2007; (4) if the articles were written in a language other than English or (5) if the studies were from books, theses and dissertations, literature reviews and systematic reviews.

Two fellow researchers (ME and DM) not directly involved in this study independently screened titles and abstracts from the systematic review. Once the citations were identified, the researchers provided the independent researcher with the full-text article to determine if it should be included in the study. The overview of the screening process is indicated in Figure 1 below:

Quality check of the studies included and extraction of data

The methodological quality of the quantitative studies was assessed by applying the 16-item criteria as proposed by Law et al. (1998) and utilised in Faber et al. (2016). The 16-item criteria were used to determine whether the research included a clearly stated objective (item 1), relevant literature reviewed (item 2), an appropriate study design (item 3), adequate and appropriate sample (items 4 and 5), informed consent secured from participants (item 6), reliable and valid outcome measures (items 7 and 8), precise details of the intervention procedure (item 9), statistical significance of results (item 10), suitable analysis (item 11), indication of clinical importance (item 12); acknowledgement of drop-outs (item 13), appropriate conclusion (item 14), mentioning of implications (item 15), and identification of limitations (item 16).

The methodological quality of the qualitative publications was assessed by making use of the 21-item Critical Review Form put forward by Letts et al. (2007). The included papers were evaluated to determine whether they contain a clearly stated objective (item 1), provide a review of relevant literature (item 2), consist of an appropriate study design (items 3, 4, and 5), an appropriate sample (items 6, 7, 8, and 9), and descriptive clarity of the data collection (items 10, 11, and 12). In addition, the procedural rigour of

data collection (item 13), the analytical rigour of data analysis (items 14 and 15), the suitability of data analysis (items 16 and 17), theoretical connections of data analysis (item 18), overall rigour (item 19), and the conclusion and implications of the study (items 20 and 21) assisted in the methodological quality assessment.

The scoring for each identified item was determined using the method described by Te Wierike et al. (2013), involving assigning marks of 1 (meets the criteria), 0 (does not fully meet the criteria), or NA (not applicable). Total scores for each publication were computed following the guidelines outlined by Faber et al. (2016), as depicted in Table 1. Consequently, a percentage score was calculated by adding the scores of all the relevant items and dividing them by the number of relevant items evaluated. The publications were then classified as low methodological quality with a score of below 50%; a score of between 51 and 75% was regarded as a good methodological quality, and higher than 75% an excellent methodological quality. All the studies included in the analysis received a rating of at least 50%, with 16 studies scoring between 51 and 75% (indicating good methodological quality) and 41 studies achieving a rating higher than 75% (reflecting excellent methodological quality). The screening process concluded with 57 (qualitative = 24 and quantitative = 33) publications for review. Notable findings from this quality check reveal that the mean score for quantitative studies was 84%, while qualitative studies averaged 74.9%. Additionally, four qualitative and three quantitative studies achieved the highest possible score of 100%. The outcome of the quality check is indicated in Tables 1 and 2 below:

Results

Overview of the quantitative studies

Table 3 summarises the 33 quantitative studies included in this review. Most of the studies were undertaken in the United States of America (USA) ($n = 14$), Europe ($n = 12$), and Asia ($n = 4$), with men as the most common participants (61%). Studies that included both genders ($n = 10$) were also biased toward male participants (898 male and 579 female); three studies included only female participants ($n = 331$). Most of the studies focused solely on amateur golfers ($n = 16$), while other studies included university-level golfers ($n = 8$), PGA professionals ($n = 5$), and coaches ($n = 3$). Parents and caddies were the participants in three studies. All the studies were descriptive and, for the most part, cross-sectional (79%). Certain studies (27%) administered a questionnaire, while others (64%) used a data set, physiological assessments, or skill tests. Most of the questionnaires focused on psychological and social support, strength and conditioning, and tournament preparation constructs associated with participation in golf. Ten studies examined aspects of the psychological impacts of golf performance, and five studies considered strength and conditioning in golfers.

A more detailed data synthesis of the quantitative studies is presented below (Table 3), in which the findings depict the significance of the quality of coaching, availability of funds, competition-specific training, strong psychological skillset, and physical conditioning.

The quality of coaching

The quality of coaching imparted to golfers, coupled with interpersonal dynamics, such as the coach-parent and coach-golfer relationships, exerts a substantial influence on the professional development of golfers (Roos et al., 2022). Coaching emerged as a central topic in three quantitative studies and an essential aspect in the elite development of golfers. The specific aspects of coaching were categorised into three sub-categories: Coaches' qualities, coaches' relationship with parents, and technology usage of coaches.

Coaches' qualities

Aspiring golfers require a qualified and knowledgeable coach to promote their development and performance (Roos et al., 2022). Moreover, a coach's character significantly influences the development of junior golfers, with attributes like morality, honesty, and responsibility playing pivotal roles (Hwang, 2021). Additionally, a high-quality coach uses methods that encompass a well-rounded balance of

Table 1. Results of the quality check for the quantitative studies (Law et al., 1998).

Quantitative studies	16-item criteria as proposed by Law et al. (1998)																
Author	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Score (%)
1. Aparicio et al. (2021)	1	1	1	1	1	0	1	1	n/a	1	1	0	n/a	1	1	0	79%
2. Ashbrook et al. (2018)	1	1	1	0	1	1	0	1	n/a	0	1	0	n/a	1	1	1	71%
3. Bassilios et al. (2021)	1	0	1	0	0	0	1	1	n/a	0	1	1	n/a	1	1	1	64%
4. Bertram et al. (2007)	1	1	1	0	1	1	1	1	n/a	0	1	1	n/a	1	0	1	79%
5. Brožka et al. (2023)	1	1	1	1	1	1	1	1	n/a	0	1	0	n/a	1	1	1	86%
6. Callan and Thomas (2007)	1	1	1	1	1	0	1	1	n/a	1	1	1	n/a	1	0	1	86%
7. Campbell et al. (2019)	1	1	1	1	1	1	1	1	n/a	1	1	0	n/a	1	1	1	93%
8. Carson and Collins (2015)	1	0	1	1	0	1	1	1	n/a	0	1	1	n/a	1	1	1	79%
9. Chambers and Marshall (2017)	1	1	1	0	1	0	1	1	n/a	1	1	1	n/a	1	1	1	80%
10. Coughlan et al. (2019)	1	1	1	1	1	1	1	1	1	1	1	0	n/a	1	1	1	93%
11. Coughlan et al. (2018)	1	1	1	1	0	1	1	1	n/a	1	1	0	n/a	1	1	1	86%
12. Driggers and Sato (2018)	1	1	1	0	1	1	1	1	n/a	1	1	1	n/a	1	1	1	93%
13. Fisher (2019)	1	1	1	1	1	1	1	1	n/a	1	1	1	n/a	1	1	1	100%
14. Hwang (2021)	1	0	1	1	1	1	0	1	n/a	1	1	1	n/a	1	1	1	86%
15. Kitching and Campbell (2019)	1	1	1	0	1	1	1	1	n/a	0	1	0	n/a	1	1	1	79%
16. Langdown et al. (2019)	1	1	1	1	1	1	1	1	n/a	1	0	1	n/a	1	1	1	93%
17. Lundkvist et al. (2021)	1	1	1	1	1	1	1	1	n/a	1	1	1	n/a	1	1	1	100%
18. McNeill et al. (2020)	1	1	0	1	1	1	1	1	n/a	1	1	1	n/a	1	1	1	93%
19. Nagashima et al. (2023)	1	1	1	1	1	1	1	1	n/a	0	1	0	n/a	1	1	1	86%
20. Nishida et al. (2022)	1	1	1	1	1	1	0	0	n/a	1	1	1	n/a	1	1	1	86%
21. Oranchuk et al. (2020)	1	1	1	1	0	1	1	1	n/a	1	1	1	n/a	1	1	1	93%
22. Parker et al. (2021)	1	1	1	1	1	1	0	1	n/a	1	1	0	n/a	1	1	1	86%
23. Pilgrim et al. (2018)	1	1	1	1	1	1	1	0	n/a	1	1	1	n/a	1	1	1	93%
24. Revankar et al. (2021)	1	0	1	1	1	1	1	1	n/a	0	0	1	n/a	1	1	1	79%
25. Rittenberg et al. (2023)	1	1	1	1	1	1	1	1	n/a	1	1	1	n/a	1	1	1	100%
26. Roberts et al. (2021)	1	0	1	0	0	1	1	1	n/a	1	1	0	n/a	1	1	1	71%
27. Shaw et al. (2023)	1	0	1	1	1	1	1	1	n/a	0	0	1	n/a	1	1	1	79%
28. Son et al. (2018)	1	1	1	0	0	1	1	1	n/a	0	1	0	n/a	1	0	1	64%
29. Thompsett et al. (2022)	1	1	1	1	1	1	1	1	n/a	1	1	1	n/a	0	0	1	86%
30. van der Lei et al. (2016)	1	1	1	1	0	1	1	1	n/a	0	1	1	n/a	1	1	1	86%
31. Vine et al. (2011)	1	1	1	1	1	1	1	1	n/a	1	1	0	n/a	1	1	1	93%
32. Wells and Langdown (2020)	1	1	0	0	1	0	1	1	n/a	1	1	1	n/a	1	1	1	79%
33. Yoon et al. (2023)	1	0	1	0	0	0	1	1	n/a	0	1	1	n/a	1	1	1	64%

Table 2. Results of the quality check for qualitative studies (Letts et al., 2007).

Qualitative studies	21-item Critical Review Form put forward by Letts et al. (2007)																					
Author	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	Score (%)
1. Carey et al. (2021)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	1	1	0	80%
2. Cotterill et al. (2010)	1	1	1	1	1	1	1	1	0	1	0	0	1	1	1	1	1	1	1	1	1	86%
3. Davies et al. (2017)	1	1	1	1	1	0	0	1	1	1	1	1	1	1	1	0	1	0	1	0	1	76%
4. Dickens et al. (2018)	1	1	0	1	1	0	0	1	1	1	0	0	1	1	1	0	1	1	1	0	1	66%
5. Diekfuss and Raisbeck (2017)	1	1	1	1	1	1	0	0	1	1	1	1	1	0	1	1	1	1	1	1	0	81%
6. Donald and Winter (2022)	1	1	1	1	1	0	1	1	1	0	1	1	0	1	1	1	0	1	1	1	1	80%
7. Fry and Bloyce (2017)	1	1	0	1	1	1	1	1	0	1	0	0	0	0	1	0	0	1	1	1	1	61%
8. Fry et al. (2015)	1	1	1	1	1	0	1	1	0	1	1	0	0	0	1	0	0	1	1	1	1	66%
9. Gabana et al. (2019)	1	1	1	0	0	1	1	1	1	1	1	1	0	1	1	0	1	1	1	1	1	80%
10. Grobbelaar et al. (2018)	1	1	0	0	1	1	1	1	1	1	0	0	1	1	1	1	1	0	0	1	1	71%
11. Hayman et al. (2014)	1	1	0	1	0	0	0	1	1	1	1	1	1	1	0	0	1	1	1	1	0	66%
12. Henriksen et al. (2014)	1	1	1	1	1	1	1	1	0	1	0	0	1	1	1	1	1	0	1	1	1	71%
13. Jeong-Keun et al. (2021)	1	1	1	1	1	1	1	1	0	0	0	0	1	0	1	0	1	0	1	0	1	62%
14. Kemarat et al. (2021)	1	0	1	1	1	1	0	1	1	1	0	0	1	1	1	1	1	0	1	1	1	66%
15. Lee (2021)	1	1	1	1	0	0	0	0	1	1	1	1	1	1	1	1	1	0	1	1	0	71%
16. McCarthy et al. (2022)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	100%
17. McNeill and Meade (2017)	1	1	1	1	1	1	0	1	1	1	0	0	1	1	1	1	1	0	1	0	1	76%
18. Mears et al. (2019)	1	0	1	1	1	0	0	1	1	0	1	0	1	1	1	1	0	0	1	1	0	61%
19. Orr et al. (2021)	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	0	1	1	1	1	1	90%
20. Pates and Kingston (2020)	1	1	1	1	1	0	1	0	1	0	1	0	1	1	1	0	0	0	1	1	1	66%
21. Pilgrim et al. (2016)	1	1	1	1	1	1	1	1	0	1	0	1	1	1	1	1	1	0	1	1	1	85%
22. Roos and Muller (2023)	1	1	1	1	1	1	0	0	1	1	0	0	1	1	1	1	1	1	1	1	1	81%
23. Roos et al. (2022)	1	1	1	1	1	1	0	0	1	1	0	0	1	1	1	1	1	1	1	1	1	81%
24. Roos and Lennox (2019)	1	1	1	1	1	0	0	0	1	1	0	0	1	1	1	1	1	1	1	1	1	76%

technical, physical, and other golf-specific knowledge (Kitching & Campbell, 2019). In this respect, coaches need to be easily accessible, and sessions should be flexible (adjusting to the needs of the golfers). For consistency, coaches need to follow a coaching curriculum to improve the content of the sessions

Table 3. Overview and study characteristics of the quantitative studies.

Quantitative studies							
Author	Year	Procedure	Phenomena of interest	Sample	Results	Key factors identified	Quality score
Aparicio et al. (2021)	2021	Survival analysis refers to the outcome variable of interest when a particular event occurs. The study used Shotlink to measure data on golfers' abilities, prior experience, schedule, and performance under pressure.	Ability to win	PGA tour golfers, 2004–2015	To compete under pressure, prior experience and the playing schedule significantly affected golfers achieving the first victory.	Competition-specific training, psychological skill/s.	79%
Ashbrook et al. (2018)	2018	The Test of Performance Strategies-2 (TOPS-II) included the assessment of 64 items in a self-report questionnaire. Mental-Skills-Training (MST) program was used to analyse the effect on the performance of National Collegiate Athletic Association (NCAA) Division 1 college golfers.	Mental-skills-training and golf performance	22 male and seven female NCAA Division I college golfers	MST programme has delayed improved performance; as a result, limiting negative thoughts and increasing positive self-talk enhances performance.	Psychological skill/s	71%
Bassilios et al. (2021)	2021	Predictive analytics using different models to identify six metrics predicting college golf success.	Determining the junior golfers that college teams should recruit and predicting college golf success.	One female golfer	Predictive analytics shows 88.6% accuracy that a high school golfer will be a Division 1 college golfer and predicts by 84% that a golfer will be ranked in the top 25.	Competition-specific training.	64%
Bertram et al. (2007)	2007	Pre-test and post-test. Twelve swings were recorded on an indoor launch monitor system. Following this, the participants randomly attended different coaching sessions and were retested to see the sessions' impact on their swing dynamics.	Video analysis: On the use and misuse of video analysis.	24 novices and 24 skilled male and female golfers	Results indicated that elite golfers showed performance improvement, specifically in their tempo in the golf swing. Conversely, novice golfers indicated decreased immediate performance after viewing their golf swing on a video.	The quality of coaching.	79%
Brožka et al. (2023)	2023	Golf skills, such as putting, short game shots, approach shots and driving performance were assessed on a Trackman 4 to investigate the specific skills needed for optimal skilled junior golf performance.	Specific skills-junior golfers	16 skilled male junior golfers	The study indicated that short and long approach shots and driving accuracy are essential to increased achievement at a junior level.	Competition-specific training.	86%
Callan and Thomas (2007)	2007	The PGA tour earnings and shot-making skills of golfers were calculated by evaluating the correlations between them.	Golf finance		Lowering a golfer's average score can be done by reducing the number of putts, increasing driving distance and accuracy, increasing the greens in regulation, and saving par from the bunker.	Competition-specific training.	86%
Campbell et al. (2019)	2019	The experiment involved a golf-putting task consisting of two blocks of 10 putts from 1.83 and 3.66 m while wearing eye-tracking glasses.	Quiet eye-putting-mental activity	24 male golfers	The study found that golfers at each level had consistent pupil levels and the same cognitive effort, and the same amount of QE was indicated during complex and easy-putting tasks.	Psychological skill/s	93%
Carson and Collins (2015)	2015	Three case studies of golfers attempting refinements to their already well-established techniques are reported. Kinematic data were supplemented with intraindividual movement variability and self-perceptions of mental effort as measures of tracking behaviour and motor control.	The combination of coaching, psychomotor, biomechanical, and psychological inputs impact the development of golf-specific skills.	Three right-handed male English golfers. PGA Professional, PGA Europro Tour, and amateur golfer.	Psychological skills, such as imagery, self-evaluation, self-regulation, and commitment are essential in successfully refining golf-specific techniques.	Psychological skill/s	79%

(*Continued*)

Table 3. Continued.

Quantitative studies							
Author	Year	Procedure	Phenomena of interest	Sample	Results	Key factors identified	Quality score
Chambers and Marshall (2017)	2017	Survey	The effect of anxiety and perfectionism on putting performance in golf is the 'yips'.	243 male participants.	The study confirmed that 'the yips' are closely linked to the level of anxiety the golfer experiences when attempting to perform certain motor skills in increased-pressure situations.	Psychological skill/s	80%
Coughlan et al. (2019)	2019	Investigated the effect that a 12-week (once weekly) strength and conditioning program would have on the clubhead speed (CHS), ball speed (BS) and physical performance of junior golfers (11–17 years old).	Junior strength conditioning	39 male junior golfers (11–17 years old)	The study revealed an increase in CHS and BS. When junior golfers engage in resistance training, CHS and BS do not decline during the off-season.	Physical conditioning.	93%
Coughlan et al. (2018)	2018	Studied the impact of a club-only warm-up compared to a dynamic exercise routine followed by a club warm-up and its effect on clubhead speed (CHS) and shot quality.	Warm-up	Eight male junior golfers and 13 female junior golfers	The study indicated that a warm-up would not necessarily increase CHS significantly, but golfers may see significant performance improvements when combined with a self-reported shot quality. Golfers who engage in a dynamic exercise routine and club warm-up had gains in CHS and self-reported shot quality.	Physical conditioning.	86%
Driggers and Sato (2018)	2018	The procedure included anthropometric, warm-up, vertical jump, and isometric mid-thigh pull testing. Golf performance testing was done using Trackman. Participants then followed a 10-week vertically oriented resistance training program. Following this, the procedure was repeated to compare values.	A 10-week vertically oriented resistance training program affects golf driving performance.	Ten male collegiate golfers	Resistance training improves driving performance, which increases overall golf performance.	Physical conditioning.	93%
Fisher (2019)	2019	Pretest-post-test design assessing shot performance using Trackman.	Launch monitor usage and golf performance	Ten female collegiate golfers	Golfers achieved an increased performance with intermediate distance (i.e. 70–130 m) approach shots into the green.	Technology usage of coaches, competition-specific training.	100%
Hwang (2021)	2021	Survey to investigate the interaction between parents and coaches of high school golfers.	Social support	250 parents and coaches	Communication, talent, and support are important factors in the social support structure.	The quality of coaching.	86%
Kitching and Campbell (2019)	2019	Mixed methods	Pathways to international success	109 golfers and 27 coaches	Various aspects are important in the pathway, such as administration, communication, and professional coaching.	The quality of coaching.	79%
Langdown et al. (2019)	2019	Experimental trials were conducted to test the effect of control, dynamic, and resistance-band warm-ups on driving performance.	Warm-ups	Twenty-three highly skilled golfers, ten professional golfers and 13 high-level amateurs.	Warm-ups increased ball velocity.	Physical conditioning.	93%

(*Continued*)

Table 3. Continued.

Quantitative studies							
Author	Year	Procedure	Phenomena of interest	Sample	Results	Key factors identified	Quality score
Lundkvist et al. (2021)	2021	The study evaluated various psychological skills before the participants played a specific hole and documented their scores after the hole.	Psychology	Twenty-eight semi-elite to elite male and female golfers	Psychological skills significantly affect golfers, and the better golfers utilise these skills more.	Psychological skill/s	100%
McNeill et al. (2020)	2018	Putter kinematics was performed using SAM PuttLab; participants completed a questionnaire assessing their ability to imagine specific movements. Putting tasks were performed before and after imagery usage.	Imagery	Forty-four male amateur golfers	Action observation and motor imagery usage enhance golf putting performance.	Psychological skill/s	93%
Nagashima et al. (2023)	2023	Golfers played 18 holes and were randomly assigned to consume CHO or not. Blood glucose, cognitive and golf performance were then tested.	Nutrition	Eleven competitive male golfers	Continuous CHO intake prevented fatigue and had an increase in concentration as a result.	Physical conditioning	86%
Nishida et al. (2022)	2022	Self-reported counterbalanced experimental study.	Sleep restriction	Eleven male collegiate golfers	Sleep restrictions have a significant effect on direction.	Self-care	86%
Oranchuk et al. (2020)	2020	8-week resistance training intervention.	The effect of strength and power on clubhead speed.	Three male and three female collegiate golfers	Strength and power exercises significantly increase clubhead speed and, in turn, improve the performance of golfers.	Physical conditioning	93%
Parker et al. (2021)	2021	Questionnaire	Imagery use	101 male skilled golfers	The usage of imagery is directly correlated with the skill level of a golfer and is essential in performance gains	Psychological skill/s	86%
Pilgrim et al. (2018)	2018	Questionnaire	Tournament preparation	36 coaches, high-performance staff, golfers, and academics	Tournament preparation may increase a golfer's performance.	Competition-specific training.	93%
Revankar et al. (2021)	2021	Survey	The 'yips'	1300 PGA professionals	'The yips' are due to psychological inadequacies and often occur in putting, approach and tee shots.	Psychological skill/s	79%
Rittenberg et al. (2023)	2023	Survey	Factors predicting technology usage	313 male and female amateur golfers	It was found that when golfers have lessons with a coach who uses technology, it gains credibility for the golfer. Golfers also need to trust the data provided.	Technology usage of coaches	100%
Roberts et al. (2021)	2021	Golfers completed ten different shots at a target	The effect of perceptual-cognitive and cognitive interference when preparing or executing a specific skill, such as striking the ball.	24 skilled golfers	The study found that golfers had a decrease in performance when cognitive interference, particularly in the form of pressure, occurs.	Strong psychological skillset.	71%
Shaw et al. (2023)	2023	Golfers performed full swing shots with a six iron and driver (clubhead speed and carry distance were measured). Isometric strength, power, movement, and core fitness were assessed.	Physical fitness and golf swing performance	64 male youth golfers	Results show that golfers who hit the ball further have increased isometric peak force, dynamic peak power, jump, better movement patterns, and better performance.	Physical conditioning	79%

(*Continued*)

Table 3. Continued.

Quantitative studies							
Author	Year	Procedure	Phenomena of interest	Sample	Results	Key factors identified	Quality score
Son et al. (2018)	2018	Body composition and height and arms, trunk and leg resistance values were measured. The BMI was then calculated. Golf-related performance measurements (driving distance, putting function and average score) were assessed.	Strength & Conditioning	90 male college students, 33 non-golfers, 31 amateur golfers (majoring in golf) and 26 PGA professionals	Muscle mass and strength are beneficial for professional golfers.	Physical conditioning.	64%
Thompsett et al. (2022)	2022	Golfers consume carbohydrates, protein, or a zero-calorie drink while playing three standardized nine-hole rounds.	Nutrition	Six male participants	The study indicated that having different macronutrient feedings does not necessarily significantly affect golf performance.	Physical conditioning.	86%
van der Lei et al. (2016)	2016	They investigated the Individual Arousal-related Performance Zones (IAPZs) when golfers performed practice swings for both full swing and putting.	Pre-performance routines	Three male university golf team members	Golfers' behavioural patterns (i.e. glances and practice swings) differ in a competitive environment. Consequently, golfers engaged in more practice swings during pressure situations in a competition than in training sessions.	Psychological skill/s, competition-specific training.	86%
Vine et al. (2011)	2011	Ten rounds of putting statistics were recorded, and golfers attended training in the QE group or the control group. Twenty putts were recorded while wearing an eye tracker.	Quiet eye	22 elite male golfers	Effective gaze control and lower anxiety.	Psychological skill/s	93%
Wells and Langdown (2020)	2020	Survey	Warm-up and Strength & Conditioning	430 male and female PGA professional assistants	Sports science and dynamic stretching are beneficial for golfers.	Physical conditioning.	79%
Yoon et al. (2023)	2023	Survey	Physical conditioning in female golfers	144 female PGA professionals and 176 elite-amateur female golfers	The evaluation of physical conditioning may enhance the performance of female golfers.	Physical conditioning.	64%

(Kitching & Campbell, 2019). In this sense, coaches need to understand why their golfers are successful and how they can continue the trend (Bassilios et al., 2021). Bassilios et al. (2021) endeavoured to identify key metrics (including ranking, tournament wins, mean score, and consistency) that could predict the success of college-level golfers and guide golf coaches in recruiting junior golfers. Their analysis revealed that golfers who scored closest to par on long holes were likelier to attain higher rankings. Consequently, predictive analytics in the study demonstrated an 88.6% probability for a high school golfer to transition to a Division 1 college golfer, with an 84% likelihood of being ranked in the top 25.

Coaches' relationship with parents

Hwang (2021) developed a measurement tool to investigate the interaction between parents and coaches of high school golfers. The study revealed that the parent-coach relationship is pivotal for enhancing performance. Essential factors include communication and support to foster a positive parent-coach relationship (Hwang, 2021). Furthermore, parents and coaches recognise mutual respect, trust, agreement, and support as critical elements contributing to the optimal development of adolescent golfers.

Technology usage of coaches

Technology usage in sports has increased considerably in recent years (Rittenberg et al., 2023). Therefore, coaches are becoming more reliant on technology, such as video analysis to assist them in their instructional setting (Bertram et al., 2007; Rittenberg et al., 2023). Bertram et al. (2017) examined how information, such as clubhead speed (CHS), clubface alignment at impact (CFA), and tempo (T) are utilised during video analysis to enhance golfers' performance. The study revealed that video analysis offers golfers valuable insights into various aspects of their golf swing, particularly their swing tempo. Consequently, the availability of information, such as CHS, CFA, and T to coaches may aid in improving golfers' performance and, consequently, their professional development (Bertram et al., 2017). Furthermore, the study by Rittenberg et al. (2023) investigated the factors that predicted technology usage among golfers. The authors found that when golfers have lessons with a coach who uses technology, it gains credibility for the golfer. In addition, the study indicated that technology is used mainly by elite golfers and not so much by novice golfers. Fisher (2019) examined the use of technology, such as Trackman amongst golfers, which is a portable launch monitor used by many professional golfers to measure their CHS, CFA, swing path (SP), launch angle (LA), spin rate (SR), carry distance (CD) and many more aspects (Bertram et al., 2017). Fisher (2019) furthermore revealed that consistent use of such technology over an extended period (more than eight weeks) is necessary for golfers to experience performance improvements. Moreover, utilising the Trackman launch monitor enhanced performance in intermediate distance approach shots (i.e. 70–130 m) to the green (Fisher, 2019).

Competition-specific training

Competition-specific training is crucial for golfers to advance to a professional level (Kitching & Campbell, 2019). The training environment, including driving ranges, golf course conditions, and the golf balls used, should replicate the conditions of actual competitions. Golfers' preparations must be purposeful (Lee, 2021), focusing on practising various skill sets, such as full swing, chipping, pitching, and putting, which they may encounter during competitions (Carson & Collins, 2015; Roos & Lennox, 2019). To optimise performance, golfers can enhance the learning environment of their training sessions by closely simulating competitive conditions (Bertram et al., 2017). Two categories emerged in six quantitative studies: Skillset required during competition-specific training and pre-shot routine.

Skillset required during competition-specific training

Short and long approach shots and driving accuracy are the golf skills regarded as important in a tournament environment at a junior level (Brožka et al., 2023). However, the demands of professional tournaments, require increased driving distance (Shaw et al., 2023) and a high level of putting accuracy (McNeill et al., 2020) to achieve success. According to Shaw et al. (2023), golfers who can achieve greater distances with their shots record lower scores. In addition, Pelz (2000) posits that 43% of the shots

golfers perform during competition are putting. As such, golfers must develop these skills sufficiently during preparation for a tournament. In addition, lowering a golfer's average score can be done by reducing the number of putts, increasing driving distance and accuracy, increasing the greens within regulation (the percentage of time a golfer's golf ball finishes on the green with two shots less than par), and saving par from the bunker (Callan & Thomas, 2007; Golficity, 2014; James, 2007).

Furthermore, golfers are encouraged to compete in various tournaments. Golfers with extensive tournament experience may experience a significant positive outcome concerning their average score (Callan & Thomas, 2007). In addition, Pilgrim et al. (2018) suggest that golfers structure their practice sessions according to the conditions required for a specific tournament. Further tournament preparation should include physical characteristics of the golf course, such as yardages, slopes of the greens, and hazards. As such, golfers should develop an appropriate game plan to deal with the pace and angles of greens, location of hazards, important yardages, general wind conditions, and shot types needed during their tournament preparation to increase their performance (Pilgrim et al., 2018).

Pre-shot routine

Roberts et al. (2021) investigated the influence that perceptual-cognitive and cognitive interference when preparing or executing a specific skill, such as striking the ball, may have on the performance of golfers. The study found that when certain golfers compete in a competition environment, their pre-shot routine differs from when they practice full swing, chipping, and putting in a training environment. When golfers do not employ a consistent pre-shot routine, they often decrease performance on short game shots of 60–70 m. A possible explanation proposed for this phenomenon is that this type of approach shot has additional cognitive involvement due to the required adjustment in the swing (Roberts et al., 2021). Furthermore, when preparation is disrupted, golfers have difficulty organising their thoughts to make good choices. Therefore, golfers are encouraged to have a committed plan and not have a rushed execution. Consequently, golfers need to remain consistent in their pre-shot routine (e.g. glances at the target and practice swings) without interference, regardless of the significance of the task (Roberts et al., 2021; van der Lei et al., 2016).

Psychological skillset

Psychology is regarded as a critical component in golf performance (Roos et al., 2022). Nine quantitative studies were analysed, revealing several themes related to psychological factors. The themes are categorized into: Anxiety management, attentional allocation and control, imagery, and self-talk usage among golfers.

Anxiety management skills

Golf demands precise technical skills amidst intense pressure, particularly for golfers aspiring to succeed on professional tours like the PGA (Aparicio et al., 2021). Effective pressure management is vital for success, especially in scenarios like putting, where negative emotions, such as anxiety can adversely impact performance (Chambers & Marshall, 2017; Vickers, 2012). This phenomenon is often associated with the yips, a psycho-neuromuscular impediment affecting fine motor skills during sporting performance, as defined by Clarke et al. (2015). The yips, characterized by involuntary movements or jerks, are frequently linked to anxiety and commonly occur during putting, approach shots, and tee shots, as noted by Revankar et al. (2021). Golfers must cultivate self-awareness of anxiety in pressure situations early in their careers and be prepared with technical adjustments to counter the yips effectively.

Attentional allocation and control in golfers

Vine et al. (2011) investigated the effect of pressure situations on golfers and found that performance degradation results from a shift in attention allocation and reduced attentional control. Consequently, an external focus on the desired effect and attentional control is essential for golfers to enhance their performance in golf (Vine et al., 2011). Putting is crucial to the success of professional golfers (Vine et al., 2011)

and requires physical actions, more specifically, a golfer's vision which is essential to successful putting performance (Vickers, 2012). When pressure situations occur, golfers often have an inconsistent number of locations where they fixate during crucial stages of a specific movement. To avoid this, golfers should attempt to employ the phenomenon called the quiet eye (QE), which entails the technique of an athlete fixating on a specific point during a motor movement, such as putting (Campbell et al., 2019; Vine et al., 2011). When golfers can employ the QE during competition, their attention may be focused on the movement effect and not on the movement production, which conjures excessive conscious control/effort associated with less skilled performances (Vine et al., 2011). In this context, the Reinvestment Theory, which pertains to attention allocation, elucidates that excessive cognitive effort can cause a skill, particularly one that has become autonomous (implicit), to regress to earlier stages of learning. This regression results in uncoordinated skill production and reduced effectiveness (Bellomo et al., 2018).

Ashbrook et al. (2018) explored the impact of a Mental Skills Training (MST) program on golfers' mental skill usage and golf performance. The study revealed that such programs, employing techniques like muscle relaxation and thought stoppage, can shift golfers' focus from technical aspects to external factors like the target, potentially enhancing golf performance.

Additionally, Lundkvist et al. (2021) investigated how golfers' perceived control, negative affect, and task-oriented coping predicted their performance during rounds. Skilled golfers showed improved scores between holes 7 and 12 following negative emotions, while elite golfers remained unaffected by poor scores, showcasing the importance of high self-confidence and resilience in golf (Lundkvist et al., 2021; Roos et al., 2022).

Imagery usage of golfers

Carson and Collins (2015) investigated the impact of coaching, psychomotor, biomechanical, and psychological factors on the development of golf-specific skills. Their findings emphasized the crucial role of imagery in refining these skills effectively. Similarly, Parker et al. (2021) explored the relationship between movement imagery ability and its functions in golfers. They also examined how imagery usage predicts its functions, defining various types of imagery as external visual imagery (third-person perspective), internal visual imagery (first-person perspective), and kinaesthetic imagery (sensory feel of movement).

Roberts et al. (2008) identified cognitive-specific imagery as prevalent among golfers, involving visualizing specific movements crucial for golf skills. They suggested that golfers should cultivate internal visual imagery and kinaesthetic imagery initially, progressing to cognitive-specific imagery to enhance performance. This underscores the direct correlation between imagery usage and a golfer's skill level, which is pivotal for performance gains (Parker et al., 2021).

McNeill et al. (2020) examined the effects of action observation (AO) and motor imagery (MI) on golfers' putting performance. MI involves mentally rehearsing a movement without physical action, while AO entails structured movement observation (MacIntyre et al., 2013; Neuman & Gray, 2013). Their study demonstrated that golfers could control putting speed after engaging in AO and MI, concluding that these techniques significantly enhance golf putting performance.

The use of self-talk among golfers

According to Ashbrook et al. (2018), golfers' performance will improve when they enhance their confidence by limiting negative thoughts and increasing positive and strategic self-talk. Golfers often make use of strategically prepared cue words that they say to themselves to assist their performance during competition. By making use of self-talk, golfers reframe any irrational thoughts that may cause anxiety (Ashbrook et al., 2018). When golfers suffer from symptoms resulting from precompetitive anxiety, they are encouraged to employ positive or strategic self-talk to their overall thinking to increase performance (Ashbrook et al., 2018).

Physical conditioning

Although golf is a technical sport, the importance of physical preparation for golfers is becoming more evident (Smith et al., 2011). Six studies identified several themes regarding physical preparation.

The themes were categorised to denote the significance of performing an adequate warm-up routine, following a strength and conditioning training program, and engaging in self-care, nutrition, and sleep.

The importance of a warm-up

Coughlan et al. (2018) studied the impact of a club-only warm-up (performing full shots with various clubs), compared to a dynamic exercise routine followed by a club warm-up, and the effect it may have on clubhead speed (CHS) and shot quality. The study found that golfers who engage in a dynamic exercise routine combined with a club warm-up had significant gains in CHS and self-reported shot quality (Coughlan et al., 2018). Coughlan et al. (2018) indicated that a warm-up that does not include exercise-based activities, such as squats, lunges, and hip rotations, and consists of a club-only warm-up would not necessarily increase CHS significantly. Still, when combined with a self-reported rating of the shot quality, golfers may see great improvements in performance. Therefore, golfers should perform exercise-based warm-ups (e.g. overhead reach, standing internal hip rotation, overhead squats, lunge and rotate) combined with a club warm-up session to have performance gains. In addition to a dynamic warm-up, Langdown et al. (2019) suggest a resistance-band type warm-up (e.g. reverse lunges with thoracic rotations, crab walks against a resistance-band) that is noted to increase ball velocity. However, this may not necessarily result in an improvement in golf performance (Langdown et al., 2019).

Strength and conditioning training

Coughlan et al. (2019) found that implementing a 12-week strength and conditioning program, conducted once weekly, leads to notable enhancements in clubhead speed (CHS) and ball speed (BS) among golfers. Consequently, this improvement is indicative of potential performance enhancements for golfers (Coughlan et al., 2019). Implementing sports science, strength and conditioning, warm-ups, and cool-downs in golf benefit golfers and may reduce injuries (Wells & Langdown, 2020). Furthermore, there is an increase in muscle mass of golfers compared to non-golfers (Son et al., 2018). Interestingly, there is no correlation between muscle mass and golf skill performance (driving distance, putting function, and average score). However, the muscular difference between amateur and professional golfers influenced the average score and putting accuracy. As such, muscle mass and strength are higher in professional golfers compared to amateur golfers (Son et al., 2018). Similarly, Shaw et al. (2023) investigated golfers' isometric strength, power, movement, and core fitness. Golfers performed full swing shots with a six iron and driver, respectively, and clubhead speed and carry distance were measured. The study found that golfers who hit the ball further had an increased isometric peak force, had a higher dynamic peak power, jumped further, and had better movement patterns. Thus, golfers with high physical fitness and strength may perform better. Furthermore, Driggers and Sato (2018) evaluated the effect of a 10-week vertically oriented resistance training program on golf driving performance. The study found that vertical-oriented resistance training, which includes sprints, overhead squats, back squats, dumbbell bench presses, dumbbell shoulder presses, and several more, improves driving performance in golfers, which may increase overall golf performance. Moreover, Oranchuk et al. (2020) conducted an 8-week resistance training intervention with golfers and found that strength and power exercises significantly increase clubhead speed and, in turn, improve the performance of golfers. It is, therefore, essential for golfers to add a physical conditioning program to their preparations to enhance their golf performance (Yoon et al., 2023).

Nutrition and sleep

Having different macronutrient feedings does not necessarily have a significant effect on golf performance (Thompsett et al., 2022). However, continuous carbohydrate (CHO) intake (gummies) prevents fatigue and improves concentration, which may result in better performance. Furthermore, golfers may find it beneficial to have continuous CHO intakes, such as bread, rice balls, and dried fruits, during a round of golf. It is important to note that golfers should not consume all the CHO at once but consume them sustainably (Nagashima et al., 2023).

Inadequate sleep adversely affects human functioning and performance (Hoshikawa et al., 2020). According to Reilly and Waterhouse (2009), athletes must have optimal physical, psychomotor and

cognitive functioning. Sufficient sleep is sometimes an overlooked part of preparation in golf. Golfers who have sufficient sleep before a round of golf will have an increased putting performance as opposed to golfers who were subjected to sleep restrictions (Nishida et al., 2022). When golfers have been exposed to sleep restrictions, they often have incorrect alignment when aiming for a specific target. As such, golfers need to be aware of their sleep routine to enhance their putting performance.

The findings from 33 quantitative studies indicated various factors that may enhance the professional development of golfers. The most prominent factors include the quality of the coaches involved in developing a golfer, different skillsets required during competition-specific training, and strong psychological skillsets, such as the use of strategic self-talk, imagery, and attentional control in golfers. The physical conditioning of golfers was the topic of discussion in many studies and proved to have a significant effect on the performance of golfers. In addition to the 33 quantitative studies, 24 qualitative studies were identified.

Overview of the qualitative studies

Table 4 provides a synthesis of the 24 qualitative studies included in this review. Most of the studies were undertaken in Europe ($n=7$), Asia ($n=4$), South Africa ($n=4$), Australia ($n=3$), and the United States of America (USA) ($n=2$); and the participants were primarily male (95%). Studies that included both genders ($n=8$) were also biased toward male participation (93 male and 21 female). Most of the studies focused solely on professional golfers ($n=10$), while other studies included amateur-level golfers ($n=8$), PGA professionals ($n=7$), and caddies ($n=3$). All the studies were descriptive and, for the most part, cross-sectional (83%). Most of the studies (96%) used interviews during data collection, while most of the interviews focused on psychological aspects, the role a caddie plays, and pre-performance preparation constructs associated with participation in golf. The overview and study characteristics of the qualitative studies are indicated in Table 4.

The expertise of the caddie

A caddie carries a golfer's bag (McNeill & Meade, 2017; Merriam-Webster, 2023), cleans their clubs, provides the golfer with correct yardages, and assists in selecting the correct targets (McNeill & Meade, 2017). Additionally, caddies assist golfers with decision-making regarding shot and club selection (Pilgrim et al., 2016). Therefore, an effective caddy is essential for the success of a professional golfer (Pates & Kingston, 2020). Four studies identified various themes regarding the role of a caddie, including the caddie-golfer relationship, the psychological influence of a caddie, the communication and decision-making skills of a caddie, and caddie experience and preparation.

Caddie-golfer relationship

Carey et al. (2021) investigated the role of a caddie and their influence on their golfers' performance. The relationship that the caddie develops with the golfer was found to play an instrumental role in performance. Substantiating this finding, Donald and Winter (2022) also found the relationship between a caddy and a golfer to be an underlying aspect of performance in golf. In addition, McNeill and Meade (2017) and Pilgrim et al. (2016) identified trust as an essential aspect of the caddie-golfer relationship. When golfers have limited trust in their caddies, the caddies are often less involved in decision-making (Pilgrim et al., 2016). Furthermore, the balance of power in the caddie-golfer relationship is also essential, and if this power is not on the golfer's side, then inadequate decision-making may occur. The relationship between caddies and golfers is paramount for optimal performance on the golf course, necessitating thorough discussion and alignment of roles (Pilgrim et al., 2016). Effective collaboration hinges on compatibility between caddies and golfers, underscoring the importance of harmonious personalities. Research conducted by McNeill and Meade (2017) highlights that a consistent caddie-golfer partnership goes beyond mere logistical support, extending into valuable psychological assistance during moments of heightened stress. Caddies must be able to alleviate golfer anxiety by fostering an environment conducive to mental clarity, thereby enhancing performance under pressure.

Table 4. Overview and study characteristics of the qualitative studies.

Qualitative studies							
Author	Year	Procedure	Phenomena of interest	Sample	Results	Key factors identified	Quality score
Carey et al. (2021)	2021	Semi-structured interviews.	Caddie's role and skill in support of golfers.	Seven professional male caddies.	The study found that skills, such as perceptual expertise and the relationship that the caddie develops with the golfer significantly affect performance. Trust is an essential aspect of the caddie-golfer relationship.	The expertise of the caddie.	80%
Cotterill et al. (2010)	2010	Interview video recordings of participants.	Perceptions of golfers on the pre-performance routines (PPR).	Six male international golfers.	For golfers, psychological skills, imagery, confidence, and self-talk were essential.	Psychological skill/s.	86%
Davies et al. (2017)	2017	Semi-structured interviews.	Macro and Meso-level effect on professional golf performance.	Three male PGA professionals, one coach, one professional golfer.	Golfers must be able to focus on their current shot briefly before arriving at their ball. Pre-tournament preparation had a positive effect on performance.	Psychological skill/s.	76%
Dickens et al. (2018)	2018	The analysis investigated participants' experiences conducting their day-to-day activities and during tournaments on the golf course.	Self-talk.	Ten golfers.	Interventions in self-talk improve a golfer's performance. Mental preparation was confirmed as an essential activity for golfers to achieve greater performance.	Psychological skill/s.	66%
Diekfuss and Raisbeck (2017)	2017	Practice session analysis, semi-structured interviews, and focus groups.	Attentional focus on college golfers during practice and tournament play.	6 NCAA Division 1 golfers	Golfers employ internal (swing thoughts) and external (target) focus.	Psychological skill/s.	81%
Donald and Winter (2022)	2022	Semi-structured interviews.	The role and influence of a caddie.	Seven professional caddies are active on the professional tours.	Caddies greatly influence their golfers and play a significant role in various psychological aspects of a golfer.	The expertise of the caddie.	80%
Fry and Bloyce (2017)	2017	Semi-structured interviews	Well-being of travelling professional golfers.	20 Professional golfers	Social support and friendships are essential for increased performance. The financial strain for golfers is significant.	Psychological skill/s	61%
Fry et al. (2015)	2015	Semi-structured interviews	Finances in golf	16 British male professional golfers	Having financial support is essential for optimal performance	Availability of funds.	66%
Gabana et al. (2019)	2019	Semi-structured interviews	The use of music and the effect it has on golfers	Amateur and semi-professional golfers	The use of music has several benefits for golfers, including attitude enhancement.	Strong psychological skillset.	80%
Grobbelaar et al. (2018)	2018	A two-group pre-test post-test quasi-experimental research design was applied.	The effect of an anxiety management programme on golfers and the effect that self-confidence has on them.	Eighteen competitive male amateur golfers were enrolled in a PGA-accredited academy programme for aspiring professional golfers.	Anxiety management has a positive effect on the transferal of anxiety and self-confidence in golfers.	Psychological skill/s	71%
Hayman et al. (2014)	2014	Interviews	Factors involved in pre-elite adolescent golfers' process to successfully transition to elite status.	Eight male adolescent amateur golfers. Golfers affiliated with EGU Under-16 and Under-21 development, and Senior Men's A team squads.	Various ecological factors influence the transition of golfers.	Psychological skill/s, developmental environment of golfers, availability of funds.	66%

(*Continued*)

Table 4. Continued.

Qualitative studies							
Author	Year	Procedure	Phenomena of interest	Sample	Results	Key factors identified	Quality score
Henriksen et al. (2014)	2014	Ethnographic study, which included observations, interviews, and analysis of school documents	Talent development in a golf environment	11 golfers (11–17 years old) and coaches, parents and administrators enrolled in an International College of Sport and Performance	The environment, balanced lifestyle, organisational culture, and social relations that talented athletes are in are essential for successful talent development.	Psychological skill/s	71%
Jeong-Keun et al. (2021)	2021	Interviews	Psychological coping strategies	25 elite golfers	Self-control, confidence and performing a pre-shot routine are essential.	Psychological skill/s	62%
Kemarat et al. (2021)	2021	Mixed method (interviews & questionnaire)	Psychological skills	150 golfers	Amateur golfers indicated higher scores concerning negative thinking. Professional golfers indicated much higher scores concerning goal setting and activation during competition.	Psychological skill/s	66%
Lee (2021)	2021	Interviews	Discontinuation in golf	Five college students who discontinued golf	Reasons for discontinuation were psychological, physical, and economic.	Psychological skill/s	71%
McCarthy et al. (2022)	2022	Interviews	Psycho-behavioural momentum (PBM) during Matchplay competition	37 A-grade golfers (the highest standard of non-professional golfers in Australia)	Various psycho-behavioural factors influence performance. Golfers who can manage these factors have proved to be more successful.	Psychological skill/s	100%
McNeill and Meade (2017)	2017	Semi-structured interviews.	The role of the caddie.	6 Irish PGA professional golfers.	The caddie influences the performance of their golfers in various roles.	The expertise of the caddie.	76%
Mears et al. (2019)	2019	Interviews.	Technology.	Three male golfers, two golf coaches and one strength conditioning coach.	Digital technology enhances the coach's effectiveness.	Developmental environment of golfers.	61%
Orr et al. (2021)	2021	Interviews.	Attentional focus.	Ten PGA coaches and ten high-level golfers.	There is a difference in the focus type of the long game and short game shots during practice. Coaches play a significant role in the focus of golfers.	Psychological skill/s.	90%
Pates and Kingston (2020)	2020	Interviews.	Psychology.	1 European tour professional golfer.	The increased confidence in changing the pre-shot routine and adding the best performance imagery improved the golfer's performance.	Psychological skill/s.	66%
Pilgrim et al. (2016)	2016	Semi-structured interviews.	The role of the caddie.	17 elite-level golfers and six caddies.	The role that the caddie has in decision-making is crucial.	The expertise of the caddie.	85%
Roos and Muller (2023)	2023	Semi-structured interviews.	Personal branding.	17 former or current Sunshine Tour golfers, PGA of SA members, PGA of SA teaching professionals and golf administrators.	Personal branding is essential in attaining finances to assist in the process of reaching a professional level.	Availability of funds.	81%
Roos et al. (2022)	2022	Semi-structured interviews.	Psycho-social factors in developing junior golfers.	17 former or current Sunshine Tour golfers, PGA of SA members, PGA of SA teaching professionals and golf administrators.	The themes to assist in the success of a junior golfer were social support, coaching, specialisation, finance, psychology, lifestyle, and branding.	Psychological skill/s, competition-specific training, developmental environment of golfers, availability of funds.	81%
Roos and Lennox (2019)	2019	Semi-structured interviews.	Practice methods.	17 former or current Sunshine Tour golfers, PGA of SA members, PGA of SA teaching professionals and golf administrators.	Spacing, variability, and interleaved practice are essential.	Competition-specific training.	76%

Psychological influence of a caddie

Pilgrim et al. (2016) have underscored the profound psychological impact wielded by caddies on golfers, emphasizing the pivotal role of cognitive strategies in maintaining peak performance. Implementing these strategies, encompassing positive reinforcement to fortify confidence, trigger words to enhance focus and attentional control, and post-shot reflection to release negative frustration, are crucial in sustaining optimal performance. Similarly, the investigations by McNeill and Meade (2017) alongside Pilgrim et al. (2016), delve into the multifaceted contributions of caddies to golfers' decision-making processes, mental conditioning, and tournament readiness. Therefore, the caddie's role is to attempt to have the golfer focus on the task and not the outcome. If the caddie conveys the correct information to the golfer, the golfer will have enhanced psychological performance (McNeill & Meade, 2017). When the caddie communicates the decisions indecisively, the golfer will not be confident and, as such, have a negative psychological state and may very well become more nervous (Pilgrim et al., 2016). When golfers make mistakes, caddies play a significant role in recovering from these errors, and the golfer needs to be provided with adequate psychological support (McNeill & Meade, 2017). On the other hand, if a golfer is experiencing an optimal performance state, caddies need to be able to step back and let the golfers continue with this flow state. However, when this flow state disappears, the caddy needs to be able to assist the golfer in regaining the optimal performance state (McNeill & Meade, 2017).

Communication and decision-making skills of a caddie

The caddie must be aware of how decisions, such as shot, club, and target selection are communicated in certain situations (McNeill & Meade, 2017; Pilgrim et al., 2016). As a result, golfers highlighted that caddies should be aware of their negative communication, such as identifying specific hazards on the course. When a caddie identifies a particular hazard, golfers often experience a disrupted thought chain where negative thoughts become present (Carey et al., 2021). Furthermore, this communication significantly affects the golfers' emotional state, especially when nervous. Confidence is essential for golfers to be successful (Donald & Winter, 2022). Furthermore, it was reiterated that consistency in all tasks, such as carrying the bag, cleaning clubs, advising the golfer on targets and yardages, and preparing for tournaments, regardless of the magnitude of the tournament, is essential (Donald & Winter, 2022).

Caddies' experience and preparation

A caddie's extensive professional background can instill confidence in the golfer regarding their effectiveness (McNeill & Meade, 2017). When the caddie efficiently handles practical tasks, such as club maintenance, green reading, and providing accurate yardages, it allows the golfer to focus solely on executing proficient golf swings during competition. The caddie's experience contributes significantly to the golfer's performance by enhancing their course knowledge. Furthermore, Donald and Winter (2022) suggest that a consistent partnership between the golfer and caddie fosters a relationship wherein the caddie assumes responsibilities beyond practical duties. This expansion into off-course responsibilities is crucial for creating an environment wherein the golfer can concentrate on executing shots without distractions (Donald & Winter, 2022). Hence, meticulous pre-tournament preparations, including practice rounds and thorough course analysis, are imperative to ensure seamless performance. Caddies play a pivotal role in these preparations, from selecting appropriate clubs to managing logistics, such as booking flights for golfers (Donald & Winter, 2022).

Developmental environment of golfers

The competitive environment of golfers consists of various role golfers that influence the professional development of golfers. These role players are parents, peers, coaches, and other support staff (Roos et al., 2022). The themes of six qualitative studies were grouped into three categories: Specialisation in golf, social support, and the coach's incorporation of technology.

Specialisation in golf

The social environment (Lee, 2021; Roos et al., 2022) and organisational culture in which talented golfers operate are essential for success and must be considered (Fry & Bloyce, 2017; Henriksen et al., 2014;

Lee, 2021). Participation in various sporting codes assists golfers with developing physical, mental, and social skills. As such, golfers should only engage in specific, deliberate practice with expert coaches at the last transition stage and start specializing from about 15 years of age. A precise balance in a golfer's lifestyle is essential in their attempt towards talent development. This implies that golfers allocate time to engage in other activities besides solely concentrating on golf (Henriksen et al., 2014; Roos et al., 2022). Consequently, mass sport participation and late specialization are essential factors involved in the process that pre-elite adolescent golfers follow to transition to elite status successfully (Hayman et al., 2014; Roos et al., 2022).

Sound support structure

The social support that golfers receive is crucial in developing adolescent golfers (Fry & Bloyce, 2017; Hayman et al., 2014; Henriksen et al., 2014; Roos et al., 2022). According to Lee (2021) and Roos et al. (2022), parents' influence was largely negative, with parents having too high expectations of their children (Lee, 2021; Roos et al., 2022). Fathers typically introduce their child to the sport, allowing expert coaches to take over (Hayman et al., 2014). The role of a father then changes to practical and financial support for their child. Hayman et al. (2014) indicated that decision-making was family-driven but guided by the golfer. The mother's role has evolved to organise practical elements, such as travel and accommodation arrangements, enabling the golfer to concentrate on their golf alone. Furthermore, the parent-golfer relationship significantly affects golfers' continuing participation (Roos et al., 2022). Lee (2021), put forward the reasons for discontinuation in competitive sports as psychological, physical, and economical. Golfers often have psychological problems due to the conflict they experience with their parents following a bad performance. Due to parents often applying pressure on golfers to perform well, golfers may experience anxiety during competition (Roos et al., 2022). Therefore, golfers expressed that effectively transferring their skills from practice sessions to competitive arenas was a challenge they struggled to overcome due to pressure from their parents. Lee (2021) indicated that physical reasons, such as injuries also play a significant role in discontinuation. Participants also indicated that they lost interest when practice sessions had no meaning (Lee, 2021). In some instances, discontinuation is due to economic reasons, such as the cost of equipment, professional lessons, and the cost involved in competing in various tournaments (Lee, 2021; Roos et al., 2022; Roos & Muller, 2023). Furthermore, golfers experience loneliness, low social support, stress (Roos et al., 2022), and job insecurity when playing on professional tours, which in turn may lead to poor mental health (Fry & Bloyce, 2017). To reduce loneliness, golfers attempt to create a social support environment while on tour similar to what they experience at home (Roos et al., 2022). The friendships that golfers build are essential to their well-being and performance, and golfers need to surround themselves with others with the same objectives.

Coaching and the incorporation of technology

Technology usage is fast becoming an integral part of the instructional setting. As such, coaches use technology to convey important information to athletes during training sessions (Bertram et al., 2007). Therefore, electronic devices that record, measure, and process information about athletes enhance the coach's effectiveness if used correctly (Mears et al., 2019). In the case where technology is used strategically, golfers will achieve psychological benefits, such as confidence in their abilities (Mears et al., 2019).

Competition-specific training

Preparation for a tournament is crucial for golfers to gain a competitive advantage over their opponents (Davies et al., 2017). Furthermore, golfers need to be equipped with a consistent pre-shot routine to create a sense of familiarity in competitions and overcome psychological disturbances that may occur (Roos et al., 2022). Eight themes regarding competition-specific training were identified in seven qualitative studies, which were categorised into two categories: Pre-tournament preparation and pre-shot routine.

Pre-tournament preparation

Pre-tournament preparation has a significant positive effect on golfers' performance (Davies et al., 2017). The most important aspect of tournament preparation is analysing the golf course and its essential features, such as the speed and slope of the greens, hazards, types of grass, essential yardages, best approach angle to the greens, wind, and the types of shots that will be needed (Pilgrim et al., 2018). These aspects will then be used in practice to develop a strategy to optimise performance during the tournament. To achieve optimal performance in the competition environment, golfers must incorporate variability and interleaved practice into their sessions (Roos & Lennox, 2019). Interleaved practice refers to a golfer combining skills, such as full swing, chipping, pitching, and putting, into a single training session (Roos & Lennox, 2019). This eliminates uncertainty and offers a sense of control and familiarity to a golfer in the competitive environment (Roos et al., 2022; Roos & Lennox, 2019). As a result, when interleaved practice is applied, golfers can attain these skills for a long time and transfer them into a competitive environment (Roos & Lennox, 2019). Further benefits of pre-tournament preparation are when the manager or caddie handles the logistics and planning of transport to and from the tournament venue. When this is removed from the golfer's duties, it allows the golfer to focus solely on their performance on the course (Pilgrim et al., 2018). In addition, inadequate planning may lead to reduced preparation time before the tournament (Donald & Winter, 2022; Pilgrim et al., 2018).

Pre-shot routine

The purpose of a pre-shot routine is to create a sense of control, rhythm, commitment to the shot, and attention allocation to the task (Davies et al., 2017). The duration of a standard round of golf is ~5 h; 25% of this time consists of golfers performing a specific shot, and the remaining 75% walking or waiting to perform the next shot (Davies et al., 2017). According to Davies et al. (2017) and Roos et al. (2022), golfers' time before and after their pre-shot routine is essential for increased performance. Focusing on the task at hand is essential to achieve optimal performance. This refers to staying in the present and not thinking of the outcome or getting caught up in the past (Cotterill et al., 2010). Consequently, golfers need to be able to move from the post-shot stage to the attentional focus stage without allowing their thoughts to deter them from the task at hand. According to Jeong-Keun et al. (2021), following a pre-shot routine and having positive thoughts are crucial for performing at a high level. Interestingly, having an adverse reaction, such as showing frustration, swearing, and slamming clubs into the ground after a bad shot, a socially undesirable action, is not necessarily bad. Davies et al. (2017) indicated that when golfers react this way, they regulate their negative emotions and can focus on the present (Davies et al., 2017). Furthermore, Cotterill et al. (2010) indicated that when golfers irrationally evaluate a specific situation, they tend to make an incorrect decision (shot selection), and consequently, their performance decreases. It is important to note that each golfer should be treated differently, as each has a unique personality and different methods to cope with specific situations. Therefore, following a pre-performance routine is essential; however, this must be tailored to the individual (Cotterill et al., 2010).

Availability of funds

The journey of professional development for golfers is expensive, and athletes require assistance from sponsors to enhance the likelihood of success and minimize the financial pressure that may occur (Roos & Muller, 2023). The following financial themes were identified in five qualitative studies: Personal branding and sponsorships and the financial strain of becoming a professional golfer.

Personal branding and sponsorships

Fry et al. (2015) and Roos and Muller (2023) investigated the effect that personal branding has on sponsorships for professional golfers. It was found that attaining a sponsorship had a significantly positive effect on professional golfers' pursuit of success. Once golfers can acquire equipment, apparel, and travel sponsorship, their financial expenses are significantly reduced (Lee, 2021). Therefore, attaining a sponsor relieves a golfer from undue financial pressure (Roos et al., 2022). The golfer-sponsor relationship is also

essential and can be hugely beneficial. Certain equipment sponsors require that golfers use their products; in some cases, the equipment is not necessarily what the golfers prefer (Fry et al., 2015). However, equipment sponsors also provide golfers with a regular financial income for using their brand and assist golfers in personalising equipment to their specific needs, which might hugely benefit their performance (Fry et al., 2015). For golfers to attain a sponsor, they must develop and manage their personal brand (Roos et al., 2022; Roos & Muller, 2023). Personal brand management strategies include improved success on the golf course, enhancing physical appearance and differentiation, marketing a relatable lifestyle of a personal brand, and effective communication through various social media platforms (Roos & Muller, 2023).

Financial strain in the process of becoming a professional golfer

The financial strain of professional golf is a reality and is evident in research (Fry et al., 2015; Roos et al., 2022; Roos & Muller, 2023). According to Fry et al. (2015), the prize money, sponsorship deals, and appearance fees of professional golfers have increased significantly. Similarly, the cost of travel to various tournaments has increased and adds to golfers' financial strain. When golfers on the European Golf Association (EGA) circuit finish in the top 115, they can profit and earn a living (Fry et al., 2015). However, it is emphasised that consistency is essential, and golfers must retain this level for multiple years. Although this is conceivable, attaining the necessary heights is not guaranteed, and security is limited in this procedure (Montague & Milne, 2014). Regardless of how well golfers do, the ability to participate professionally comes with a cost and does not guarantee financial income. In 2015, 90% of Challenge Tour golfers reported no income or a financial loss.

The financial strain that golfers experience is significant and may hamper the process required for success (Fry & Bloyce, 2017). Therefore, golfers are encouraged to develop a personal brand (Roos & Muller, 2023), and attain sponsorships to counter the financial implications of professional development (Fry et al., 2015; Lee, 2021; Roos et al., 2022; Roos & Muller, 2023).

Psychological skillset

The psychological skills golfers develop in pursuing elite status in golf are essential for success (Hayman et al., 2014). The level of personal development and psychological skills acquired by golfers from a young age makes a significant difference in their pursuit of reaching elite status. A level of maturity and sufficient psychological skills are essential at this stage, as golfers must deal with bad performances and challenges that may arise. When golfers evaluate their performance and make the required adjustments, they benefit significantly. The themes regarding psychological factors were identified in twelve qualitative studies. They included psychological momentum, self-talk, anxiety and the effect on golfers' confidence, attentional focus, psychological tournament preparation, imagery, and pre-shot routine.

Psychological momentum

McCarthy et al. (2022) attempted to understand how golfers experience Psycho-behavioural momentum (PBM) during a competitive Matchplay contest. PBM is defined as '*an altered state of mind that enables extraordinary performance with a tendency to persist with reinforced behaviours until extinguished or satiated by an opposing force*' (McCarthy et al., 2022). The research findings unveiled that unanticipated occurrences, such as the discrepancy between anticipated success and subsequent failure, detrimentally impacted PBM (McCarthy et al., 2022). Therefore, golfers need to adopt an adaptive mindset and manage their expectations to minimize negative emotions (Roos et al., 2022). McCarthy et al. (2022) found that during Matchplay competition, the round needed to surpass a certain amount of time before a shift in PBM occurs. To control PBM, golfers need to be calm and positive. Having a good sense of emotional regulation, such as feeling and appearing in control by golfers, was crucial in having consistent psychological processes (McCarthy et al., 2022). Roos et al. (2022) investigated various psychological skills needed for the professional development of golfers and found that emotional regulation is regarded as a critical component that contributes to golf performance (Roos et al., 2022).

Strategic self-talk

Self-talk is a positive affirmation utilizing phrases, such as 'I can do it' (Jeong-Keun et al., 2021). When golfers apply a positive internal dialogue with themselves, they may encounter various benefits during competitive golf (Cotterill et al., 2010). These benefits include enhanced motivation and confidence and reduced negative thoughts. Golfers are encouraged to stay in the present, focus on the specific shot needed, and not take part in an internal dialogue that focuses their attention on the outcome or result (Cotterill et al., 2010). It is also essential for golfers to not dwell on the past by having a negative internal dialogue with themselves, as this will harm their performance. As such, Cotterill et al. (2010) and Jeong-Keun et al. (2021) suggest that imagery, confidence, and self-talk are essential skills for golfers to achieve optimum performance. Consequently, golfers are encouraged to engage in as much positive self-talk as possible (Dickens et al., 2018).

Anxiety and the effect on the confidence of golfers

According to Thomas et al. (2007), competitive anxiety is an emotional response to competitive stressors, including negative thoughts, perceptions, and stress from a golfer's immediate environment (Suinn, 2005). When golfers develop competitive anxiety, a decrease in their self-confidence levels is evident (Pates & Kingston, 2020). As a result, when golfers are competitive, confidence is essential when attempting a difficult shot under severe pressure (Jeong-Keun et al., 2021; Roos et al., 2022). To acquire confidence and increase performance, golfers must sometimes play offensively (Pates & Kingston, 2020). According to Jeong-Keun et al. (2021), selecting the wrong club may cause a rise in worry and negative thoughts. To overcome the pressures, golfers may improve their performance by using an anxiety management programme to boost their self-confidence (Grobbelaar et al., 2018). The anxiety management programme included thinking, pausing, and positive self-talk. Moran (2012) defines thought stopping as verbal cues that an individual emits anytime undesired ideas arise. Dickens et al. (2018) investigated utilizing Descriptive Experience Sampling (DES) to delve into the inner experiences of golfers within a tournament context. This method provides a nuanced examination of individuals' inner dialogues, including self-talk, during both daily activities and golf events. Notably, self-talk comprises a significant portion, constituting 31% of a round of golf (Dickens et al., 2018), and plays a pivotal role in bolstering golfers' confidence and performance (Cotterill et al., 2010; Grobbelaar et al., 2018). Moreover, the nature of self-talk is intricately linked to both the golfer's personality and the specific context in which it unfolds (Dickens et al., 2018).

Attentional focus

According to Diekfuss and Raisbeck (2017), golfers have an internal (swing thoughts) and external (target) focus. There are two alternate types of focus: situation (the focus required from circumstances where higher performance is required) and reactive (due to previous performance or mental state) focus. In addition, there seems to be a difference in the focus type of long-game and short-game shots during golf practice (Orr et al., 2021). The importance of having qualified coaches assisting golfers in aspects, such as attentional focus was highlighted by research (Diekfuss & Raisbeck, 2017; Orr et al., 2021). To further enhance their attentional focus, golfers often use music during pre-performance routines before a tournament. This allows the golfer to focus on the task needed in specific competitive situations (Gabana et al., 2019; Pates & Kingston, 2020). In addition, music has other benefits, such as when golfers utilise motivational lyrics, it increases their motivation (Gabana et al., 2019; Pates & Kingston, 2020). Music also prevents external distractions from disturbing golfers' practice sessions. The psychological benefits are clear, as golfers have indicated that their mental performance state and enjoyability improved when using music (Gabana et al., 2019).

Psychological tournament preparation, imagery, and pre-shot routine

According to Pates and Kingston (2020), a golfer's confidence increases by adding the best performance imagery to their pre-shot routine. This dual approach consists of a conscious (best-performance imagery) and unconscious (hypnosis and music) approach, vastly beneficial to a golfer. It is suggested that golfers document their best performances in a diary to use during imagery (Pates & Kingston, 2020). Amateur golfers have higher scores than professional golfers regarding imagery, relaxation, and goal-setting in

training. In turn, amateur golfers have higher scores than professional golfers regarding negative thinking and lower scores in goal-setting during competition (Kemarat et al., 2021). These findings indicate that professional golfers can demonstrate higher psychological skills in competition. Furthermore, professional golfers had higher scores concerning goal-setting and activation during competition and lower scores regarding automaticity, imagery, attentional control, and negative thinking than in training (Kemarat et al., 2021). Furthermore, mental preparation for a tournament is vital to golf performance (Dickens et al., 2018; Pilgrim et al., 2018). Mental preparation entails the development of mental strategies for the golfer to manage anxiety associated with a tournament. In addition, Cotterill et al. (2010) and Pates and Kingston (2020) suggest that golfers should employ best-performance imagery in their pre-shot routine.

Physical conditioning

A single theme regarding physical conditioning was identified in three qualitative studies: The importance of a warm-up.

The importance of a warm-up

Golfers often engage in a pre-round technical routine of putting, chipping, and a range session (Pilgrim et al., 2018). In addition to a technical routine, a pre-round physical warm-up, which consists of stretching, massage, and mobility work, is essential for tournament physical preparation. This may well enhance golfers' physical performance and prevent injuries (Shellock & Prentice, 1985). Furthermore, it is indicated that golfers may have an increase in clubhead speed when a sufficient warm-up routine is followed, which in turn may enhance golf performance. Pates and Kingston (2020) agree and suggest that golfers complete stretching exercises in addition to the technical routine they complete before a competition to enhance performance.

Discussion

The review aimed to outline critical factors associated with the professional development of golfers. In total, 33 quantitative and 24 qualitative publications were identified, focussing on various factors that may influence the professional development of a golfer. The seven main factors that have a significant influence on promoting professional development in golf include: the quality of coaching (Bertram et al., 2007; Diekfuss & Raisbeck, 2017; Hwang, 2021; Kitching & Campbell, 2019; Lee, 2021; Mears et al., 2019), competition-specific training (Ashbrook et al., 2018; Baker & McHale, 2022; Carson & Collins, 2015; Davies et al., 2017; Fry & Bloyce, 2017; Hayman et al., 2014; Henriksen et al., 2014; Pilgrim et al., 2018; Roberts et al., 2021; Roos & Lennox, 2019), physical conditioning (Coughlan et al., 2018; Langdown et al., 2019; Pates & Kingston, 2020; Pilgrim et al., 2018; Son et al., 2018; Wells & Langdown, 2020), psychological skillset (Aparicio et al., 2021; Ashbrook et al., 2018; Campbell et al., 2019; Carson & Collins, 2015; Chambers & Marshall, 2017; Clarke et al., 2015; Lundkvist et al., 2021; Parker et al., 2021; Revankar et al., 2021; Roberts et al., 2008; Roos et al., 2022; Vickers, 2012; Vine et al., 2011), expertise of the caddie (Carey et al., 2021; Donald & Winter, 2022; McNeill & Meade, 2017; Pates, 2021; Pilgrim et al., 2016), and availability of funds (Fry et al., 2015; Fry & Bloyce, 2017; Hayman et al., 2014; Lee, 2021; Roos et al., 2022; Roos & Muller, 2023).

The quality of coaching is essential in the professional development of golfers, and they need a knowledgeable coach to assist them in this process (Kitching & Campbell, 2019). Coaches need to balance the different developmental areas (e.g. technical, physical, psychological) that golfers need to develop (Kitching & Campbell, 2019; Roos et al., 2022). In addition to the quality of the coach, the parent-coach relationship is important for achieving optimal results (Hwang, 2021). As such, the parent and child need to trust the guidance and coaching of the coach to gain the most benefit for themselves (Kitching & Campbell, 2019). Parents and coaches need proper communication, support, and guidance for this trust to be achieved (Hwang, 2021). Golfers are first encouraged to participate in mass participation and specialise in golf during their adolescent development (e.g. 15 years of age) (Hayman et al., 2014; Roos et al., 2022). As such, golfers should participate in several different sports

to develop the necessary physical, mental, and social skills that a golfer will need later (Hayman et al., 2014). Furthermore, junior golfers should have fun during these early stages of development (Hayman et al., 2014; Roos et al., 2022). If golfers do not have fun, they will lose interest and discontinue playing the sport (Lee, 2021; Roos et al., 2022). Social support is crucial, and when a golfer's social environment is filled with too much pressure and an imbalance in their lifestyle, junior golfers may terminate the process of professional development at an early stage (Henriksen et al., 2014; Lee, 2021; Roos et al., 2022).

Competition-specific training is a crucial category identified by this investigation. Coaches must assist golfers in adapting their practice sessions to make them meaningful and prepare them for competitive play (Lee, 2021). Golfers must employ practice sessions that simulate how they would play on the course. Consequently, golfers to progress from deliberate practice to a challenging point utilizing spacing, variability, and interleaved practice (Roos & Lennox, 2019). As many golfers are technically at approximately the same technical level, sufficient competition-specific training can give golfers an advantage (Davies et al., 2017). This should consist of analysing the demographics of the golf course and specific shots that will be needed during a specific tournament (Pilgrim et al., 2018).

Another factor deemed significant in the professional development of golfers is the expertise of the caddie (Carey et al., 2021; McNeill & Meade, 2017; Pates & Kingston, 2020; Pilgrim et al., 2016). The caddie plays a critical part in the competition-specific training of golfers (Carey et al., 2021; Donald & Winter, 2022) and where this is done well, a golfer can gain immense confidence on the golf course. A proficient caddie allows golfers to only focus on the technical aspects needed for improved performance (McNeill & Meade, 2017; Pilgrim et al., 2016).

The availability of funds is an essential component of the success of golfers, and parents are responsible for providing this financial support for the golfer's development (Hayman et al., 2014; Roos et al., 2022). Golfers are required to play in a competitive environment, which significantly impacts parents' finances as golfers need to travel to various destinations to participate in tournaments (Fry et al., 2015). In addition, the cost of equipment, caddies, coaches, and golf course fees are significant (Lee, 2021). Unfortunately, the financial strain only increases as golfers develop their careers (Fry et al., 2015; Fry & Bloyce, 2017). Personal branding is essential for the successful development of golfers to assist in this financial strain (Roos & Muller, 2023). As such, golfers should be aware of their personal brand and manage themselves accordingly to gain sponsorships (Roos et al., 2022; Roos & Muller, 2023). Golfers should be aware of their behaviour on and off the golf course and maintain a professional image (Roos & Muller, 2023).

Various psychological skillsets were identified as necessary in reaching a professional level, such as anxiety (Aparicio et al., 2021; Chambers & Marshall, 2017; Revankar et al., 2021; Vine et al., 2011), attentional control (Ashbrook et al., 2018; Campbell et al., 2019; Diekfuss & Raisbeck, 2017; Lundkvist et al., 2021; Orr et al., 2021; Vine et al., 2011), imagery (Carson & Collins, 2015; Parker et al., 2021; Roberts et al., 2008), confidence (Grobbelaar et al., 2018; Jeong-Keun et al., 2021; Pates & Kingston, 2020; Roos et al., 2022), and self-talk (Ashbrook et al., 2018; Cotterill et al., 2010; Dickens et al., 2018; Jeong-Keun et al., 2021). Having sufficient emotional control in pressure situations is essential for golf performance (McCarthy et al., 2022; Roos et al., 2022). Putting is a critical aspect of success, and often golfers experience negative thoughts, which results in anxiety (Vine et al., 2011) and often 'the yips' (Chambers & Marshall, 2017; Kemarat et al., 2021). Anxiety may often result due to an inconsistent pre-shot routine caused by pressure situations (Jeong-Keun et al., 2021). As such, golfers are encouraged to have a consistent pre-shot routine from which they do not deviate (Roberts et al., 2021; van der Lei et al., 2016). Golfers should use skills, such as the 'quiet-eye' (Campbell et al., 2019; Vine et al., 2011), best-performance imagery (Carson & Collins, 2015; Parker et al., 2021; Pates & Kingston, 2020), self-talk (Ashbrook et al., 2018; Dickens et al., 2018), and incorporate these skills in their pre-tournament mental preparation (Dickens et al., 2018; Pilgrim et al., 2018).

The physical conditioning of golfers proved to be a considerable factor contributing to the success of golfers (Coughlan et al., 2019). For golfers to gain a competitive advantage, golfers should employ experts (Gordin, 2016), and use a well-developed warm-up session (Coughlan et al., 2018; Langdown et al., 2019; Pilgrim et al., 2018), cool-down (Wells & Langdown, 2020), a golf-specific strength and conditioning program (Coughlan et al., 2019; Son et al., 2018), as well as proper nutrition during competition

(Nagashima et al., 2023; Thompsett et al., 2022). Employing physical conditioning to the training of golfers may add ball speed to their shot and positively affect their golf performance (Coughlan et al., 2018; Driggers & Sato, 2018; Oranchuk et al., 2020; Shaw et al., 2023; Yoon et al., 2023).

Strengths and limitations

The literature search was strengthened by a thorough search strategy and an experienced librarian who assisted in this review. Furthermore, this study adopted a segregated design, including both quantitative and qualitative findings, to provide in-depth findings that were thoroughly interpreted. In addition, the risk of bias was carefully analysed using validated tools from previous studies. The limitations of the current literature may be that the findings are primarily derived from cross-sectional research data and lack the availability of longitudinal studies that document the entire career of professional golfers, which will provide greater insight. Future studies could employ an ethnographic methodology to analyse the environment professional golfers find themselves in to find even more information on the subject. In addition, intervention studies could be conducted on professional golfers by implementing the factors found in this study and evaluating the impact on their professional development.

Conclusion

The number of academic papers identified in this study investigating golf performance confirmed the notion confirmation that this subject needs to be further investigated Therefore, the findings of this review indicate that a holistic approach should be adopted to support not only golfers themselves but also coaches, parents, and other stakeholders within the professional golfer environment. The study recommends that golfers consider incorporating the aspects identified into their professional development. This includes considering the expertise of the caddie, the quality of the coach, availability of funds and incorporating, competition-specific training, psychological skills, and physical conditioning. There is a lack of research reviewing the holistic development of professional golfers. This review shows several studies identifying stand-alone factors that may enhance golf performance. However, very few of these studies have developed a fully ecological view that encompasses all aspects needed for the professional development of golfers. As such, this study attempts to bridge this gap and provide the golf fraternity with rich data to utilise in various areas to assist professional golfers in their pursuit of success.

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Author contributions

Stephanus Johannes Roos: conception and design, analysis and interpretation of the data, the drafting of the paper. Ankebé Kruger and Julius Jooste: analysis and interpretation of the data, revising it critically for intellectual content, and the final approval of the version to be published. All authors have read and approved the final work.

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Data availability statement

The data that support the findings of this study are available from the corresponding author, SJ Roos, upon reasonable request.

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